Book of abstracts

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ECCB 2024

BOLOGNA

7th European Congress of Conservation Biology

"Biodiversity positive by 2030"

17-21 June 2024 – Bologna, Italy

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Plenary Presentations

Navigating global to local conservation challenges: a fascinating journey

Patty Balvanera

Achieving a positive biodiversity world by 2030 in ways that are globally diverse, equitable and inclusive entails a paramount challenge. In this talk, I reflect on such challenge from two different aspects of my personal journey navigating global to local perspectives. The first one is a global to local perspective gained through the global and values assessments of the Intergovernmental Platform on Biodiversity and Ecosystem Services. We analyzed the direct and indirect drivers of biodiversity loss, tapping into the role of values and power imbalances as the ultimate drivers. We explored how predominant world views and narratives have led to conservation approaches that have been imposed into local conservation policies. We identified four values centered leverage points, as well as a set of justice-oriented actions, to revert those trends. The second one is a local to global exploration as a women scientist from the global south. I reflect on how diverse, equitable and inclusive my participation into such global processes has been. I assess the limitations of three conservation initiatives in Mexico that have been considered positive for biodiversity and local communities. I speculate on what a conservation biologist's journey that addresses distributive, procedural and recognition justice could entail, and how such approach would contribute towards operationalizing the Kunming-Montreal Biodiversity framework by 2030.

Biodiversity conservation in a warming world: integrating biodiversity and climate action

Yvonne Buckley

Climate is a critical determinant of the diversity and types of species of plants that can persist and human land use is the major driver of biodiversity change and loss. We have shown that the effects of land use are in fact equivalent to a biome-level differences in climate in terms of the life-forms of plants that occur and their abundance in ecosystems. We have developed models for how the traits of plants, together with the climate context, determine plant life-history. Actions that are being taken and being proposed to mitigate and adapt to climate change will drive land use change over the coming decades. Renewable energy installations, afforestation, reforestation, peatland restoration, deployment of nature-based solutions and changes in agricultural systems and practises all have implications for biodiversity, particularly as they could happen quickly and over large areas in the landscape. I will discuss the need to bring together an understanding of how climate and land use jointly determine plant diversity and population functioning to better project biodiversity impacts of climate change and the land use change resulting from climate mitigation and adaptation actions.

Co-opting Conservation: Biodiversity Economics & the Financialisation of Nature

Clive Spash

Conservation in its traditional mode of operation has been criticised on various grounds and not least by the attempt to create a new conservation a decade ago that was spearheaded by The Nature Conservancy. In this presentation I revisit some of the counter arguments to the presumed pragmatism of adopting mainstream orthodox economic concepts, values and policies that are employed to align conservation with corporate interests. I then look at some of the recent developments in biodiversity economics (e.g. the Dasgupta Review) and the moves to reduce biodiversity to a financial capital asset. Along the way I note problems with the policy instruments being promoted (e.g. nature based solutions, bio-credits, biodiversity offsets) and the agenda of 'green growth'. I highlight the larger social economic context within which conservation is operating and the vested interests that are working to co-opt its traditional regulatory approach and opposition to commensuration of values, monistic values, domination of Nature and denial of autonomous Nature.

Białowieża calling: A look into conservation through the eyes of a forest

Nuria Selva

Białowieża Forest, located at the Polish-Belarusian borderland, is the best-preserved lowland forest in Europe. Designated as a Natura 2000 site and a transboundary World Heritage Property, it holds unique and significant habitats for biodiversity conservation, including those of threatened species, and supports ongoing ecological and biological processes shaping evolution of communities and ecosystems. Białowieża Forest has been fundamental for science and a benchmark for conservation, raising crucial conservation debates during the last years. This plenary talk will highlight the role of Białowieża Forest as a lighthouse in conservation science and will convey crucial messages from the Białowieża Forest perspective to the global conservation community. It will explore the importance of definitions of ecological terms, and address major threats, such as forestry and fragmentation by roads and border barriers. Likely the longest environmental campaign in Europe, the presentation will go delve into the history and successes in protecting Białowieża Forest. These achievements have been driven by robust scientific evidence and close collaboration among scientists, NGOs and civil society, and legal protection from international conventions and nature conservation law.

Environmental DNA to understand multifaceted impacts on biodiversity

Francesco Ficetola

Environmental DNA (eDNA) is increasingly used to produce high-quality data on the distribution of organisms. I show how eDNA analysis can greatly assist biodiversity conservation, including 1) the early detection of alien invasive species; 2) the detection of rare and secretive organisms; 3) the identification of interspecific interactions; 4) the assessment of long-term trends and of the underlying drivers and 5) the evaluation of impacts of climate change on communities. Furthermore, I highlight key issues and limitations that must be taken into account to produce reliable eDNA data, and propose strategies that can be adopted to limit these issues. Finally, I discuss new avenues in the use of eDNA for biodiversity analysis, including approaches that can enable an exhaustive assessment of entire communities, the analysis of functional diversity, and the integration of eDNA-based biodiversity data into adaptive management strategies.

Abstracts of symposia

101: Designing a future Trans-European Nature Network (TEN-N) for a nature-positive Europe

Building a resilient and coherent Trans-European Nature Network

Piero Visconti[1], Martin Jung[1], Nestor Fernandez[2], Henrique Pereira[2], Jutta Beher[1], Matea Osti[1], Miguel Fernandez[2]

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The EU 2030 Biodiversity Strategy aims to put biodiversity on the path to recovery by 2030, as a contribution to the European Green Deal goal of preserving and restoring Europe's natural capital and placing Europe in a leadership position in the Post-2020 CBD Framework. A key component of the EU Biodiversity Strategy is the development of a truly coherent Trans-European Nature Network (TEN-N). The TEN-N is expected to bring added coherence to the existing network of Natura 2000 sites and other nationally designated protected areas, by addressing gaps in the coverage of priority habitats and species. The TEN-N should legally protect at least 30% of the land, including inland waters, and 30% of the sea in the EU, of which at least one third under strict protection, connected via adequately managed Green and Blue Infrastructure. Here we present the legal basis behind TEN-N, the status quo of the network in terms of its comprehensiveness, adequacy, resilience and effectiveness and the scientific and technical support that our community should provide to the European Commission and Member States to planning and implementing an effective TEN-N.

A critical evaluation of current practices in connectivity projects across Europe

Francisco Moreira[1], Filipe Dias[1], Jeremy Dertien[2], Luis Borda-de-Água[1], Miguel Porto[1], Sílvia Carvalho[1], Ana Ceia-Hasse[1], Carina Seliger[3], Rafaela Schinegger[3], Luca Santini[4], Luigi Maiorano[4], Francesca Cosentino[4], Andrea Sacchi[4], Néstor Férnandez[2]

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The NaturaConnect project seeks to establish a methodological framework and guidelines for mapping ecological corridors across Europe. We conducted an online survey aimed at practitioners involved in connectivity projects in Europe, and organized a two-day online workshop focused on identifying priorities for connectivity planning, exploring knowledge gaps and identifying solutions. The survey was conducted from May 2023 to January 2024, during which we contacted 200 practitioners involved in 162 connectivity projects. The purpose of the survey was to gather information about the projects they were involved in, including the scope, the target users, and the selected approaches. The online workshop spanned two half-days and had a total of 75 participants, which were split in groups in which they discussed the desired outcomes of connectivity across scales, the areas that should be better connected, corridor routes, and solutions for promoting connectivity. In this presentation we discuss the outputs from both the survey and the workshop, seek to clarify concepts and make some recommendations regarding key issues such as connectivity in protected area selection, functional connectivity challenges for multiple species and sites with multiple habitats, connectivity challenges for small-sized animals, and the importance of freshwater corridors.

Beyond protected area boundaries: identifying OECMs in Europe and its implications for biodiversity conservation and management

George Kefalas[1], Stefanos Boutsios[1], Roxanne Suzette Lorilla[1], Camino Liquete[2], Ioannis Vogiatzakis[3], Alexandra Demertzi[4], Konstantina Apostolopoulou[5], Dimitrios Bormboudakis[5], Evangelia G Drakou[1]

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Within the EU, expanding or creating protected areas (PAs) has served as the main strategy towards improving biodiversity. Despite these efforts, biodiversity trends have not shown significant improvement, highlighting the necessity for more effective conservation measures. Considering the EU Green Deal and the new Restoration Law it is essential to have robust understanding of the critical to biodiversity areas. The establishment of "Other Effective Area-Based Conservation Measures" (OECMs) began as one of the measures that can lead to effective in-situ conservation. This study aims to identify areas of high biodiversity value which could support OECMs at the European and National level. We followed the IUCN's process to identify critical areas which could serve as expansions of PAs and further support biodiversity protection using existing management frameworks. We test the methodology at two levels: i) the EU Member State level and ii) the National level (Greece). Adapting the methodology at the national level requires considering the national legislation for nature management and we specifically outline these implications. Finally, we showcase an application, by pinpointing biodiversity significant areas, which spatially co-occur with areas in which renewable energy infrastructures are installed, emphasizing the importance of aligning green energy transition strategies with biodiversity goals.

Private Land Conservation in Finland - challenges and potentials

Khorloo Batpurev[1,2], Heini Kujala[1], Mar Cabeza[1], Steve Sinclair[2]

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The backbone of biodiversity conservation has been the preservation of natural habitats with protected areas. Despite decades of conservation efforts, only 12.5% of Earth’s surface is currently protected. These areas alone cannot stop biodiversity decline, and many countries, including Finland, face notable socio-economic challenges in meeting international targets, such as the proposed 30% protected area coverage in the EU 2030 Biodiversity Strategy.

It is evident that Private Land Conservation (PLC), where people are paid, offered access to markets, or given discounts to encourage them to manage their land to benefit biodiversity, will play a central role in the conservation efforts needed to meet these targets. More broadly, PLC provides us with the opportunity to halt the extinction crisis and mass habitat loss, especially in the face of climate change. PLC is complex by nature. The effectiveness of PLC programs is dependent on the complex interactions between people’s willingness to participate, program design and their impact on biodiversity.

This talk will give overview of the METSO program, the Finnish government incentive based voluntary PLC scheme, discuss its role in the EU's 2030 Biodiversity Strategy. I will discuss current challenges and future potentials for similar programs across Europe.

Opportunity cost estimates for spatial conservation prioritisation across Europe

Douglas Spencer[1], **Alexandra Marques**[1], **Clara Veerkamp**[1], **Martijn van der Marel**[1], **Peter Verburg**[2], **Anandi Sarita Namasivayam**[2], **Moreno Di Marco**[3], **Martin Jung**[4], **Heini Kujala**[5], **Louise O'Connor**[4], **Piero Visconti**[4], **Aafke Schipper**[1,6]

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Opportunity costs, the foregone economic benefits from alternative activities or uses of a resource on a particular site, represent one of multiple options to approximate costs of nature conservation and can be used alongside biodiversity and ecosystem services data in spatial conservation prioritisation analyses. However, such cost data are not yet available across Europe. We created a European opportunity cost layer for productive (arable, pastoral and forestry) and urban lands at a spatial resolution of 1 km2, using land, resource , and residential rents. We mapped the opportunity costs of productive lands based on (sub)national land and resource rent data, which we allocated to the grid level based on gridded agricultural and forestry production data combined with country-specific commodity prices. We assigned residential rents to urban areas across Europe using a linear regression model relating area-standardised residential rents to population density, based on empirical data from 42 European cities. Across land types, urban land reflects the highest opportunity costs followed by arable, pastoral and forestry land. Our opportunity cost map can be used for European-specific spatial conservation prioritisations aiming to find cost-effective novel conservation sites.

Stress-testing protected areas against global change

Virgilio Hermoso

ESTACIÓN BIOLÓGICA DE DOÑANA-CSIC, Spain

Efforts to preserve biodiversity, mostly in protected areas (PA), are challenged by global change. To date, most of assessments focus on changes in the distribution of some species within PAs, missing other key ecological aspects, such as ecosystem functions, genetic and trait diversity, mostly related to climate change. For this reason, more integrated assessments are needed.

Stress-tests, commonly used in the financial sector, are tools that help evaluate the impact of interacting drivers of change and plan action to minimize risks, in a standardized, and transparent way. A stress-test to networks of PA could help identify the vulnerability of the network to future impacts, communicate the risks associated with those impacts. Moreover, it could help plan proactively monitoring and management to increase the resilience of PA networks to the impacts of global change and, ultimately, the persistence of biodiversity.

Here, I will present how existing efforts of scenario development, biodiversity monitoring and biodiversity indicators systems could be the foundation for a stress-test to PA networks. The future implementation of these tests would benefit from a coordinated supervision to ensure that assessments are standardized, the results communicated transparently and that adequate measures are planned whenever needed, like in the financial analogue.

105: Can biological pest control support farmland biodiversity while maintaining ecosystem services?

Optimising agri-environment schemes: from general principles to biological pest control

Johan Edvard Ekroos[1], **Henrik G Smith**[2]

[1]University of Helsinki, Finland; [2]Lund University, Sweden

Agri-environment schemes have been the main policy tool to enhance farmland biodiversity within the Common Agricultural Policy of the European Union. However, the efficacy of these schemes has varied. One reason could be that the multiple goals of agri-environment schemes are not considered, such that it may be better to separately consider general conservation goals and support of biodiversity-based ecosystem services. We have shown that this may entail spatial targeting of different interventions, related to their marginal benefits and the spatial scales relevant for underlying ecological mechanisms. However, applying these general principles on biological pest control is complex and highly context-dependent. Given the current policy push to significantly reduce the use of pesticides in the EU, enhancing biological pest control in structurally simple, productive landscapes will become increasingly important. Improved predictability of natural pest control, and a better understanding of the role of increasing crop diversity can significantly contribute to the success of this policy transition.

Floral resources and ground covers promote natural enemies but not pest insects in apple orchards: A global meta-analysis

Christine Judt[1,3], **Dávid Korányi**[2], **Johann G. Zaller**[1], **Petér Batáry**[2]

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Agricultural intensification has led to a loss of biodiversity and associated ecosystem services such as natural pest control. Conservation biological control (CBC) addresses this problem by providing alternative habitats and food sources for natural enemies of pest species and/or through a general extensification of the orchard management (e.g., reduced agrochemical input, less disturbance). However, these measures are rarely implemented by farmers due to the wide range of options with inconsistent effects. We conducted hierarchical meta-analyses to identify general patterns of local CBC interventions in relation to (i) insect pest abundance, (ii) natural enemy abundance, (iii) biological control, and (iv) fruit quality in apple orchards. Across 54 studies, we found an overall significant, positive effect of local interventions on natural enemy abundance. Among our established intervention categories - flower resources, ground covers, extensification - ground covers promoted natural enemies the most, especially predators. Furthermore, ground covers tended to reduce the density of pest insect. Similarly, flowering components promoted natural enemies, especially parasitoids, and showed no negative effects on fruit quality. In contrast, extensification of orchard management alone had no significant effect on the abundance of natural enemies, but showed a tendency to increase populations of pest insects and reduce fruit quality.

The role of birds and bats in the biological control of grape pests

Dávid Korányi[1], **Sándor Zsebők**[1,2], **András Báldi**[1], **Mattia Brambilla**[3], **Péter Batáry**[1]

[1]HUN-REN Centre For Ecological Research; [2]ELTE Eötvös Loránd University; [3]University of Milan

Agricultural intensification, with high agrochemical input and landscape simplification, poses a major threat to wildlife. At the same time, natural pest control can greatly contribute to biodiversity conservation and agricultural production. In our study, we examined the effects of birds and bats on grapevine pests and their pest control service using experimental field exclosures in 12 Hungarian vineyards, considering vineyard management and deciduous forest proximity. We found that insectivorous bird abundance and bat activity in spring were positively affected by forest proximity, whereas grape eater bird abundance and bat activity in summer showed an opposite pattern. The abundance of canopy-dwelling arthropods (herbivores and predators) was higher in organic vineyards than in conventional ones, which resulted in higher leaf herbivory and higher sentinel prey predation there. In addition, grape plant exclusion positively affected leaf herbivory and fruit damage, showing the biocontrol service of birds and bats. Furthermore, leaf herbivory and fruit damage increased with increasing abundance of leaf herbivores and moths, respectively. Considering the functional relationships, moth abundance decreased with higher bat activity in spring. Ultimately, our results showcase that bats can reduce fruit damage in vineyards by regulating grapevine moth populations, especially at the beginning of the growing season.

Pesticide use, farming system and vegetation management drive biodiversity and ecosystem service provision in vineyards - insights of a meta-analysis

Silvia Winter[1], **Léa Beaumelle**[2,9], **Yang Chen**[10,13], **Maria Comsa**[3], **Stefan Möth**[1], **Sylvie Richart-Cervera**[2], **Dumitrita Dascalu**[8], **Martin Entling**[6], **Rafael Alcalá Herrera**[4,11], **Christoph Hoffmann**[5], **Sebastian Kolb**[6], **Daniela Popescu**[7], **Jo Marie Reiff**[6], **Adrien Rusch**[2], **Mignon Sandor**[8], **Pauline Tolle**[2], **Andreas Walzer**[1], **Daniel Paredes**[4,12]

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Local edaphoclimatic factors, viticultural practices, and landscape composition significantly influence ecosystem

services and biodiversity within vineyards. Pest control by natural enemies is a crucial ecosystem service in viticulture, contributing to current pesticide reduction goals of the EU in one of the most pesticide-dependent land use types.

We investigated the effects of different inter-row tillage intensities, cover crop types, pesticide use and proportion of semi-natural habitats on biodiversity and ecosystem services within five European wine-growing regions. These field data were combined with a global meta-analysis analysing the effects of pesticide use, farming type, vegetation management and landscape composition on biodiversity and ecosystem service provision.

Natural pest control by predatory mites and other natural enemies in vineyards benefited from reduced pesticide use and spontaneous vegetation cover in the inter-rows. In organic vineyards higher use of inorganic fungicides resulted in higher toxicity loadings for predatory mites and other arthropods. The global meta-analysis resulted in positive effects of vegetated vineyard inter-rows and organic management with especially large benefits for biodiversity and regulating ecosystem services. In addition, biological control benefited from larger proportions of semi-natural habitats and biodiversity from lower proportions of agricultural land cover.

Can we predict biological pest control (and its impacts) in agricultural landscapes?

Emily Poppenborg Martin
Justus Liebig University of Giessen, Germany

Managing agricultural landscapes to support biodiversity and natural pest control could be a key avenue towards sustainable and climate-resilient agriculture that works for farmers. However, precisely how to manage these landscapes – and how effective this will be - is unclear. I briefly review the results of recent syntheses that show the importance of local and landscape parameters for maintaining or enhancing arthropod biodiversity and ecosystem services including pest control. These include the amount of habitat and crops in farmed landscapes, but also their compositional and configurational heterogeneity, spatiotemporal patterns of crop rotations, and neighbourhood effects. These studies show that these parameters can act synergistically, and that separating species according to dietary, dispersal and overwintering traits leads to contrasting responses. Based on these results, I describe how the development of archetypes formed from key combinations of species' traits can inform predictive models of natural pest control potential anticipating the impacts of landscape- and field-scale management, towards a workable ecological intensification of agricultural production under global change.

Ecosystem multi-functionality across agricultural landscapes: trade-offs or synergies among ecosystem services?

Lorenzo Marini, Andree Cappelari
DAFNAE, University of Padova, Italy

Although most agricultural landscapes are principally managed to maximize food provisioning, they can also provide a large array of supporting and regulating ecosystem services. Biological control, in particular, is one of the most studied services and a large body of literature has investigated its local and landscape drivers. However, we do not know yet whether managing landscapes for improving biocontrol could also generate other environmental co-benefits. Compared to crop-dominated landscapes, heterogeneous landscapes are expected to provide better biocontrol but also high delivery of multiple services. Here, we empirically measured multiple ecosystem services (plant and pollinator diversity, pest and seed predation, and several below-ground services) in different habitats across a landscape composition gradient and tested for potential trade-offs and synergies between services. At the local scale, relationships between services were complex and often context-dependent. We found a positive correlation between weed and pest predation in semi-natural habitats but not within crops. High levels of weed and pest predation were not associated with plant and pollinator diversity nor with the delivery of other services. Synergies were generally rare. Except for the expected positive association between plant and pollinator diversity, we mostly observed idiosyncratic relationships among services.

106: Non-lethal study methods in conservation biology

Why do we need to increase the prominence of non-lethal methods in invertebrate conservation research?

Gabor Lovei[1], **Marco Ferrante**[2]
[1]Aarhus University, Denmark; [2]University of Gottingen, Germany

In the current human-triggered biodiversity crisis, conservation biology research has gained additional importance. The research by conservation biologists generates public interest, and conservation biology in general has come under increased scrutiny. This extends to the use of public funds, the setting of priorities, the efficiency and effectiveness of research but also to the application of study methods. Against that changing set of settings and expectations, conservation biologists need to re-evaluate their methodological toolkit. This is also required in the light of new findings about animal sentience, perception of pain, and changing ethical awareness and attitudes. Entomological research does not seem to be fully aware of these new developments, and the use of destructive or harmful methods are common. Invertebrate conservation research, if it does not embrace non-lethal methods whenever possible, risks alienating the public and thus undermining its own aims to conserve vitally important components of global biodiversity.

The current and future use of non-lethal methods to study arthropods.

Marco Ferrante[1], **Gabor L Lövei**[2]
[1]University of Göttingen, Germany, Germany; [2]Aarhus University, Denmark

Entomological research has traditionally relied on destructive techniques which kills countless organisms, including beneficial and non-target species. While ethical and effective monitoring tools exist, they are rarely used by entomologists and do not receive sufficient attention. Ethically acceptable entomological research can be conducted in several ways: using techniques that harm but do not kill the organism (e.g., mutilation), that disrupt the activity of an organism but do not directly harm it (e.g., live light traps), or that neither harm nor disturb the organism (e.g., camera traps). The reuse of already dead material (e.g., museum collections, bycatch) is also an indirect way to decrease the killing of arthropods. Automated monitoring systems based on artificial intelligence are also becoming increasingly popular and their usefulness is likely to rapidly grow in the near future. Identifying species without having a physical specimen available remains the biggest challenge to overcome. However, even in cases where lethal methods are irreplaceable, it is possible to reduce unnecessary killing by carefully considering the necessary sample sizes and maximising the use of bycatch. Lethal methods can also be sidestepped if the research focuses on the effects resulting from the activity of the species and the ecosystem services they provide.

Radio telemetry as a tool for studying beetles' movement

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Radio telemetry with very high-frequency transmitters is a potential tool for investigating animal movement patterns, widely applied to various vertebrates. However, its utilization in large-bodied insect species is limited. Some beetles, with their relatively large bodies, robust exoskeletons, and established ecological backgrounds, stand out as a popular insect group for radio-tracking. We reviewed the available literature on radio telemetry in beetles with a focus on methodological strengths and limitations in recording their movement as well as how this method can assist in understanding various ecological aspects of beetle life history. Despite the method's potential, only 13 beetle species across five families, predominantly in the Western Palearctic region, have been tracked. Studies have been primarily descriptive, focusing on trajectory parameters and single-strategy movement behavior. Ecological aspects have been accessed to a lesser extent, especially concerning the effects of abiotic factors and habitat use. There are still conceptual knowledge gaps: promising statistical approaches for movement analyses can connect movement patterns with specific habitat utilization but they are not yet used by entomologists. Moreover, knowing the movement patterns of many individuals and species can assist us in understanding the composition and dynamics at the community level.

Widow spiders spin a history of climate effects on abundance, foraging success, and reproductive potential

Yael Lubin
Ben-Gurion University, Israel

Population declines have been recorded in many invertebrates worldwide, but assessment often requires lethal sampling. Nests of adult female desert widow spiders, Latrodectus revivensis, are highly visible in the desert shrubland and preserve a complete record of individual productivity that can be monitored and compared over the years. During 1992-2000, a yearly survey was conducted of L. revivensis nests in the Negev highlands, Israel, in which abundance, foraging success and reproductive output were assessed non-destructively. We counted L. revivensis nests at the end of the reproductive season and recorded the number of egg-sacs present in each. A subset of nests was collected to analyze prey remains, and egg-sacs were opened to count the contents (eggshells or young). The abundance of L. revivensis declined sharply in 1994 and did not recover during the following years, yet neither foraging success nor reproduction was affected. Causes for the decline are discussed.

Non-invasive deep learning based technology to predict the distribution of an invasive mosquito

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Biodiversity is being lost at an unprecedented rate on Earth. As a first step to more effectively combat this process we need efficient methods to monitor biodiversity changes. Recent methodological advance can provide powerful tools (e.g. camera traps, digital acoustic recorders, satellite imagery, social media records, citizen science) that can speed up the collection of biological data. Apart from speed these tools also provide non-invasive means to monitor biodiversity. Nevertheless, the processing steps of the raw data served by these tools are still painstakingly slow. A new computer technology, deep learning based artificial intelligence, might, however, help. In the first part of our talk we briefly oversee recent technological advances in conservation biology, highlight problems of processing their data, briefly describe deep learning technology and show case studies of its use in conservation biology. Then we report our preliminary results on using deep learning to predict species distribution maps of an invasive mosquito by satellite imagery.

Nature positive: the case of the Mediterranean monk seal recovery in the Southern Adriatic and Northern Ionian Seas.

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The Mediterranean monk seal (Monachus monachus) is recovering both numbers and range, which is why it has been recently reclassified from the IUCN Red List report as Vulnerable instead of Endangered. Nevertheless, the species distribution is still unclear in most of the Central and Western Mediterranean Sea, where both species density and monitoring efforts are very low. Based on environmental DNA monitoring and verified sightings, we give insights into its presence in the understudied regions of the Southern Adriatic and Norther Ionian Seas between Italy, Albania and Greece. The study period was from September to December 2022, which corresponds to the monk seal peak of the reproduction period. Results suggest a more constant and spread seal presence than previously thought, which bodes well for the nature-positive goal considering the seal's ecological role as a predator. We identified seven "distinct signal clusters" and three locations with a high probability of breeding activity that need to be further investigated with other techniques. The study also corroborates that eDNA can foresee or confirm seal sightings. Overall, we highlight the need to monitor monk seal presence in data-deficient areas and update its official distribution.

108: Sustaining forest ecosystems: exploring ecological connectivity for biodiversity

Seed dispersal networks in regenerating forest fragments in Brazil

Marijke van Kuijk, **Robert Timmers**
Utrecht University, Netherlands, The

Despite theoretical recognition of the importance of plant-frugivore interactions for successful forest regeneration, there are surprisingly few empirical studies of the role of these networks in forest restoration. Across the world, old-growth forests are rapidly disappearing while at the same time forest recovery is increasing secondary forests, which may have the potential to mitigate loss of biodiversity. Using the Atlantic Forests of Brazil as a case study, we quantify the extent to which landscape connectivity affects restoration outcomes in terms of functional plant-frugivore relationships in forest fragments. We studied interactions between frugivores, seeds and fruits in 12 fragments of varying age and connectivity using camera traps on the ground and in the tree canopies, and focal observations. We found that fragment age did not affect seed dispersal networks while forest cover, and thus fragment connectivity, was highly correlated to several network metrics. With increasing forest cover the networks' stability and complexity significantly increased. This has implications for restoration efforts since natural regeneration alone might not lead to plant-frugivore interactions recovering, especially not in isolated fragments. More attention should be paid to connecting forest fragments in order to restore seed dispersal processes and thus forest functions.

Does fragmentation support plant invasions?

Marcin K. Dyderski
Institute of Dendrology,Polish Academy of Sciences, Poland

Ecosystems fragmentation is one of biggest threats for populations and ecosystems functioning. Due to settlements development, connectivity between natural vegetation patches decreases, and proportion of edge zone increases. Edge zones characterize by different resources availability and allow for entering of species with different ecological requirements. That way we may expect that fragmentation will make ecosystems more vulnerable to invasion of alien plant species, providing more source populations at the edges of natural vegetation patches. Especially, linear open structures (e.g. roads), connecting invaded and non-invaded sites, might increase risks of invasion. On the other hand, invasion requires constant supply of alien species propagules, therefore cutting their migration routes can limit their spread. As biological invasions are strongly context dependent here I propose conceptual framework for assessment whether fragmentation and connectivity can favor or inhibit plants invasions. Expected effects of fragmentation on invasion rate can depend on species traits, introduction history, and recipient communities. Moreover, assessment of potential fragmentation effects requires also predictions of habitat suitability under changing climate, which can modify future spread of assessed species. In this talk I propose conceptual framework for future studies and examples of facilitation and inhibition of plant invasions related to habitat fragmentation.

It's in the matrix – a less fragmented landscape promotes both presence and abundance of conservation relevant species.

Malin Undin, **Anita Atrena, Fredrik Carlsson, Mattias Edman, Bengt Gunnar Jonsson, Jennie Sandström**
Mid Sweden University, Sweden

Forestry and land-use change are leading causes of habitat loss, degradation, and fragmentation worldwide, and in boreal forest. To become biodiversity positive by 2030, extensive change is needed to current forest management policy. In such policy, landscape perspectives are often missing. Thus, we conducted a systematic review asking: To what extent does surrounding landscape explain stand-level occurrence of conservation-relevant species in fragmented boreal and hemi-boreal forest? We screened 17 587 abstracts, and identified 172 relevant studies relating stand level presence, abundance, species richness, and/or composition of conservation relevant species to landscape fragmentation. Conservation relevant was defined as threatened, red listed, rare, or area sensitive; old growth forest or dead wood dependent; an indicator, keystone, umbrella, or flagship species. Our meta-analyses showed that both presence and abundance was significantly higher in less fragmented landscapes. Particularly, when fragmentation was measured as distance to surrounding habitat for presence, and as habitat amount for abundance. This suggests that, to promote viability of conservation relevant species, policy must ensure a high enough amount of habitat within a short enough distance. These results emphasize the negative effects of the practice of clear-felling and associated landscape transformation that has been the norm for the last century.

Mammal-informed restoration: LDA insights in Sarawak's oil palm landscapes

Rebekah Puttick
Newcastle University, United Kingdom

Tropical forests face severe degradation, impacting biodiversity, climate, and society. To address this, we advocate restoring these ecosystems. But how do we prioritize limited restoration resources? And how can we effectively market restoration interventions to landowners and decision makers? Our approach uses linear discriminant analysis (LDA) modelling and centres on mammals as connectivity indicators to inform the spatial prioritization of restoration efforts.

Using camera traps and LDA, we spatially predict the distribution of key large-bodied disperse mammal species within a highly fragmented oil palm/forest landscape in Sarawak, Malaysian Borneo. This study provides vital baseline data to inform the restoration process, helping us understand how species are responding to these disturbances and assessing the potential for natural regeneration within the study site. Furthermore, these insights provide critical information for stakeholders on where to focus active restoration efforts to improve landscape connectivity, whilst bridging key knowledge gaps on how mammals respond to oil palm, human disturbance, and landcover.

Crucially, by identifying areas where natural regeneration may be plausible, we provide an appealing restoration pathway to landowners with limited resources for forest restoration, minimizing the need for costly or inappropriate interventions such as tree planting or intensive management.

110: Supporting national and global Red List assessments via the sRedList platform

Introducing the sRedList platform for rapid and effective global biodiversity monitoring

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The extinction risk of species is globally monitored by the IUCN Red List (RL). Despite the goal to update extinction risk assessments at least every 10 years, over 21,000 assessments (~18% of the total) are considered outdated. The resources needed to keep assessments up to date present a clear sustainability challenge, and without a strategy to streamline the assessment process, the RL risks becoming unviable.

By bringing together RL practitioners and ecological modellers in a series of international workshops, we have designed and developed the sRedList platform, a user-friendly web-interface that guides assessors through a step-by-step procedure to assess species' extinction risk. The platform returns all key parameters for RL assessment together with suggested RL categories its uncertainty.

Facilitating and streamlining the assessment procedure, the platform can reduce costs and time required to perform assessments, therefore improving our capacity to track global trends in the conservation status for multiple taxa. By eliminating technical barriers that prevent assessors from using certain data and analyses, the platform will also reduce taxonomic inconsistencies and the number of Data Deficient species. Overall, the sRedList platform has the potential to underpin the viability of the RL in the future.

Time-series of terrestrial, freshwater, and intertidal habitats to support species status assessments and monitoring

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iDiv (Germany Centre for Integrative Biodiversity Research), Germany

Reliable data on different habitats' extents and their changes are a much-needed resource for assessing species' conservation-status under different IUCN Red List criteria, especially by supporting estimations of species' area of habitat (AOH). We will present GlobES – global time-series for 58 terrestrial, freshwater, and intertidal ecosystem types conforming to the Red List's habitat classification scheme. To achieve this thematic detail, but also sufficient mapping accuracy and consistency for reliable AOH and AOH-change estimations, we integrated quality-assured information derived from >40 satellite-based and in-situ datasets (covering land cover, land use, hydrology, climate, soil, coastal and stream topography, etc.). Comprehensive validation against millions of reference records show high overall accuracies and improved habitat representations in species' ranges compared to existing products. The modular GlobES modelling framework is flexible regarding specific input layers, allowing for continued improvements, e.g., as unbiased time-series become available for more land-cover/use classes. The first version of the time-series will soon be published (open-access/FAIR). We will showcase how GlobES data can support improved AOH mapping, and, when integrated with different types of species-level information and covariates in sophisticated models, also support approximations of areas of occupancy for large species groups.

Integrating hunting pressure models into IUCN assessments for improved Area of Habitat maps and population size estimates of tropical vertebrates

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Hunting-induced defaunation poses an important challenge for biodiversity monitoring in tropical ecosystems, since it goes undetected by conventional remote sensing methods used for tracking deforestation. This information gap introduces biases in global conservation assessments of vertebrate species, potentially overestimating their distribution based solely on forest extent. To address this gap, we conducted a pantropical evaluation of hunting impacts on tropical bird and mammal abundance. We modelled hunting impacts using an extensive database of abundance estimates, predictors of hunting pressure, and biological traits that render species sensitive to hunting, while accounting for spatial and phylogenetic autocorrelation. We found that body mass, distance to hunter's access points and travel time to urban markets were the most important predictors of hunting-induced declines of bird and mammal abundance. Then, we used our models to identify hotspots of defaunation at the pantropical scale for targeted conservation interventions. Lastly, we showcase how integrating our models in the sRedList platform will enhance Area of Habitat (AOH) maps by excluding suitable areas that are unlikely to be occupied. Additionally, it will enhance the application of IUCN criteria C and D by adjusting population size estimates based on predicted densities.

A standardized approach to estimate generation length for amphibians and squamates

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Generation length is defined as the average age of parents of the individuals in the population, and is a key parameter to assess species' extinction risk using IUCN Red List criteria. Generation length is needed to define a universally comparable time horizon (either past or future) across different taxa over which species' decline is measured. Yet, the information on generation length is still largely missing, and even among terrestrial vertebrates, which are fully assessed in the Red List, generation length is comprehensively available only for birds and mammals. This lack of knowledge inevitably affects the applicability of Red List criteria. Here, we used Generalized Additive Models to predict the generation lengths for squamates and amphibians based on a set of available data such as morphological traits, reproductive traits, phylogeny and climate. We found generation length increased with the size of the species and decreased with warmer climate for both groups, with snakes and Asiatic salamanders having the longest generation length on average. Our predictions can be used in future Red List assessments, expanding the applicable Red List criteria to assess past as well as future projected declines due to climate change.

Big machines for little bugs: automation of species extinction risk assessments in hyperdiverse taxa

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Despite notable successful efforts in conservation policies, there is a clear global trend of declining biodiversity. Part of this is due to the crippling lack of information and man-power available to conservationists, straining efforts for all but the most popular (mostly vertebrate) species. This is reflected in the lack of extinction risk assessments for the neglected majority. To overcome data and analytical limitations, major current efforts are being made using big data and machine learning. Here we present project Asterisk, which attempts to automate much of the process of data collection and analysis to reach preliminary extinction risk assessments for invertebrates. The workflow is composed of multiple interrelated projects, including a global threat GIS database, automated extraction of location data from unstructured text, and extinction risk prediction using minimal data on species distributions and the threats facing them. The full workflow is made openly available through multiple online tools and R packages in constant development and update. Our goal is to multiply the pace of extinction risk assessments for the millions of species still lacking them and this way provide the necessary tools for the better conservation and management of biodiversity across the world.

Extinction risk predictions for the world's flowering plants to support their conservation

Steven Bachman, Matilda Brown, Tarciso Leão, Eimear Nic Lughadha, Barnaby Walker

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The flowering plants (Angiosperms) are a large clade of ~330,000 species. Despite global and regional efforts over recent decades, the extinction risk of most (~70%) of these species remains unknown. We address this shortfall in knowledge by using the World Checklist of Vascular Plants to generate the first comprehensive set of predictions for all angiosperms (flowering plants).

We used Bayesian Additive Regression Trees (BART) to predict the extinction risk of all angiosperms using predictors relating to range size, human footprint, climate, and evolutionary history and applied a novel approach to estimate uncertainty of individual species level predictions.

From our model predictions we estimate 45.1% of angiosperm species are potentially threatened with a lower bound of 44.5% and upper bound of 45.7%.

Our species-level predictions, with associated uncertainty estimates, do not replace full Red List assessments, but can be used to prioritise predicted threatened species for full Red List assessment and fast-track predicted non-threatened species for Least Concern assessments. Our predictions and uncertainty estimates can also guide fieldwork, inform systematic conservation planning and support global plant conservation efforts and targets.

113: Towards an European camera trap network for standardized monitoring of wildlife: where we are, what it is needed

Camera trapping in Europe: current status and future perspectives

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The development of transnational biodiversity monitoring is recognized as a key working area by the EU's 2030 Biodiversity Strategy, and camera trapping is often the tool of choice for terrestrial mammals. However, despite the widespread use of camera trapping across the continent, efforts to build a European network of standardized camera trapping are still scant. We will first review the multi-faceted complexities associated with building such a network, spanning from those that relate to financial and institutional arrangements to the methodological ones, which include monitoring aims, targets, metrics, data management and sharing routines. We will then introduce the objectives and contributions of the symposium and provide examples of current transnational efforts and collaborations at both global and European levels. Among the promising European projects is Snapshot Europe, the first standardized and coordinated initiative to monitor mammal communities at the European scale. Every year since 2021, volunteer researchers have collected camera-trap data on more than 35 species at 1000+ locations spread across 22+ countries. This talk will set the context towards identifying potential ways forward in terms of how existing and new collaborations can be leveraged to achieve harmonized monitoring across the continent.

SCANDCAM: challenges and lesson learned from 12 years of lynx and wildlife monitoring in Scandinavia

John Odden[1], **Neri H. Thorsen**[1], **John DC. Linnell**[1,2], **Tim R. Hofmeester**[3]
[1]Norwegian Institute for Nature Research, Norway; [2]Inland Norway University of Applied Sciences, Norway; [3]Swedish University of Agricultural Sciences, Sweden

Monitoring of lynx Lynx lynx populations in Scandinavia is based around unreplicated minimum counts of family groups, i.e. adult females with dependent kittens. The number of family groups is estimated every year based on confirmed observations of family groups. Traditionally, observations have been tracks from family groups in snow and dead kittens. After experiencing milder winters and decreasing snow cover, a large-scale network of camera traps has been used to increase number of observations (Scandcam). As well as contributing to lynx monitoring we are also exploring ways to utilize the bycatch data on other species to achieve a broader ecosystem monitoring. The last few years the project has also been a central part of monitoring wild boars in Norway. In addition, observations of other species are being used in research on other species.

We will present the design and use of the Scandcam network of camera traps and discuss challenges and lesson-learned from over 12 years work.

Camera-trapping protocols and the potential for large-scale and long-term monitoring programmes

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Camera trapping has unmatched capability to standardize mammalian monitoring across multiple areas. An important sampling option relates to the placement of camera traps on trails and forestry roads versus random. While the latter potentially provides for estimating density and studying activity patterns under minimum anthropogenic disturbance, the former is more suitable to monitor both human presence and a relatively larger pool of wildlife species, given the preference of many species to move along trails and roads. We deployed systematic sampling on trails and forestry roads to study the effect of humans' outdoor recreation as a potential source of disturbance on wildlife. We targeted four protected areas in Italy and found that the mammalian meta-community consistently increased nocturnality in response to human passage, with effects mediated by species body mass. In one of the study areas, we monitored over 7 years and estimated occupancy trends both at community- and single-species level: mammals' occurrence increased over the years in spite of increasing human frequentation, although species tended to temporally avoid humans. The protocol we adopted appears suitable to monitor wildlife populations and communities, and assess their vulnerability to anthropogenic threats, with promising results for broader replication at national and trans-boundary scales.

Combining camera-trap data sets across large spatial scales: challenges and solutions

Rahel Sollmann
Leibniz Institute for Zoo and Wildlife Research, Germany

Combining camera-trap datasets holds promises for large-scale wildlife monitoring, but also comes with challenges. Here, I provide an overview of common challenges in programs that rely on combining data from multiple surveys, and how some of them can be addressed.

First, full standardization of sampling is rarely possible, causing variation across datasets in the spatial extent and resolution of data. Different camera models and setup strategies further affect the data collected. Many of these issues can be addressed by hierarchical models, which can account for the nested data structure, variation in sampling-related parameters, and differences in camera spacing.

Second, focusing on large-scale spatially representative sampling, these programs risk ignoring representative sampling at the local scale, where sampling may be biased towards more easily accessible areas. This may have implications for inference on wildlife communities and requires careful interpretation of results.

Finally, for data analysis large-scale programs frequently use an occupancy framework, as it allows accounting for imperfect species detection. Estimates of occupancy from point-based sampling in continuous habitat, however, are affected by population density and movement behavior and may not be readily comparable across surveys. This issue has received little attention from the camera-trap and statistical modeling communities.

Camtrap DP: enabling local-to-global scale data interoperability among camera trapping data producers and users

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Camera trapping has revolutionized wildlife ecology and conservation by automating data acquisition and generating massive amounts of camera trap data worldwide. However, the management and exchange of this data remain limited, hindering its full potential. To address this, a new data exchange format called Camera Trap Data Package (Camtrap DP) has been developed. Camtrap DP is based on a simple yet flexible data model, allowing users to easily exchange, harmonize, and archive camera trap data at various scales. It supports different camera deployment designs, classification techniques, and analytical use cases, ranging from compiling species occurrence data to distribution, occupancy, activity modeling, and density estimation. The format builds upon existing standards and is developed openly, collaboratively, and with version control from the start. Camtrap DP aims to enable large-scale data interoperability among camera trapping data producers and users, facilitating integration with other biodiversity data sources like GBIF. It also promotes the development of standardized data processing pipelines and the application of AI methods for automatic image recognition and data analysis. By harmonizing camera trap data from large-scale distributed networks, Camtrap DP harnesses the collective power of researchers and conservationists for more effective wildlife monitoring and conservation efforts.

Triggering a change: perspectives for collaborative science, conservation and policy based on camera trapping

Francesca Cagnacci

Fondazione Edmund Mach, Italy

Camera trapping biodiversity monitoring is advanced and broadly deployed worldwide, from a sheer diversity of entities, including research institutions, protected areas, wildlife offices, hunters, and citizens, and for a moltitude of reasons, from base research, to nature enjoyment. Often, camera trapping happens in the context of collective data collection or collaborative initiatives. This huge interest and wealth of data poses a lot of opportunities and some challenges. The recent advances in data standardisation protocols offer the technical possibility to archive camera trapping data in standard way and to communicate outputs between streams of data. Yet, this technical possibility is not paralleled by the emergence of a common 'space' where the different entities and projects are able to easily 'find' themselves, identifying their common purposes or specific objectives, and optimise both data collection and sharing of outputs. As a consequence, ability of camera trapping excercises to direct policy has been so far limited. I discuss these points and possible avenues ahead.

114: Biodiversity loss and zoonotic disease risk: Exploring One Health linkages and synergies in conservation

Environmental aspects of zoonotic disease emergence: opportunities and risks for biodiversity conservation

Moreno Di Marco, Andrea Tonelli, Lara Marcolin, Hubert Cheung

Dept of Biologies and Biotechnologies Charles Darwin, Sapienza University of Rome, Italy

Environmental change determines biodiversity loss and alters the natural dynamics of pathogen transmission within ecosystems, posing challenges to human and ecosystem health. About half of human infectious diseases which emerged in recent decades originated from wildlife, and many were triggered by the same pressures that determined rapid biodiversity loss (land-use change, wildlife trade, forest loss and degradation). The One Health approach has been promoted in response to this dual crisis, as a conceptual framework that recognizes the interconnected and interdependent nature of human, animal, and environmental health. These linkages are also recognised in the Kunming-Montreal Global Biodiversity Framework, under Target 11 "restore, maintain and enhance [...] ecosystem functions and services, such as […] reduction of disease risk". Yet, despite increased interest in One Health science and policy, biodiversity-related aspects of zoonotic disease risk remain poorly integrated into epidemic preparedness plans. Conservation science can play an important role in facilitating this integration. This talk will introduce several of the topics discussed during the symposium such as the role of ecological modelling in zoonotic preparedness plans, the impact of biodiversity loss on ecosystem function, the role of ecosystem integrity, and the analysis of social factors associated with wildlife consumption.

Comparison of three approaches to wildlife vaccination and working with farmers to tackle a major livestock disease in the UK

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Bovine tuberculosis (bTB) is a major disease affecting livestock, especially cattle, across Europe, but prominently in the UK and Ireland. The European badger (Meles meles) is a known wildlife host of this disease, and transmission occurs between badgers and cattle and vice versa. Recently, badger vaccination has been used to reduce disease incidence, and protect landscape biodiversity as an alternative to badger culling. Badger vaccination schemes require the permission and buy-in of farmers, and this research compares the approaches of schemes in England. We show that famers' different motivations have an effect on how they are likely to view the success of schemes, and how they want schemes to be carried out. We show that the role of conservation groups to help carry out vaccination can be complex, with farmers either preferring this approach, or actively shying away from it, depending on contextual factors. Scheme monitoring is also of crucial importance: monitoring badger bTB is resource-intensive, but we show farmers are unlikely to be satisfied with schemes without conclusive empirical evidence the scheme is working. This research draws several important conclusions for how conservation can work with farming communities to undertake mutually beneficial action that preserves farm biodiversity.

Identifying global hotspots of mammal-borne viruses of high public health priority

Andrea Tonelli[1], Marcus Blagrove[2], Maya Wardeh[2], Moreno Di Marco[1]

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Zoonotic outbreaks in recent decades have highlighted viruses as a group of pathogens with remarkable epidemic and pandemic potential. Among these, mammal-borne viral zoonoses have been recognised as a major threath for public health and targeted by surveillance strategies for zoonotic risk prevention. Still, the full spectrum of reservoir hosts of many viruses of primary public health concern remains severely underestimated. Here, we implemented a trait-based predictive pipeline to predict currently unknown wild mammals that may serve as reservoirs of high-risk viral zoonoses that require priority research attention according to the World Health Organisation (WHO)'s blueprint of infectious diseases. Using trait similarity and phylogenetic proximity with known virus-seropositive or virological-positive reservoir species, we predicted unrecognised viral reservoirs and mapped their geographical distribution to identify neglected hotspots of mammal-associated viral hazard at the global scale. We show that the overall diversity of viral reservoirs is currently underestimated in mammals, with direct implications for the establishment of critical control points for spillover prevention at the human-wildlife interface. We anticipate that our results will support the identification of shared targets between biodiversity conservation and zoonotic spillover prevention under a One Health approach.

An ecological approach to the assessment of zoonotic risk exposure

Elena Catucci, Andrea Tonelli, Lara Marcolin, Moreno Di Marco

Sapienza University of Rome, Italy

The One Health approach accounts for the inextricable connection between environmental and human health. However, human-induced environmental change can severely alter this critical connection, leading to undesired outcomes, such as increased risk of zoonotic disease emergence. Such emergence is influenced by several processes which occur at different scales and levels, making it highly challenging to determine . As a matter of fact, the ecological dynamics relating environmental changes, especially the human-induces ones, to the zoonotic risk remain unexplored. Therefore, we align spatial information on anthropogenic factors influencing natural ecosystems with environmental correlates of spillover risk, to draw a standardized framework for modeling human exposure to zoonotic disease emergence. We combine multiple drivers of human exposure to zoonotic viral spillover through machine learning approaches, which allow to account for non-linear and non-intuitive relationships between the predictive variables and the response one. Our framework could represent a useful approach for analyzing, and potentially mitigating, the risk from emerging zoonotic diseases. Moreover, when coupled with the data on the costs for zoonotic disease monitoring, our outcomes could help decision-makers defining effective monitoring strategies and management actions.

Testing associations between West Nile Virus circulation in Culex mosquitoes and avian biodiversity in Emilia-Romagna, Italy

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Background:

West Nile Virus (WNV) is a zoonotic arbovirus that is maintained in a transmission circle between Culex mosquitoes and birds, and occasionally spills over into the human host. Current knowledge of the link between WNV circulation and avian biodiversity has been inconsistent, with dilution effects (negative correlations) and amplification effects (positive correlations) observed in different parts of the world. However, this relationship remains largely unexplored in European countries including regions with high WNV circulation, such as Emilia-Romagna in Italy.

Method:

We explored the statistical association between WNV circulation from mosquito surveillance data collected in Emilia-Romagna (Italy) from 2013 to 2018 and observed avian biodiversity data collected in the region during the study period as part of the MITO 2000 project. Regression models were employed to test the association between multiple measures of WNV circulation and of avian biodiversity, including presence/absence and relative species abundance in combination with climate and environmental data.

Significance:

This study has the potential to unveil local effects of avian biodiversity on WNV transmission, which can inform surveillance programmes as well as policies integrating biodiversity protection into public health planning for WNV prevention in Emilia-Romagna and beyond.

Prototypical epidemiological modelling of Disease X infections spreading along different environmental pathways

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One side of preparing to the probability, rather than the possibility, of a next pandemic caused by a still unknown "Disease X" is to pre-allocate funds for vaccines or design pandemic treaties, as recently discussed at the World Economic Forum. Another side consists in projecting plausible scenarios of disease transmission, based on (i) information about pathogens' emergence risk, and (ii) the combined modelling of credible local-scale dynamics with data-driven, large-scale diffusion mechanisms. Here we first identify a taxonomy of prototypical epidemiological models that could promisingly describe infections of Disease X, which is expected to come out of the WHO Blueprint list of priority diseases. This includes zoonotic viruses spilled over from animals but then circulating mainly in humans (e.g. SARS), carried by vectors (e.g. Zika), or co-circulating in humans and animals (e.g. RVF). Depending upon their major environmental transmission pathways, we then discuss the relevant modelling approaches to anticipate possible geographies of pandemic spread, as potentially emerging from the diversified connectivity networks between communities (e.g. air flights vs cars vs cargos). We finally discuss the advantages of building an intermediate-complexity framework to hierarchically model the spread of "Disease X" at different spatiotemporal scales.

Improving wildlife trade governance and reducing spillover risk go hand-in-hand

Hubert Cheung

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The COVID-19 pandemic placed the linkages between wildlife trade and human health in the global spotlight. Its human toll and socioeconomic costs have been devastating, and its impacts will stretch into the future. Various factors associated with wildlife trade can influence the chain of events that align to result in zoonotic spillover. The pandemic has prompted urgent policy and regulatory action to reduce the risks of future spillover events and pandemics. Strengthening the regulatory measures for wildlife trade has been central to policy response discussions; measures like sweeping bans on wildlife trade and banning specific species for human consumption have been proposed and discussed. However, it is important to recognize that wildlife trade is diverse, complex, and important for the livelihoods and sociocultural identity of people and communities around the world. Established governance principles should guide policy-making aimed at reducing the risk of future spillover events and pandemics stemming from the wildlife trade. This will help ensure that solutions are equitable, responsive, robust, and effective. Incorporating these principles will support the development of context specific, culturally sensitive, and inclusive responses that recognize the complexity of disease emergence and of the socio-ecological systems in which wildlife trade occurs.

Exploring the link between habitat richness and tick-borne encephalitis risk in Europe.

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Background: The transmission of Tick-borne encephalitis (TBE) virus, a severe human neurological infection (TBE), is governed by complex interactions between ticks and hosts, closely related with habitat features. No efforts have yet been made to explore the relationship between biodiversity and TBE risk, probably due to the scarcity of large-scale hosts density data. Here, we considered habitat richness as a proxy for biodiversity to explore its connection with TBE risk in Europe.

Methods: We applied binomial regression to model the relationship between the habitat richness index (HRI) and the distribution of TBE cases across Europe. We validated our findings at local scale using municipality data collected in Trento and Belluno provinces, in northern Italy.

Findings: Our results showed a significant parabolic effect of HRI on the presence of human TBE cases in Europe, and a significant negative effect on the local presence of TBE in northern Italy. At both spatial scales, TBE risk decreases in areas with higher values of HRI.

Interpretation: Our findings suggest that in highly diverse habitats TBE risk decreases, and that biodiversity loss could enhance disease risk for both humans and wildlife.

Ecosystem integrity and the risk of emerging zoonotic diseases

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Anthropogenic pressures have increasingly disrupted ecosystems' integrity worldwide, jeopardizing their capacity to provide essential contributions to human well-being. Recently, the role of natural ecosystems in reducing disease emergence risk has gained prominence in decision-making processes, as a growing body of scientific evidence indicates that human-driven pressure, such as habitat destruction and deforestation, can trigger the emergence of zoonotic infectious diseases. However, the intricate relationship between biodiversity and emerging infectious diseases (EIDs) remains only partially understood. Here, we analyse the relationship between EIDs of wildlife origin (zoonoses) and various facets of ecological integrity. We found EID risk was strongly predicted by integrity metrics such as human footprint and ecoregion intactness, in addition to well-known risk correlates such as tropical rainforest density and mammal species richness. EID events were more likely to occur in areas with intermediate levels of compositional and structural integrity, underscoring the risk posed by human encroachment into pristine, undisturbed lands. This study highlights the need to identify novel indicators and targets that can effectively address EID risk alongside other pressing global challenges in sustainable development, ultimately informing strategies for preserving both human and environmental health.

Tick bite risk and mammal and bird specices diveristy; disease ecology in a host species poor area of Europe

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Lyme borreliosis (LB) is a zoonotic disease caused by bacteria of the Borrelia burgorferi sl. complex. This pathogen is vectored by ticks, with Ixodes ricinus being the main vector in Europe. LB is endemic in many regions throughout the world, and is the most prevalent vector-borne disease affecting humans in Europe.

The disease is transmitted to humans via parasitism by an infected tick. Tick abundance in an area is an important predictor of tick bite risk. However, ticks also parasitise a wide range of other mammalian, avian, and reptilian hosts, and previous studies throughout the United States and Europe have identified varying relationships between vertebrate host species richness, tick abundance, and LB risk. These varying relationships can be explained by variability in the pathogen, vector, and vertebrate host species between LB endemic regions, resulting in differing disease ecology between regions.

The current study presents data collected over three years, in tick habitats in Ireland, answering questions on the relationship between vertebrate host species richness and tick bite risk to humans in a host-species poor region of the European LB disease ecosystem. The findings from this study can inform a One Health approach to LB risk and vertebrate biodiversity conservation.

119: Birds and renewables: from movement data to management and conservation actions

How can movement ecology help assess and prevent impacts of renewables?

João Paulo Silva, Ana Teresa Marques
BIOPOLIS-CIBIO / Universidade do Porto, Portugal

Careful planning for renewable infrastructure is necessary to mitigate significant impacts on animal wildlife, especially when focusing on preventing mortality, habitat loss, and barrier effects. Importantly, evaluating the cumulative effects arising from multiple projects, including powerlines and renewables, is crucial for assessing the overall impacts comprehensively.

Previous methods addressing ecological aspects relevant for impact assessment, such as animal mortality risk and habitat loss, faced limitations including inadequate temporal and spatial resolution and susceptibility to successive bias arising from correction factors. With the advent of the technological revolution, movement ecology has emerged as a critically important field in science. The increased affordability of technology has facilitated the acquisition of larger datasets, more representative of populations, thereby enhancing our understanding of animal ecology and behaviour.

With this presentation, we will explore how movement ecology has been applied to address pressing issues regarding energy projects. We will demonstrate its use in enhancing the understanding of the effects of these infrastructures, such as estimating mortality caused by collisions with power lines and the avoidance behavior next to wind turbines. Additionally, we will highlight its role in supporting mitigation efforts, including the development of high-resolution collision risk maps to predict areas with high hazard risk.

From animal GPS-tracking to predictive maps: Guiding spatial planning for renewable infrastructures

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The strategic spatial planning of new renewable energy infrastructures is crucial to prevent potential impacts on wildlife. Best practice usually recommends the development of systematic conservation planning to prevent the establishment of new industries in ecologically significant areas, and to support governments' licensing frameworks. However, this becomes especially challenging when dealing with species whose home ranges shift seasonally and are not entirely confined within specific boundaries.

Data from animal GPS-tracking studies have high spatial and temporal resolution, providing detailed information about species occurrence throughout the annual cycle. Such data, when integrated with high spatiotemporal resolution environmental data from remote sensing, have the potential for accurately predict species distribution across seasons.

In this presentation, we will showcase the use of high-resolution animal GPS-tracking data and remote sensing environmental data to identify priority areas for species with marked seasonal shifts in their ecological requirements. We use steppe birds in the Iberian Peninsula as an example, as their distribution greatly overlaps with areas of high potential for renewable energy, especially in relation to solar farms. Mapping the fine-scale habitat suitability of steppe birds across their seasonal phenology, provides a crucial tool for mitigating potential conflicts between renewable energy development and wildlife conservation.

Predicting and mapping hotspots of bird collision risk with energy infrastruture across Europe and Northern Africa

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Bird mortality through collision or electrocution is expected to rise in the next few decades due to an increasing need for energy infrastructure associated with the transition to renewable energy sources. Hence, the identification of collision high-vulnerability areas and associated mitigation and avoidance strategies is urgently needed to minimize the impacts of a zero-carbon energy society. We use GPS location data from species susceptible to collision within Europe and North Africa to identify where birds are most at risk of colliding with existing energy infrastructure and to determine which environmental variables affect bird flight height and collision risk. The environmental variables used included land use, weather and uplift. Vulnerability to collision was obtained by overlaying model outputs with density of wind turbines and transmission power lines. Sensitive areas were concentrated within important migratory corridors and along coastlines but there were high sensitivity areas scattered across Europe and Northern Africa. We map vulnerability hotspots where building new energy infrastructure should be avoided and where mitigation with existing infrastructure should be prioritised to reduce collision risks.

Tracking the skies: Quantifying the spatio-temporal dynamics of vulture survival in Europe

Andrea Santangeli, Ana Sanz-Aguilar, Giacomo Tavecchia
IMEDEA-CSIC-UIB, Spain

Understanding the extent of animal mortality, the where and when mortality occurs, is paramount to implement effective conservation actions and secure the persistence of animal populations. Unfortunately, so far our understanding of animal survival (the inverse of mortality) is very limited, even for well-studied species such as vultures. We integrate individual high-resolution GPS tracking data with detailed life-history information to quantify the survival of three European vultures (Griffon, Cinereous and Bearded vulture) across the entire Europe. The study included >1400 vulture individuals across the three species. The survival model accounted for the GPS tag failure and allowed to estimate survival separately for juvenile, immature and adult birds. Adult and immature annual survival for the three species were high (> 0.93 and > 0.90, respectively) and consistent across species and populations (e.g., from West and East Europe, or the Middle East). Survival of juveniles was also relatively high (generally > 0.85) but with high variation across species and populations, being lowest for griffon vultures in Western Europe. Collectively, these findings are indicative of healthy European vulture populations (of the three species studied), and highlight the positive impact of recent decades intensive conservation efforts.

Characterising the impacts of renewable energy on animal movement

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Installing renewable energies necessary for the energy transition will inevitably lead to the almost immediate emergence of anthropic structures (e.g. wind turbines, solar panels, dams, etc.) worldwide. The development of these structures has a straightforward impact on wildlife, which is the subject of countless studies. However, their secondary effects on more general natural processes, such as animal movement, are rarely analysed, even though movement plays a central role in evolutionary biology, ecology, and conservation. Therefore, if the massive installation of renewable energies becomes a barrier to animal movement, it may trigger unpredictable ecological effects from individuals to ecosystems. We have conducted a quantitative review on the impacts of renewable energies on animal movement to summarise and synthesise the current knowledge explicitly. Specifically, we have analysed the effects of different technologies (e.g. solar, wind, hydro-etc) in the determinants of animal movement (How, why, when and where the movement occurs), whether it affects movement at different scales, and whether any biases persist in terms of regions, taxonomic group and renewable energy type. Here, we show some preliminary results based on the data obtained for birds, discuss some of their conservation implications, and highlight the need for information where it could be improved.

120: Laying the groundwork for fungal conservation

Ivestigating the fungal community of the very old. Can ancient Kelos act as life boats for those thougt to be lost?

Fredrik Carlsson[1], Bengt Gunnar Jonsson[1], Anders Dahlberg[2], Mattias Edman[1]

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In this study we are investigating old standing dead pines also called Kelos. These trees has a unique chemichal profile and can remain standing several hundred years after death. Within residies a fungal community of which, so far little is known. These substrates has been colonized sequencially anually since time of death and we hypothesise that mycelial constituents can still be found originating from these colonizations. Combining dendrochronolgy and NG-sequencing we will be able to tie fungal community structure to substrate age. Will these really old substrates contain species now scarse or even lost in the post industrial landscape? Is it possible that Kelos are a sanctuary from which rare species may yet emerge. On ECCB we will present the first dataset in this new research project.

When all else fails: reintroduction to conserve red-listed fungi

Joette Crosier

University of Helsinki / Natural Resources Institute Finland, Finland

In the face of mass extinction, wood-decay fungi is one group of species under serious threat. Since the normal ways (protection of forest areas and leaving dead wood in managed forests) do not seem to help all of these critical species alone, we need complementary methods to save them. Inoculation and translocation of native fungi is still a rare, but very interesting approach to develop as a method for the conservation of threatened fungi, especially in areas where other methods do not seem to be efficient enough.

Thus, my research investigates novel approaches to the cultivation and reintroduction of rare and endangered fungi both in laboratory phases and on logs, ex situ. The lack of established methods is one reason why fungi are greatly underrepresented in conservation, despite being key organisms in a healthy ecosystem. In this talk I will discuss various tested cultivation techniques and the process of inoculating threatened fungi on dead pines, spruces, aspens, and willows in eight forest areas in Finland and Sweden. I will further provide context around the appropriateness of choosing such an approach.

Mapping and protecting the world's mycorrhizal fungi: a hidden link between biodiversity protection and carbon drawdown

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SPUN is a scientific research organization that maps mycorrhizal fungal communities and advocates for their protection. Mycorrhizal networks regulate the Earth's climate and ecosystems, yet they are not considered in current conservation and climate agendas. SPUN aims to change this by working with local communities and global researchers to create open-source maps of the planet's fungal networks. We use large datasets and machine learning models to predict where there are hotspots of mycorrhizal diversity, and where they are most at risk. We aim to track the responses of mycorrhizal communities to climate change, and understand their contributions to biodiversity and ecosystem functions so that mycorrhizal fungi can be considered in restoration and conservation decisions.

Fungi in gardens: enhancing ecological corridors and public awareness

Lorin von Longo-Liebenstein

Mushroom Agent, Finland

Gardens are an important way for many people to connect with nature even though modern gardens often are mostly far from a natural habitat.

In the UK an estimated 27 million people enjoy gardening as a hobby and a garden report found that 87% of adults with a garden want to attract more wildlife into their garden.

In the USA alone there are an estimated 16-20 million hectares of lawn . Maintaining those yards consumes nearly 11 trillion liters of water, 2,6 million kilograms of pesticides and 11 billion liters of gasoline annually. In rural communities in the global north, gardens are often the only green corridors between fragmented natural spaces, making gardens an important landscape for wildlife. Fungi play a major role in the health of a garden and its biodiversity but traditionally, fungi have often only been seen as a pest and issue for gardeners. An increased interest for fungi in the mainstream and a better understanding of the public about biodiversity offers a chance to invite fungi into gardens. This presentation will give an overview on the best ways to implement fungi into gardens and to increase the overall biodiversity and resilience of gardens.

121: The use of online digital data to advance invasion science

Do we pay enough attention to costly invasive alien species?

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Invasive alien species (IAS) are an important driver of biodiversity loss worldwide. Their widespread detrimental ecological impacts contribute to important economic impacts, associated with damage and management costs. Despite this, the general public is less aware of biological invasions compared to other drivers of global change. Public perceptions of IAS may be linked to how much they are incorporated into the conservation discourse. Here, we utilized a conservation culturomics approach to analyze human-nature interactions manifested in large digital databases, improving our understanding of IAS salience and highlighting avenues for conservation communication and decision-making regarding IAS. We investigated the relationships between costs incurred by tetrapod IAS (mammals, birds, reptiles, and amphibians) in Europe and their internet salience. We hypothesized that IAS with higher costs would have higher salience, suggesting that conservation communication about IAS costs has been effective in raising popular interest. To test this, we used the InvaCost database to extract IAS management and damage costs, and quantified their salience using Google Health internet search volumes and Wikipedia visitation rates in each of the countries where they occur. This method has much promise in contributing toward our understanding of how conservation communication may influence issue salience and subsequent policies.

Where is Wally? The search for the invasive plant Cortaderia selloana on citizen-science and social media images!

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Artificial intelligence techniques, and specifically deep learning, have advanced and empowered the content analysis of digital data, opening promising opportunities for detecting, mapping, and monitoring invasive alien species. In this study, we tested the ability of openly available classification and object detection models (i.e., convolutional neural networks: CNNs) to identify and map the invasive plant Cortaderia selloana (pampas grass) in mainland Portugal. CNNs were trained over citizen science images and then applied to social media content (from Flickr, X/Twitter, Instagram, and Facebook), allowing to classify or detect the species in over 77% of situations. Images where the species was correctly identified were mapped, using their georeferenced coordinates and time stamp (whenever available), showing previously unreported occurrences of Cortaderia selloana, and a tendency for the species expansion from 2019 to 2021. This study shows great potential from deep learning models, citizen science and social media data for the early detection, mapping, and monitoring of invasive plants, and, by extension, for supporting follow-up management options.

Human dimensions of biological invasions: novel research opportunities

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Invasive alien species negatively impact ecosystems, biodiversity, human societies, and economies. To prevent future invasions, it is crucial to understand both the ecological and the human and social factors determining whether a species is picked up, transported and introduced beyond their native range. However, we often have no or little information on key human and social factors. Here, we present a conceptual framework exploring how alien species introductions are shaped by a combination of ecological, and human and social factors, and highlight the potential of the emerging fields of conservation culturomics and iEcology for disentangling their relative importance. We argue that quantifying and assessing the relative importance of the human and social dimensions of alien species introductions can substantially improve our understanding of the invasion process.

Secondary Data: an untapped Treasure for Invasion Biology

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Understanding patterns and drivers of ecological and biological phenomena at different scales, such as biological invasions, increasingly depends on collecting comprehensive data and making the best use of existing data. The proposed talk will address the concept of secondary data, which refers to additional information that is unintentionally captured in species records, especially in multimedia citizen science reports. Secondary data can provide ecologically relevant information that improves our understanding of interactions between native and alien organisms and their impact on biodiversity dynamics. We present the possibilities offered by secondary data, describe their main types and sources and give an overview of selected case studies in invasion biology. Finally, challenges to the wider use of secondary data, including biases, licensing issues, and a lack of awareness of this data source due to a lack of common language, are also discussed, along with possible solutions to overcome these barriers.

Time series of societal attention and perception during the invasion process based on recent introductions in the Iberian Peninsula

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Social networks can provide relevant information about the process of biological invasion, as users can share information about the invading species in real time, and societal perceptions of the invading species can provide valuable information about the risks of invasion, such as the likelihood of intentional introduction or potential management support or opposition. The use of historical data in time series analyses could be very helpful in predicting and providing early warning of an impending invasion. Here we use digital data to explore possible relationships between the societal interest that species elicit at different stages of invasion and the outcome of the invasion process. We also explore the identification of specific traits or keywords that characterise different levels of invasion risk and different invasion scenarios, and hypothesise that references to the species vary according to invasion stage. We observed a greater correspondence between the event of first discovery at a site and public interest raised prior to this event, with peaks indicating that awareness increases when the species is in the early stages of its invasion process. This study shows that culturomics data can be used to some extent to predict the risk of a species invading a new habitat.

Spatial-temporal patterns of public attention to invasive alien species across an invasion front: a case study from the Mediterranean Sea

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Biological invasions are considered one of the major threats to biodiversity, having ecological as well as socio-economic effects, frequently with negative impacts. To achieve effective conservation measures, understanding societal interest in invasive alien species is crucial since greater public attention can help mobilise conservation efforts, investments and success. One of the main challenges in monitoring societal interest is developing near-real-time indicators to cover large-scale spatial-temporal dynamics of public attention. The digital revolution has opened up new opportunities to alien species research and management. Here, we focus on the lionfish (Pterois miles) in the Mediterranean Sea and investigate spatial-temporal patterns of public interest in the species along its invasion gradient by using Google search volumes as a proxy for societal attention. Our study revealed that 1) public attention is higher in countries that have already experienced lionfish invasion compared to ones in which the species has yet to arrived; and 2) temporal patterns of societal attention do not seem to be fully related to the year of arrival of lionfish in a given country. While the first results confirm a clear, spatial pattern in public attention, further research is needed to investigate drivers of temporal trends.

123: Digital data for biodiversity conservation: Opportunities, challenges and applications

Investigating online wildlife trade using machine learning

Enrico Di Minin
University of Helsinki, Finland

Online wildlife trade poses increasing threats to the conservation of thousands of species globally. However, attempts to quantify online wildlife trade have often focused on a few platforms and taxonomic groups. Here, I will explain how novel methods for automated data collection and filtering can be used to investigate online wildlife trade across digital platforms and taxonomic groups. Specifically, I will focus on explaining how these methods are being used to monitor the online trade in species at high risk of extinction globally. I will also explain how these methods can be used to monitor the trade in species of conservation concern on a more regional scale. Meanwhile, I will describe how these studies can be conducted in full respect of data privacy and data protection concerns according to the European Union General Data Protection Regulation. I will conclude by highlighting what are the main challenges that we are still facing to make progress towards better investigating online wildlife trade and what are the ways forward for research on the topics.

The inroads of machine learning in Conservation Science

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Machine Learning methods are rapidly advancing and finding applications across diverse fields including conservation science. Here we discuss machine learning methods used to investigate the online digital environment in the context of threatened species and wildlife trade. Global biodiversity faces a significant threat from unsustainable wildlife trade, which has found a new venue in digital marketplaces and social media. With vast amount of digital content, there is a growing demand for automated techniques. First, we present an end-to-end pipeline begins from searching and downloading news articles about species listed in Appendix I of CITES and proceeds with implementing natural language processing and machine learning methods to filter and classify the data. News articles are studied with information extracted using a named entity recognition and analysed for details related to price and quantities. Next, we developed machine vision models based on Deep Neural Networks with the aim to automatically identify images of exotic pet animals for sale. We trained 24 neural-net models spanning a combination of five different architectures, three training methods and two dataset types. Further, we developed object recognition models which can help identify specific target products like elephant ivory and pangolin scales, in an image and highlight them.

What makes a bird charismatic?

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Birds are one of the most charismatic groups of animals, and the bird watching community being one of the most engaged and expansive groups of amateur nature hobbyists. Birds are also relevant for the larger public, being present in a variety of cultural expressions such as songs, visual arts, films, myths, and religions. Previous studies have investigated which characteristics make birds more attractive, but were mostly focused on surveys among amateur bird watchers, which have specific interest that may not be transferable to the larger public. The emerging field of conservation culturomics (the study of human-nature interactions using digital data) provides us tools to investigate this issue at a larger scale, using data on the online behavior of a massive number of internet users all over the world. In particular, data on the use of Wikipedia, the largest online encyclopedia in the world, can shed light on the interests of people trying to learn more about bird species, in almost any language. In this study, we use Wikipedia pageviews to uncover which morphological, behavioral or ecological traits are associated with bird species that generate greater online engagement. This information can be useful for conservation marketing and educational outreach.

Enhancing Visitor Engagement and Conservation Management through AI Analysis of Social Media Images – an example from birding sites in Israel

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The great accumulation of online data together with advanced Artificial Intelligence (AI) tools, holds much promise for conservation management and policy through conservation culturomics. For example, understanding peoples' engagements and preferences in nature and protected areas can be greatly aided analyzing social media produced while visiting such sites. Such insights can consequently guide efforts to increase sites' public appeal for visitors and improve their management for both people and nature. Here, we analyzed over 1000 sample images from Instagram that were posted at six dedicated birding sites in Israel. We aimed to identify both manually and with AI, key features of each image, their main attractors, and expressions of visitors' emotions. We analyzed images with automated image classification, object detection, image-to-text analysis, and sentiment analysis. Overall, we found that automated image classification and identification tools can be very useful to identify broad features of both images and sites. AI tools also enabled us to identify attractors and sentiments of people across and within different sites. We further highlighted unique features of manual versus automated image analysis. These results can provide managers and policymakers with efficient tools to enable grounded conservation policy and management decisions regarding nature sites visitation.

ClimateMedia: Understanding climate change phenomena and impacts from digital technology and social media

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Climate change is amongst the most striking environmental challenges of modern times, producing major socio-ecological impacts with economic and conservation repercussions. More dynamic, automated, and social-oriented observatory systems are needed to tackle climate change and consider adequate mitigation and adaptation responses. Social media data has emerged as an opportunity to get insights on which climate phenomena and impacts people perceive of highest relevance and concern. Concurrently, the information shared by social media users may not always align with that from scientific facts, bringing many challenges to climate change policy and decision-making. Here we present ClimateMedia, a project that aims to: understand the extent to which climate change phenomena are reported by social media users; explore how those users perceive its climatic impacts; evaluate how divergent/congruent such reports and perceptions are to the scientific evidence. The project adopts recent advances in artificial intelligence algorithms, namely from Natural Language Processing, to explore textual content about climate change from social media data and the scientific literature. Outputs from ClimateMedia aim to help practitioners to establish appropriate political goals, enhance conservation efforts and foster biodiversity preservation. Ultimately, ClimateMedia serves as a proof-of-concept determining the feasibility of a future development of a social observatory system.

MEDigital: A digital observatory of public attention and recreational fishing of Mediterranean marine fishes

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The Mediterranean Sea is a global marine biodiversity hotspot facing a biodiversity crisis. Tackling this crisis effectively and efficiently is hampered by a lack of necessary ecological and social information to guide decision-makers. To fill this gap, we developed a digital observatory with two main objectives - public attention towards and recreational fishing of Mediterranean fishes. First, understanding public attention is key to mobilise political interest, and consequently increase conservation efforts and success. Second, social and ecological aspects of recreational fishing are not well understood due to difficulty in obtaining reliable and comprehensive data. Catches of recreational fishers have a huge, underexplored potential to monitor marine ecosystems. MEDigital integrates two emerging research approaches (conservation culturomics and iEcology) to provide an unprecedented volume of data for Mediterranean fishes. First, we quantified Google search volumes (i.e., a proxy of public attention) in each Mediterranean country for 770 fishes from 2013 to 2023. Second, we assembled a machine learning workflow to automatically extract information about recreational fishing from YouTube. MEDigital will contribute to characterizing social-ecological aspects of the Mediterranean biodiversity crisis in near real-time with special focus on societal attention to species and recreational fishing.

124: Drivers of native plant diversity in urban environments

Plant responses to urban gradients: extinction, plasticity or adaptation?

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Biodiversity-oriented urban management and planning require information on the drivers of wildlife composition and ecosystem function within cities. Urban landscapes impose environmental gradients along which species may be filtered away, or respond by showing adaptive variation in functional trait values. Such trait variation may be due to phenotypic plasticity, or a consequence of microevolution leading to local adaptation. We investigated three possible plant responses to urban environmental gradients: extinction, plasticity and adaptation. We assessed whether three individual functional traits, two population performance traits, as well as species frequency, responded to gradients in mowing frequency, soil fertility and structure, temperature, and compactness of the built-up matrix, among four herbaceous plant species in the city of Strasbourg. Using a common garden experiment, we tested whether the observed trait variation was hereditary. Each species displayed a different set of the 3 expected responses. Urban management and planning therefore impact on the evolutionary capabilities of plants in cities. In the case of management this was highlighted by the detected trends in species' traits and frequency in response to mowing. The consequences of urban planning were evidenced by compactness of the built-up matrix most often eliciting plastic and adaptive responses.

Genetic connectivity of the spontaneous flora in Paris : what can we learn from wood avens (Geum urbanum)?

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Through the Biodiversity Plan, Paris aims to enhance the city's natural environment. The Labbé law (2017) prohibiting phytosanitary products in public spaces and the adoption of sustainable practices in green areas foster the growth of spontaneous flora in Paris. The city's ecological connectivity is improved with "Les Chemins de la nature," a network of ecological reservoirs and corridors, facilitating seed dispersal and promoting genetic connectivity within species.

To evaluate the effectiveness of these policies, we focus on the genetic diversity and the population genetic structure of Geum urbanum (wood avens), a common autogamous and epizoochorous species in Paris. Analyzing the polymorphism of 10 microsatellite loci across 650 individuals from 30 stations, we consider the following hypotheses:

1. The high urban density limits gene flow, increasing genetic differentiation between populations while restricting intra-population genetic diversity.

2. Dispersal relies mainly on humans and domestic animals, fostering extensive gene flow across Paris and enhancing within-population genetic diversity with weak or no population genetic structure.

3. Ecological connectivity restoration limits dispersal primarily by spatial distance, resulting in an isolation by distance genetic pattern.

Floristic diversity and richness in different types of urban habitats in Serbia

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This study aimed to investigate the floristic features of urban habitats in 24 cities in Serbia. Seven 1-ha plots were selected in every city and each selected plot represents a different habitat type. In each plot, spontaneously growing vascular plant species were recorded to determine species composition, species richness and diversity, taxonomic, horological, and ecological structure, indicator values, and presence of alien species. A total of 647 taxa were recorded in the study area, of which 172 were alien species. The taxonomic spectrum of urban flora in Serbia is dominated by representatives of the families Asteraceae and Poaceae, while the range of the spectrum is dominated by Eurasian and Adventive areal types. The flora of urban habitats in Serbia is hemicryptyphite-therophytic, moderately thermophilic, moderately heliophilic, mesophilic to moderately xerophilic, neutrophilic to moderately calciphilic, moderately nitrophilic, and moderately continental. The habitat types studied are characterized by significantly different floristic features. Differences between floras of cities are less pronounced and mostly consistent with the climate and geographical affiliation of the city, indicating that local features have the greatest influence on the flora of urban habitats in Serbia, while the influence of climatic parameters and the degree of urbanization is much less pronounced.

Urban spontaneous vegetation composition shaped by drivers at local and landscape scale

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Urbanization and agricultural intensification effects can be well studied in small settlements within contrasting landscape settings. In our study, we carried out botanical surveys in 64 villages around 16 cities in the Carpathian Basin in 2022. We sampled the spontaneous vegetation of village centres and edges embedded in semi-natural vs. agricultural landscapes, located close to vs. far from cities. We found 455 plant species, including ten protected and 128 alien species in 1152 coenological quadrats (1m2). We found that landscape composition and within-village position were the most important factors shaping spontaneous vegetation. The richness of grassland species, and the relative cover of natives was higher,

whereas alien cover was lower in villages in semi-natural than in agricultural landscapes. Edges had a higher richness of grassland related species but also a higher richness of short-lived species and aliens than the centres. From the conservation viewpoint, the vegetation was the most favourable in village edges within semi-natural landscapes as they hold a high native and perennial herb richness, and the highest cover of species characteristic to broadleaved forests. We found the lowest plant biodiversity in villages surrounded by agricultural land and in village centres, where greening measures would be the most important.

Native plant diversity in urban community gardens: opportunities and challenges

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In the dynamic social-ecological context of urban gardens, plant communities consist of a diverse mix of species ranging from ornamentals to food crops, wild varieties, and natives. Yet, the degree to which urban gardens can support native plants across a local management and a landscape urbanization gradient remains unclear. Thus, challenges in native plant conservation are understudied and opportunities are underutilized. We conducted plant surveys in 31 urban community gardens in Berlin and Munich, Germany. We examined the diversity of native species present, which species may be of conservation concern, and how local and landscape-scale urbanization may predict such occurrences. We also investigated the relationship between cultivated and native plant species. We discovered a diversity of plant species including native endangered species, regardless of urbanization context. This implies that all community gardens, irrespective of their urban environments, can foster plant diversity alongside food production. Yet, at the local garden-scale, there remains opportunity to enhance plant habitats in gardens. In this talk, we discuss which species were found, underscoring the unique nature of community gardens as urban ecosystems of diverse flora. As the urban agriculture movement thrives, botanical investigations provide insight into how gardens can harmonize plant conservation and food production.

Flowering meadows in the city — how to increase vascular plant biodiversity in urban grasslands?

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Grassland biodiversity is endangered in Europe. Urban areas can provide opportunities for the conservation of grasslands as they provide considerable amounts of open habitats with underexplored biodiversity potential. We are asking: how to increase plant biodiversity in urban grasslands?

While urban grasslands can be highly species-rich and host rare grassland species, they can also be limited by processes such as eutrophication and fragmentation. It is still poorly understood how different kinds of grasslands contribute to biodiversity conservation in the highly variable mosaic of open habitats in cities. Even though cities have attempted to create more biodiverse habitats, e.g., by reducing management intensity in lawns, or by establishing new grasslands by sowing seed mixtures, we need to better understand the outcomes of these actions.

We sampled vegetation from 200 urban grasslands in the Helsinki capital region, Finland. We explore how plants with different traits assemble into communities as a function of local and landscape-scale factors, producing communities with varying levels of biodiversity and trait compositions. The results help us understand the relative roles of different kinds of urban grasslands, environmental conditions, and biodiversity actions for conserving grassland biodiversity.

125: Advancing biodiversity monitoring for achieving Europe's Sustainable Development Goals: a visionary approach

EBVs to support policy and management in Europe

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For three decades, the nature directives in Europe have required countries to report regularly on the status of different aspects of biodiversity, particularly those related to the species and the habitats in the directives. However, no systematic effort to design an biodiversity monitoring system had been carried out until recently. EuropaBON was a research project tasked with the challenging of designing a framework for an European biodiversity observation system. It identifies a set of 70 variables to monitor multiple dimensions of biodiversity that are feasible and policy relevant. Here we present how these variables match existing regulatory reporting requirements and upcoming requirements such as the nature restoration law. We also examine how these variables go beyond existing monitoring requirements to strengthen our understanding of biodiversity change ands it drivers.

Bottlenecks in European biodiversity information flows

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We assessed the capability of existing monitoring programs and data flows in Europe to produce a set of Essential Biodiversity Variables (EBVs) across the terrestrial, freshwater, and marine realms. We proposed a novel framework to analyze data flows' bottlenecks based on 16 criteria related to diverse aspects linked to data collection and sampling, modelling, interoperability and IT infrastructure and data integration. The main bottlenecks in the current European biodiversity monitoring data flows mainly relate to data integration problems. These include lack of long-term funding, limited data flow automation, and insufficient use of modelling to quantify and map EBVs at large scales. We also found various data collection bottlenecks that hinder the production of EBVs for certain taxonomic groups such as zooplankton in freshwater systems, lichens or terrestrial arthropods. Moreover, we found that monitoring data in European marine waters are fragmented and primarily integrated at the regional level, with biodiversity from Southern and Eastern European waters being scarcely represented in continental databases. We discuss how these bottlenecks affect the ability to generate a broad set of EBV indicators that can be used to track the state of the European environment in a harmonized and holistic manner in the long term.

Assessing monitoring gaps towards the production of Essential Biodiversity Variables in Europe

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Identifying gaps in current biodiversity monitoring capacity in Europe is crucial for successfully implementing and supporting a European Biodiversity Observation Network. We leveraged monitoring data from Europe to evaluate the capability for producing field-based Essential Biodiversity Variables (EBVs) as defined by EuropaBON. We covered 44 EBVs corresponding to the six generic EBV classes defined by the GEO BON network, across the freshwater, marine, and terrestrial realms. We found that monitoring across Europe is taxonomically biased and does not cover all regions. Moreover, sampling density and frequency are usually insufficient for the production of the EBVs at the desired spatial and temporal resolutions, there is a lack of long-term time-series data, and raw data needed to produce the EBVs is hardly accessible. As a consequence, monitoring data is lacking for many taxa. Our work provides the most comprehensive continental-scale assessment of ongoing monitoring capacities in relation to user and policy needs, providing guidance for the identification of important new areas and target taxa for monitoring in Europe.

Toward an optimal biodiversity monitoring network for Europe: a comparative analysis of sampling designs for robust monitoring

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As the impacts of global change continue to unfold, a pressing need arises for a coordinated biodiversity monitoring effort across Europe. An important research question is how to best design a spatial sampling scheme to monitor several essential biodiversity variables and changes resulting from diverse global change drivers. This research focuses on testing the effectiveness of four distinct sampling designs to provide a representative assessment of both species occupancy trends and habitat extent. The evaluation leverages data sourced from Nature directives and citizen science, aiming to assess the performance of these sampling designs. Additionally, the study examines the capacity of the sampling designs to detect changes in land use types, climate change speed, nitrogen deposition intensity, and the effectiveness of the protected areas network. To enhance practical implementation, the proximity to existing monitoring sites is considered. Preliminary results suggest that, depending on the dataset under consideration, grid-based sampling consistently outperforms random design. However, the success of stratified sampling is found to be influenced by the specific type of stratification applied. This research sets the stage for the development of a comprehensive and adaptive monitoring framework capable of addressing the dynamic challenges posed by global change to Europe's biodiversity.

Connecting stakeholders for biodiversity: a european network

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The Europa Biodiversity Observation Network (EuropaBON) includes one of the largest and most influential biodiversity communities in Europe. The aim of this impressive network of stakeholders is to co-design a seamless European biodiversity and ecosystem monitoring system that integrates existing biodiversity data and fills remaining data gaps. Network members are included in each step of designing the system from identifying user and policy needs, assessing existing European monitoring schemes and identifying data gaps, to defining Essential Biodiversity Variables (EBVs) to be monitored by the system, and demonstrating in a set of showcases how workflows tailored to various EU policies, can be implemented. We therefore developed the EuropaBON dashboard that allows users to map and interact with data and displays of Europe's biodiversity community, its key actors and their connections. It offers high-level information in one view that can be used to identify occupational sectors (e.g., academia, private industry), realm (e.g., marine, freshwater), or geographic regions (e.g., eastern Europe, southern Europe) with the most connections and pinpoint the central actors within the network.

Conservation of Mediterranean marine benthic biodiversity through innovative, integrative, and standardized methods

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Maintaining marine healthy ecosystems is crucial for sustaining life on Earth and promoting human well-being. Unfortunately, biodiversity is declining, because of human-induced stressors like coastal sprawl, overexploitation of resources, non-indigenous species (NIS) spread, and pollution. Monitoring marine biodiversity changes through space and time is fundamental to defining and enrolling suitable actions for habitat conservation and preservation. This is particularly needed in those areas that are very rich in species compared to their low surface extension and characterized by strong human pressures, such as the Mediterranean Sea. Subtidal rocky benthic habitats exhibit a complex structural architecture and harbor a multitude of small, often unknown organisms. Autonomous Reef Monitoring Structures (ARMS) have been developed as standardized sampling tools to study hard-bottom marine communities, enabling replicable and comparable data collection across various locations and times. Here, we present how ARMS are used to 1) evaluate alpha, beta, and intraspecific diversity along the Mediterranean Sea and 2) survey and monitor NIS in harbor environments. By combining traditional morphological taxonomy with modern techniques like DNA-sequencing (DNA barcoding and metabarcoding) and image analysis, we show that ARMS are powerful standardized tools to assess and follow spatial and temporal changes in Mediterranean hard-bottom marine communities.

127: Vanishing habitats: opportunities and challenges for the conservation of biodiversity and ecosystem services in glacial and proglacial zones.

Diversity of bacterial communities of cryoconite holes in different geographical areas of the world

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Glaciers are shrinking at an alarming rate. As techniques and knowledge improved, it was discovered they host a variety of cold-adapted taxa. Intrinsically fragmented and isolated, mountain glaciers are thought to host high biodiversity, especially in cryoconite holes, still poorly known as isolation prevents investigations. Small mountain glaciers have shorter response times to climatic oscillations and a higher probability of disappearance. This suggests studying high-altitude biodiversity before glaciers are lost due to climate change.

We collected 502 cryoconite samples from cryoconite holes on 19 glaciers in the Alps, Andes, Karakoram, Mount Kenya, Patagonia, Sierra Nevada, and Svalbard. The bacterial community composition was studied by sequencing the hypervariable regions V5-V6 of the 16S rRNA gene. Diversity within communities was analysed through ecological indexes, while biogeography was analysed using cluster and redundancy analysis.

All bacterial communities presented a low evenness (Gini Index > 0.95) and samples from the same glacier clustered together with few exceptions. Glaciers close to one another also tended to cluster together.

Our results are the first assessment of the global diversity of bacterial communities in cryoconite holes on mountain glaciers and the first evidence of a biogeographical pattern at the global level.

Smaller, wind-dispersed, less tropical? winning plant species and traits in the Andes after glacial retreat

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The acceleration of global warming is leading to ever-larger areas of land becoming exposed as glaciers retreat. In the tropical Andes, these novel ecosystems are being closely scrutinised by scientists and stakeholders as they modify the availability of ecosystem services such as water resources, natural hazards, carbon sequestration and cultural services. The trajectory of these novel ecosystems will depend largely on their capacity to be colonised by vegetation. Based on the study of seven post-glacial chronosequences in South America, we present here some elements of these trajectories. Over a period of 150 years after glacial retreat in Bolivia and Peru, plant succession is strongly constrained by the access of propagules to proglacial margins, wind-dispersed seeds being the most likely to colonise the area. Nurse plants are absent or insufficiently mature to accelerate succession, even though they have a vital role to play in this type of ecosystem. In Colombia, alpine plants are both from tropical and temperate origins but plants of tropical origin and shape have great difficulty in establishing themselves and plants of temperate origin, smaller, are the winners in the novel ecosystems. We discuss how these new plant assemblages could affect tropical alpine ecosystem services.

Proglacial plant functional diversity along a snow cover gradient from tropical to temperate alpine communities

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Global warming leads to a worldwide glacier shrinking, which results in new proglacial plant communities' establishment. The general patterns of primary succession following glacier retreat are relatively well understood. However, the effect of snow cover variation and the reduction in its protective effects against frost damage to plants have not yet been studied. We characterized proglacial snow cover duration along an equatorial to temperate latitudinal gradient to infer how snow cover duration influences proglacial plants functional diversity. We used 150 data loggers buried in 13 post-glacial chronosequences (tropical Andes, European Alps and Pyrenees) to monitor soil temperatures (1 ~ 3 years) and detect snow presence. We profiled at each site plant taxonomy and community-weighted functional traits (LDMC, SLA, Growth form, etc.). The results confirm that annual snow cover was almost absent at equatorial latitudes and remained very short in tropical regions, whereas it lasted up to 10 months in temperate regions. We found a higher proportion of facilitating life form diversity in tropical plant communities, and we hypothesized that facilitation processes are more pronounced where snow cover duration is shorter. Accordingly, in an accelerated warming context, interactions between plants in tropical alpine ecosystems could be of a more facilitating type.

Understanding successional dynamics of soil communities after glacier retreat, a multi-taxa and global approach.

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Succession, a cornerstone in ecology, remains incompletely understood. Succession is a complex phenomenon influenced by interacting and continuously changing factors operating at different temporal and spatial scales, each one having successional consequences. The lack of consideration for specific contexts and the properties of targeted taxa hampers a comprehensive understanding of successional trajectories and their prediction.

To assesses various successional trajectories on a wide geographical scale and integrating several taxonomic groups, we used environmental DNA to efficiently obtain standardized inventories of soil communities colonizing forelands after glacier retreat. Soil samples were collected along chronosequences (representing 1-419 years of succession) in 46 forelands around the world.

Taxonomic richness increased over succession, showing a consistent pattern among taxa and across regions, but rates varied among groups. Moreover, the local climate modulated successional rates, with colonization starting earlier in forelands with milder summer temperatures. The changes in the community composition of microbes contrasted with other taxa. For plants, springtails, insects and earthworms, dissimilarity and the importance of taxa addition decreased with time while replacement became more important on late communities.

In general, we observed heterogeneous but predictable patterns. Our study highlights the importance of multi-taxa and global studies in defining generalized features of succession.

Greenland plant diversity patterns and pollination networks in a changing Arctic

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Understanding biodiversity and ecosystem processes in the Arctic is of key importance for mitigating against rapid environmental and climate change. Greenland is currently experiencing increases in temperature and precipitation, along with greater climatic and environmental variability. This causes changes within plant communities including, vegetation shifts, shrub expansion, and earlier and shorter flowering seasons that lead to complex responses within Arctic terrestrial ecosystems. Our research focuses on plant diversity and plant-pollinator interactions. We aim to:

1. Quantify Greenlandic floral diversity patterns using museomics and metadata from herbarium specimens, along with corresponding key environmental drivers.

2. Investigate the effect of habitat and latitude on plant-pollinator networks using pollen DNA metabarcoding.

3. Model how both floral diversity and pollinator ecosystem processes may alter with future environmental changes.

Greenland's strong climatic gradients and vegetation zones, combined with the excellent coverage of climate data and extensive herbarium collections, make the island an important study system for understanding current and future changes in the Arctic environment. The outcomes of this research will help to predict the consequences of future environmental change to Arctic terrestrial ecosystems, and support public awareness, conservation efforts and policy development to protect Arctic biodiversity.

Protecting high-alpine alluvial zones released by melting glaciers as a consequence of global warming

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Melting glaciers are emblematic symbols of the accelerated warming of alpine ecosystems. Climate change scenarios forecast their disappearance from central Europe by 2100. This dramatic melt will however open new spaces for species, ultimately leading to the formation of new alpine habitats. Among them, of special interest and conservation value are high-alpine alluvial zones as they host unique – but little known and studied – biodiversity values. However, these alluvial zones and their biodiversity are also at risk for new infrastructure development like damming for hydropower production or sediment exploitation. With the aim to provide spatially explicit recommendations to the authorities, policy-makers, and organizations as a scientific basis for decision-making, we are starting a project that will (1) identify where these high-alpine alluvial habitats are and will appear across Switzerland, (2) evaluate their actual and future biodiversity value using bioindicator species, (3) identify where conflicts with infrastructure development are likely to arise and how to evaluate potential trade-offs with biodiversity conservation. Combining geomorphology and biodiversity through spatially explicit modeling, this project aims for a ranking of the Swiss proglacial alluvial areas based on their conservation value and potential vulnerability to infrastructure development over two global warming horizons: 2050 and 2100.

Loss of nature contributions to people following glacier retreat.

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Plant species provide both positive and negative contributions to people's quality of life (NCP). With climate change, we observe shifts in plant communities, which ultimately leads to a shift in NCP distribution. However, the future distribution of NCP has been poorly studied, especially in the context of glacier retreats, one of the most striking signs of climate change. With the retreat of glaciers, new lands (glacier forelands) are open for colonisation by plants and other living organisms. In our study, we are assessing the current distribution of plants species and thus, their NCP along 4 Italian glacier forelands. We then predict the future (100 years) distribution of plant species along the same forelands. We finally compare the future and current distribution of NCP along the glacier. Our findings suggest that we are facing a loss in species diversity in the future, and thus, a loss of NCP diversity. In addition, fewer species are supporting each remaining NCP, which can make them even more vulnerable to climate change. Even though mountain ecosystems are remote areas, geographically far from densely populated areas, they greatly contribute to people's quality of life and need to be protected.

Glacier retreat triggers chain reactions across ecological scales: time for conservation actions

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The retreat of glaciers worldwide is followed by the loss of plants and insects from local communities. Changes in community composition cause changes in plant–animal interactions. However, the impact of glacier retreat on plant–animal networks remains poorly understood. Here, we analysed how glacier retreat directly influences plant–pollinator networks and indirectly through biodiversity change. We observed sharp changes in the diversity of plant and pollinator communities. Plant facilitation enhanced biodiversity in recently ice-free terrains, whereas shrub encroachment decreased species persistence in late stages. We also observed an increase in the frequency of species interactions following glacier retreat, but an ultimate decrease with glacier extinction. Our results indicate that cascading effects of glacier retreat on mountain ecosystems erode ecosystem services, including pollination and food production from pioneer, threatened species. Urgent conservation actions and management strategies are required for mitigating socio-ecological impacts of glacier extinction. Specifically, I propose that sustainable ungulate grazing may limit shrub encroachment while maximizing people–nature co-benefits by supporting biodiversity and increasing ecosystem services and health for sustainable food production and human welfare.

Recent 5-years plant colonization in proglacial forelands has been faster than expected in two Gran Paradiso National Park study sites (Italian Alps)

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Plant colonization in glacier forelands has been studied for decades, mainly with the chronosequence approach (Pickett 1989) and less frequently by revisiting permanent plots (Fickert and Grüninger 2018). However, the latter approach can provide more reliable information on vegetation dynamics and climate change effects.

By revisiting permanent plots in two proglacial chronosequences in the Gran Paradiso National Park, spanning 5 to 165 years from deglaciation (Mainetti et al. 2021), this study aims to scrutinize how quickly vegetation colonization is occurring in present years. Thirty-six vegetation plots were surveyed in 2016-2017 and revisited in 2021-2022.

The speed of colonization was computed as the ratio between the increments in vegetation cover and species richness recorded in the last five years on permanent plots and those observed along the chronosequence.

Results showed that vegetation cover and species richness increased up to 17-19 and 14-21 times faster in recent years than predicted by the chronosequence, respectively.

Such rapid dynamics are likely related to climatic changes, e.g. higher summer temperatures and longer growing season, that favor the colonization from species of lower elevations. Further revisiting of such permanent plots in alpine proglacial forelands is necessary to better understand and strengthen these findings.

Glacier fleas (Collembola) of European Alps: insights on taxonomy, ecology and biogeography for the conservation of micro-endemic species

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Springtails are edaphic arthropods particularly linked to glacial habitat and to cold biomes in general; they are the only group, among Alpine arthropods, including cryophilic ice-dwelling species, i.e. adapted to survive only in direct contact to the glacial ice: the so called “glacier fleas”. Their evolutionary history is strictly linked to the glacial history, and they represent an important portion of biodiversity at risk of disappearing with the ongoing climate change and subsequent glacier disappearance. Despite their relevance, springtail diversity and distribution in the European Alps have been few considered until now and, due to the lack of information, their diversity is underestimated hindering conservation efforts. Thank to four years of sampling on European Alp glaciers, the first comprehensive description of ice-dwelling springtails of European Alps through integrative taxonomy approach was presented, in order to give a first overview also of phylogeny, ecology and potentiality as biogeographic indicators of ice-dwelling cryophilic springtails. In addition to the two already known species, four other species new for science were described, two of them micro-endemic. Their current distribution suggests the presence of past refugia that should be considered the hub of future conservation project of glacial biodiversity.

Andean camelids as engineers of post-glacial ecosystems: a regional strategy for adaptation to glacier retreat.

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By 2100, 49 to 83% of the world's mountain glaciers will disappear, opening vast areas for novel ecosystems to develop. These novel proglacial ecosystems lie at the head of watersheds and produce the key services (water, carbon-storage, biodiversity) needed by local people and nature. In the Tropical Andes, accelerated glacial retreat leads to environmental degradation aggravated by high levels of poverty that further harms people and ecosystems. Here, we propose an approach on a human scale to respond to global issues. We study whether rewilding Andean camelids (llama, vicuña, alpaca) to deglaciating pastures and downstream bofedales (peatlands) can accelerate the formation of novel proglacial ecosystems and related services. Through the study of two experimental systems: (1) a camelid exclusion system conducted since 2014 in the Cordillera Real, Bolivia; and (2) a camelid inclusion system at the Uruashraju glacier foreland, Peru, set up in 2019; and (3) an observational approach carried out in two additional valleys (Bolivia-Peru), we show that camelids contribute to the maintenance of the bofedales and facilitate the formation of novel proglacial ecosystems. Our study provides scientific support that native Andean camelids rewilding may favor adaptation to glacier retreat and inform conservation and management strategies in post-glacial landscapes.

Glaciers and postglacial ecosystems : common goods to protect in the Anthropocene.

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The scientific community has made enormous progress in quantifying and anticipating the evolution of the Earth’s glacier volume, but a worldwide detailed analysis of the future evolution of glacierized areas and the associated ecological consequences has not yet been carried out. Thanks to detailed glacier evolution modeling, we analyzed the evolution of the 210 000 glaciers on our planet (excluding the Antarctic and Greenland ice sheets) as well as the future ice-free topography and air temperatures that will appear and prevail in deglaciated areas until 2100. Depending on the greenhouse gas emission scenarios, the world’s glaciers area of 665 000 km2 in 2020 is projected to decrease by 22 ± 8 to 49 ± 15% until 2100. As a result, areas that become ice-free between 2020 and 2100 will cover from 149,000 ± 55,000 to 339,000 ± 99,000 km2 and consist of terrestrial areas (78%) and submarine (14%) as well as terrestrial (8%) overdeepenings. This will lead to the emergence of large terrestrial (rocks and sediments, grasslands, forests, etc.), marine (fjords, lagoons, coastlines) and freshwater (lakes, wetlands, rivers) ecosystems

129: Mapping renewable energy development for biodiversity conservation

Long-term direct and indirect effects of wind energy development on birds

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Wind energy contributes to the reduction of greenhouse gas emissions, but the development of wind-power plants has negative effects on biodiversity. Here, I present two case studies assessing the direct (wind-power plant) and indirect (powerlines) impacts of wind energy development on birds and the effectiveness of mitigation measures. Long-term monitoring of the population of white-tailed eagles (Haliaeetus albicilla) on Smøla island (Norway) after the construction of a large wind-power plant revealed no effect on the number of active territories and nests, and the reproductive output over 1998–2023 despite changing the spatial distribution of territories after construction. Black blades were used as mitigation measure, which reduced mortality by 70%. In the last carcass search period (2020-2023), 23 casualties were found, none by black rotor blades. Despite this mitigation measures, DNA monitoring of all territories revealed a decline in adult survival of resident individuals with proximity to the wind-power plant. Regarding mitigation of the impact of powerlines on birds, we assessed the effectiveness of flight diverters on individual's flight behaviour using a dedicated 3D avian radar. We found strong responses to the diverters both in the use of the airspace and flight behaviour when comparing marked and unmarked section of powerlines.

Collision risk mapping and validation with long-term mortality data reveal current and future wind energy development impact on sensitive species

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The demand for renewable energy has driven the expansion of wind farms worldwide. To mitigate their impact on flying species, a spatially explicit assessment of collision risk in vulnerable species is needed to guide management actions and prioritise areas for development. We used GPS data from 127 adult and 50 juvenile griffon vultures, a species prone to turbine collisions in peninsular Spain (2014-2022), to evaluate factors influencing vulnerability and exposure and predict collision risk. We validate the observed collision risk with recorded long-term mortality data (1999–2022) at regional and wind farm scales and evaluate the estimated impact of current and future turbines. Our results showed that food availability increases vulnerability and exposure, whilst distance to nesting areas and the conspecific presence decreased vulnerability and exposure in vultures. Our maps revealed that between 10-19% of the Spanish peninsular area had a high collision risk. Importantly, the number of turbine casualties was positively related to collision risk at the regional and wind farm scale and ~18 of the breeding population lies within high collision risk areas. Moreover, areas with the highest collision risk have the highest number of turbines and largely overlap with areas suitable for developing new wind farms.

Impacts of wind power farms on biodiversity: interspecific and spatial variation in collision mortality for European birds and bats.

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IIASA, Austria

In line with Europe's decarbonization goals, the number and the capacity of wind-power farms in Europe is projected to increase in coming decades. However, wind farms pose risks to biodiversity: flying animals can fatally collide with wind-farm infrastructure and bats can experience deadly barotrauma when flying close to turbines. To inform the deployment of wind farms at the European scale and minimize the risk to wildlife, we aim to assess collision mortality across European birds and bats. We use a compilation of recorded collisions for birds and bats from published papers which we combine with data on species traits, wind farm and landscape characteristics, and we investigate associations between collision mortality and these variables. We then use our models' outcomes to create species-specific and functional group specific collision-mortality maps for European birds and bats, with the aim of informing spatial deployment of wind-power projects and possible mitigation measures.

Mapping rapid renewable energy development in the Mediterranean: challenges and potential solutions

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Wind energy development is increasing steadily in the whole Mediterranean and zonation is needed to ensure its compatibility with biodiversity protection. We highlighted criticalities and challenges connected with mapping wind energy development in Sardinia, an island hosting many protected habitats and species, including birds and bats which are negatively affected by wind turbines.

Existing official data from 2020 reported 963 turbines. However, when validated with 2023 aerial pictures, a total of 1,079 turbines emerged (+12.0%). Absent a webgis we had to map 741 wind turbines manually, from individual projects available from the website of the Ministry of the Environment. Some projects were impossible to map, as they did not contain any coordinate or their maps had an unsuitable resolution.

Overall data about existing wind farms became obsolete in a timespan of 3 years and information about ongoing projects is scarcely accessible. Therefore zonation policies based on these data will be flawed. There is urgent need for updated, validated and FAIR data about wind energy development in Europe. Freely available satellite imagery is fundamental to update wind turbine maps and algorithms for object identfication are a promising tool for this taks.

Marine renewable energy: more evidence required

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We present a comprehensive analysis of sixty-nine studies examining how offshore wind energy affects marine migrating

species. Our results show that, in contrast to hopeful predictions, there are numerous adverse effects during the building of fixed offshore wind infrastructure and its operation. The most common problems were behavioural ones, such as avoidance and changed swimming patterns, as well as acoustical ones that affected voice patterns.

The evidence base is significantly biased towards European waters and species that are listed as Vulnerable, Endangered, or Critically Endangered on the IUCN Red List: particularly non-mammalian taxa like fish and turtles. Our analysis highlights the urgent need for further information, particularly with relation to the pre-construction and decommissioning stages and new technologies such as floating offshore wind farms.

To address these knowledge gaps, we encourage the use of existing information and resources to better understand the effects on migratory species outside of the frequently researched fish, birds, and turtles. We call on efforts to improve data accessibility and sharing, highlighting the need to strengthen data infrastructure and encourage stakeholder collaboration to successfully navigate the complex issues presented by wind energy developments in the marine environment.

130: Sustainable land use: biodiversity conservation and ecosystem services in Mediterranean agroforestry systems

Linking biodiversity conservation and ecosystem service management in Mediterranean olive cultivation landscapes

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Global land use and climate change are major drivers of rapid biodiversity declines and impaired ecosystem services - particularly in Mediterranean areas. Here, olive agroforestry systems can play a crucial role in sustainable land use development, given their economic, cultural, and ecological importance. Depending on their local and landscape management context, they can benefit from pest suppression services provided by key organisms such as birds, bats, and arthropods – and likewise contribute to biodiversity conservation.

The ECO-OLIVES project studied these relationships on 192 olive trees located in 12 olive groves from the Monte Pisano region in Italy. We will present results from the first two years of this project (2022-2023): At the landscape level, higher proportions of surrounding semi-natural habitats significantly promoted species richness and abundance of birds, bats, and arthropods in olive groves. Related to this, experimental exclusions of birds and bats (compared to controls) resulted in lower yields and increased pest infestation rates of olives, while systematic pruning techniques led to opposite effects at the farm level. Integrating insights from socio-ecological studies, we discuss our findings with focus on challenges and opportunities of how transdisciplinary research can contribute to Sustainable Development Goals in biodiversity conservation and land use.

Why bats need sustainable farmland, and why sustainable farmland needs bats

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The global challenge of insect pests in agriculture demands sustainable solutions. Recent research underscores bats' pivotal role in integrated pest management, positioning them as vital natural enemies of agricultural pests. Bats exhibit top-down effects on crop pests, providing a valuable pest-consumption ecosystem service. Enhancing habitat heterogeneity and providing additional roosts encourage bat insectivory, but gaps persist in understanding the direct impact. In the Mediterranean, organic farming synergizes with bat activity, emphasizing habitat structure. Bats prefer organic farming, with a scale-independent effect on activity. However, landscape structure management is crucial for increasing bat richness. Even forest bat species may prey on agricultural pests, as observed at the Abruzzo Lazio and Molise National Park (Italy), underscoring the importance of forest patches and treelines within agricultural landscapes. Important research gaps include sublethal bat echolocation effects on tympanate moths, indirect impacts on plant pathogens, and active arthropod pest surveillance. So-called "common species" such as Savi's and Kuhl's pipistrelles are key pest suppressors: molecular tools have identified their diverse diets including many pest insects, which highlights the associated ecosystem service. Sustainable management practices should therefore prioritize these bat species, often overlooked in conservation strategies, balancing bat conservation with economic and social sustainability.

Biodiversity drivers and ecological services in agroecosystems: insights from birds, bats and apples.

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Birds and bats frequently co-occur in agroecosystems. However, information about their environmental responses and ability to provide common ecosystem services, like pest control, is still lacking. We analyzed the effect of landscape structure and agricultural management on bird and bat biodiversity, and the role of birds and bats in pest control, in apple orchards of northern Spain. We found differential responses of birds and bats to landscape structure and orchard features. Bird abundance and richness was higher in forested landscapes and in orchards with dense apple tree canopies. Bat activity and richness was higher in more urbanized and heterogeneous landscapes. These different responses suggest large-scale spatial complementarity in the provision of ecosystem services. Bird assemblage composition and functional diversity were resilient to landscape changes but, in the case of bats, were positively affected by forest cover. Birds exerted top-down control on apple pests. Pest control was positively affected by bird abundance, richness and functional diversity, with behavioral and trophic segregation underpinning these positive effects. Bat foraging activity was unresponsive to the abundance of apple Lepidoptera pests. Forest habitat conservation and orchard management may promote complementarity within and between bird and bat assemblages and improve pest control in apple agroecosystem.

Scale dependency of biodiversity-friendly land management - a FRAMEWORK case study

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Biodiversity-sensitive land management is gaining interest from policy-makers and land managers, following the increasing global decline in biodiversity that is affecting most groups of species, from the less mobile vascular plants, fungi and soil microbial organisms, to mobile arthropods, big mammals and birds. Among all the economic activities responsible, intensive agriculture has played an important role. Through the Common Agricultural Policies and Nature Conservation laws, the EU has tried to halt this loss, but the efforts are not enough. In recent years the scientific community has provided evidence for the fact that biodiversity can be better managed at a landscape scale. In this context, the EU-H2020 project FRAMEwork has developed and tested an approach able to involve local farmers to develop area-wide biodiversity-sensitive land management aimed at limiting pest insects and supporting beneficials.

In this presentation, we will show the case of the Italian olive growers cluster OliValGraziosa. Monitoring of wild bees and butterflies has allowed us to identify patterns and interactions at local and landscape scale that affect the abundances of these two important groups in a biodiverse olive grove agroecosystem. This knowledge can guide the farmers in the cluster in optimising local and landscape scale management practices.

Disentangling trophic relationships in agroecosystems for sustainable management: lessons from ants

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Ants represent a large proportion of the arthropod fauna in many terrestrial ecosystems, where they play a pivotal role in determining the structure and functioning of local communities. Disentangling the details of their ecology may help to understand the dynamics of such communities and to design ecologically sound control techniques.

The role of ant predation in the biocontrol of pest species has been widely acknowledged. Recent advances show that the control of pest populations by ants can also be achieved through non-consumptive, trait-mediated interactions (TMI), which occur when the pest species perceives the predation risk and modifies its behaviour to escape it. However, ants can also limit the populations of other useful predators through intra-guild predation and thus indirectly favour herbivores and plant parasites. Finally, ants actively tend honeydew-producing pests, such as scale insects and aphids, thus hampering the biological control of these pests.

Disentangling this complex network of interactions requires the concurrence of several different approaches, which range from direct observations of ant behaviour, predation experiments, and trophic analysis using, e.g., stable isotopes, to an effort to identify the compounds that may be involved in TMIs.

132: The role of non-crop habitats to support arthropod diversity and ecosystem services in agricultural landscapes

Promoting farmland biodiversity and ecosystem services at the landscape scale

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Agri-environment schemes (AES) have so far failed to halt the strong decline in farmland biodiversity. Landscape-scale implementation of AES through collaboration of multiple stakeholders could be a key to substantially improve their ecological effectiveness. However, it remains unclear how to determine the amount of target measures in a landscape, how this depends on the previous landscape heterogeneity, and what the social and economic consequences of collaborative AES are.

To address these questions, we implemented a landscape-scale experiment in the project KOOPERATIV by sowing 0-13.5 ha of perennial flower fields in 37 landscapes along an independent gradient of land use diversity.

Initial results show positive effects of landscape-scale land use diversity on bird species richness, abundance of bumblebees in oilseed rape fields and abundance of omnivorous and granivorous carabids. In the first year, the area of flower fields in the landscape did not affect birds, possibly due to the sampling shortly after sowing.

Our six-year monitoring of biodiversity and ecosystem services in the landscape experiment, as well as our analysis of social and economic influences, will be essential for designing collaborative AES in the future. It will therefore help to make AES a more effective tool for farmland biodiversity conservation.

Grasslands and crop fields are complementary for biodiversity irrespective of landscape grassland cover

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Temperate agricultural landscapes are experiencing an unprecedented erosion of biodiversity. The amount of non-crop habitat in a landscape is commonly identified as a driver of the species richness of taxonomic groups, but the relative contribution of crop and non-crop habitats to biodiversity has been surprisingly little studied. Using 86 paired permanent grasslands and oilseed rape fields across five European countries, we assessed how habitat type and cover of permanent grasslands in the surrounding landscapes affected species richness, diversity and assemblages of plants, butterflies, wild bees and carabids. Species richness and diversity were generally determined by habitat type and country but not by the the cover of permanent grasslands. Plants were more species rich and diverse and butterflies more diverse in grasslands, while wild bees and carabids where more species-rich (but not more diverse) in oilseed rape fields. Habitat type shaped species assemblages in most taxa and both habitats hosted a considerable share of unique species. Our results indicate that local biodiversity is not necessarily determined by surrounding non-crop habitat amount and that crop fields, depending on the taxonomic group, contribute significantly to the regional species pool. Biodiversity friendly local habitat management is thus needed in both grasslands and crop fields.

Climate and semi-natural cover drive fungicide and insecticide use in vineyards

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The choice of agricultural practices, their intensity as well as the yield and economic profits of most crops change depending on landscape and climate factors. For example, semi natural areas usually provide food and refuge sites to predators and parasitoids, enhancing pest control and enabling the reduction of pesticide use. We conducted an observational study to test how agronomic practices, pest management, environmental impact and yield of conventional and organic vineyards changed along wide climatic and landscape gradients across Italy. We used a block design with 38 pairs of conventional and organic vineyards, for a total of 76 selected vineyards. Most agronomic practices showed no significant differences between the conventional and organic vineyards. Instead, we found that the considerable variation in management practices within both farming systems was largely driven by climate and landscape composition. First, increasing semi-natural areas around the vineyards reduced pesticide pressure and related environmental impacts, but was also associated with lower yield. Second, a warm and dry climate was associated with reduced fungicide pressure. Overall, we highlighted the need for future assessments to consider the climatic and landscape context and explore the variability of both systems to achieve a less intensive and more sustainable grape production.

Positive effects of wildflower strips on invertebrate organisms and ecosystem services above and below ground

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Many studies have evaluated the effects of wildflower strips (WFSs) on pollinators, but the evidence for WFS influence on the abundance and species richness of other animal taxa and ecosystem services levels is limited. In this talk, we will introduce our experimental study system where WFSs of various types were established in 2020/21 in collaboration with local farmers. Using the BACI approach, i.e., collecting data before as well as during several years after WFS establishment, we gathered long-term data for the responses of eleven invertebrate taxa (bees and wasps, butterflies, carabids, hoverflies, leaf beetles, myriapods, spiders, true bugs, weevils, earthworms, soil-dwelling arthropods) and three ecosystem services (decomposition and pest and weed seed predation). In addition, short-term studies to investigate WFS effects on pest suppression (pest egg predation), winter performance (arthropod overwintering) and the effects of WFSs management on arthropods were conducted. Preliminary results indicate that the presence of WFSs supports invertebrate abundance and diversity across diverse invertebrate groups both above and below ground. In contrast, positive effects on ecosystem services levels were less obvious. In addition to existing evidence of WFS benefits for local biodiversity during the growing season, we also highlight their importance during the winter season.

Wildflower strips as key overwintering shelters for ground-dwelling arthropods at different life stages

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Wildflower strips (WFS) provide essential shelter, food, and nesting resources to beneficial arthropod taxa in agroecosystems during winter. However, the impact of WFS management practices on overwintering arthropod survival varies depending on the taxa and life stage considered. While most studies focus on adult arthropods, larvae may exhibit distinct distributional patterns and ecological requirements. To establish the significance of WFS and their management practice for winter survival of ground-dwelling arthropods, we conducted pitfall samplings in mowed and unmowed WFSs, field edges, and field interiors across ten fields from early January to late March 2023. Morphological identification was employed for adult specimens, while a metabarcoding approach was utilized for larval identification. We observed significantly higher species richness and abundance of adult ground beetles and beetle larvae within WFSs than the field interior, particularly along field edges. Moreover, WFS mowing negatively impacted carabid and beetle larvae in terms of individual numbers. These findings highlight the critical role of WFS in supporting the overwintering of multiple ground-dwelling arthropod taxa across different life stages. However, mowing may hinder their efficacy, making it necessary to explore mitigation strategies.

133: Advancing biodiversity monitoring for achieving Europe's Sustainable Development Goals: a visionary approach

Exploring the role of vegetation height heterogeneity through remote sensing information for biodiversity estimation

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Assessing biodiversity is vital for conservation and ecosystem management. Traditional methods, like field surveys, can be labor-intensive, hindering precise data acquisition. In recent decades, diverse methodologies utilizing remote sensing have emerged, comprehensively assessing structural and species diversity. The "Height Variation Hypothesis" (HVH) is an indirect approach tailored for this purpose. It posits that greater vegetation height heterogeneity (HH), measured through LiDAR or photogrammetry, corresponds to increased complexity in ecosystem structure and heightened species diversity. Tested in various ecosystems, the HVH has gained attention in recent literature. In forests, it's been applied with airborne laser scanning LiDAR and GEDI LiDAR data, showcasing space-borne LiDAR's capability to discern biodiversity patterns. The HVH's application extends to forest areas affected by extreme weather events, like the Vaia windstorm, aiming to understand the impact of HH on on forest biodiversity and stability. Beyond forests, it proves valuable in agricultural landscapes, integrating LiDAR data with ecological modeling for avian biodiversity conservation. Additionally, it assesses flower and bee biodiversity in grasslands using photogrammetric data from UAVs.

In conclusion, the HVH presents a promising approach for estimating biodiversity across ecosystems through LiDAR and photogrammetric data, offering insights from recent literature to advance understanding and support effective conservation strategies.

Monitoring aerial biodiversity using a network of small-scale biological radars

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Each day, trillions of animals take to the skies in pursuit of increased survival or reproductive output. In the current biodiversity crisis, continuous large-scale monitoring of these aerial activities would provide key information on (changes in) this aerial biodiversity, enabling targeted conservation actions for a large part of the terrestrial biodiversity. Radars are powerful remote-sensing tools that can provide such information in detail by quantifying the intensity, timing, and spatial distribution of aerial animal abundance and movements. Small-scale biological radars simultaneously track and classify individual birds, bats, and insects from 3 m up to several hundred meters above ground. Various features measured by these radars such as the size or shape facilitate differentiating into several species-groups. We present a summary on the current biodiversity monitoring possibilities with such biological radar, the open-source tools to process the data, and showcase the potential of a network of such radars for large-scale, detailed biodiversity monitoring by demonstrating their use in quantifying the abundance and temporal movement patterns of insects across Europe. If networks of biological radars would be established through national and international governmental programs, their detailed, temporally-continuous, and large-scale monitoring of aerial biodiversity could provide key input on global Essential Biodiversity Variables.

Past, present and future of EU priority habitats, example from the Alps

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Europe's Alpine landscape has undergone significant modifications in the last decades due to socio economic changes. The Trentino region, Italy, has shown the same trend with a significant increase in forest coverage as a result of the abandonment of marginal agricultural sites. Due to the natural forest recolonization, open areas like meadows and pastures have shrunk in many mountain rural areas changing the ecological landscape mosaic. Priority habitats where a unique botanical biodiversity is preserved are among the open spaces that are endangered, together with the fauna that depends on open areas (capercaillie, black grouse...). Remote sensed data are crucial to detect, georeference and quantify the spatial environmental changes with the aid of GIS and machine learning algorithms. Combining remote sensed data with historical sources like cartography and forest management plans allows to rebuild past landscape and model future scenarios that can help to guide environmental management choices, for example highlighting the most endangered priority habitats or the effect of climate change Different examples of application of these techniques (developed using FOSS4G) applied at different spatial scales are presented, discussing how the changes affect the distribution of biodiversity, social and cultural dynamics, perception of the landscape, and ecosystem services.

Advancing bat conservation: insights from automatic acoustic long-term monitoring in the Italian Alps

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Bats are facing a global decline primarily due to habitat loss and agricultural intensification. In Europe, bats are protected by laws, and the monitoring of their populations is required by the European Union. However, studying bat species is challenging due to their nocturnal, elusive habits, and high mobility. Direct sampling methods for their monitoring can disturb the animals, are often costly, usually limited to small geographical areas and require specialised personnel. Nowadays, automated and miniaturised bat detectors allow long-term and large-scale monitoring studies on bat communities.

Here we present a broad-scale case study using automatic bat detectors to assess the effects of agricultural intensification on bat diversity in mountain environments (South Tyrol, Italy). We selected 47 sites in open agricultural areas, considering pastures, hay meadows, dry grasslands, and annual crops. We used generalised linear mixed models to analyse the activity of bat foraging guilds in relation to agricultural practices, natural structural elements, and landscape variables. Overall, woody features, hedgerows, and wetlands positively influence especially endangered bat species and play a key role in agricultural areas. Bat detectors contribute to efficient large-scale survey and monitoring systems, advancing our understanding on bat distribution even in remote areas and facilitating targeted conservation actions.

Classification performance in camera trap photos varies across citizen science, artificial intelligence, class types, and environment

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1. Camera trapping, a popular non-invasive wildlife monitoring tool, produces numerous images. The overlooked variation in classification performance, which affects ecological inference, arises from using systems like Citizen Science (CS) and Convolutional Neural Networks (CNNs), class types, and camera/environment factors.

2. We evaluated a Citizen Science project and two CNN architectures on a dataset of 100,059 expert-classified images, identifying diurnal and nocturnal images across six classes: humans, cervids, leporids, wild boars, red foxes, and empty images.

3. Citizen Science showed high precision, while CNNs had a superior recall, particularly for leporids. Both struggled with nocturnal photos, especially in precisely identifying empty images, indicating possible under-detection at night. CNNs processed up to 1,150,000 images daily, far outpacing Citizen Science, which annotated only 25% of the same volume. Filtering out low-confidence classifications leads to an impractical increase in the manual workload, lowering the overall detection rate due to fewer images for reliable identification.

4. These findings highlight a key distinction: CNNs effectively maximize species detection with speed and high recall, whereas Citizen Science is better for minimizing classification errors. The study underscores the need to evaluate misclassification variations across systems, classes, and environmental factors for accurate ecological inference.

134: Ethical assessment in conservation projects

The role of ethics in conservation: tools and methodologies

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Conservation projects can be ethically challenging as they involve several value demands and different stakeholders — biodiversity, animals, and people— with different and competing interests. The ethical challenges have to be carefully addressed in order to support decision-making and prevent conflicts which, ultimately, can compromise the success of conservation projects. By addressing the various ethical dimensions involved in a conservation project, with the help of specific tools and methodologies, conservationists can strive for responsible and effective decision-making. Key factors to be considered include projects' effectiveness in achieving conservation goals, their compliance with legal and best practice standards, their integration within the social environment and local communities, their scientific quality and, last but not least, animal welfare considerations. Appropriate tools and methodologies are discussed herein, specifically developed and standardized for the ethical analysis and self assessment of ethical implications in conservation projects, maintaining a focus on case studies to show their appropriateness and usefulness in conservation practice. The application of a standardized ethical assessment can promote the consistency and comprehensiveness of conservation projects, while favoring communication among projects' partners and ultimately contributing to the preservation of biodiversity and the success of their actions.

The ethical and media content analysis of human-large carnivores conflicts: the "JJ4" case study from Trentino, Italy

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Challenges in Human-Wildlife Conflict (HWC) management, especially when involving large carnivores, often revolve around conflicting ethical perspectives, needs and interests between different stakeholders, and can be exacerbated by media coverage that tends to sensationalise negative incidents. In this study, we applied an ethical tool, combined with media content analysis, to navigate these conflicts, focusing on a notable HWC scenario in the Trentino Region (Italy) involving the bear JJ4, responsible for a resident's death on April 5th, 2023. We collected media reports (n=274) from April to September 2023 using Google News, obtaining reported statements from eleven stakeholder categories, which were used to fill out an Ethical Matrix. The EM is a conceptual tool designed to assist decision-makers in navigating ethically intricate situations, categorising stakeholders' moral demands across three principles: well-being, autonomy and fairness. Findings show a strong, ethically relevant imbalance in media representation of stakeholders' opinions and interests, markedly emphasising conflicts between the region's politicians and animal rights activists, while other categories' ethical standpoints were largely less portrayed. This bias poses an obstacle to HWC management, which can be properly identified and addressed by applying ethical tools, contributing to a more equitable consideration of different stakeholders' interests in the decision-making process.

Using decision trees and the Bateson's cube in ethically-sensitive conservation scenarios

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Acting for the conservation of biodiversity can often confront us with mutually conflicting demands coming from different dimensions of ethics—the environmental, the animal, and the social. In such cases, setting up the decision-making process transparently and robustly can be crucial to achieving fair trade-offs. It is possible to facilitate this goal using conceptual tools for the ethical analysis. In this talk, I will describe how two well-known tools—decision trees and Bateson's cube—can be specifically tailored to analyze ethical conflicts in conservation and successfully employed to assist decision-making on ethically sensitive conservation scenarios. The use of ethical analysis tools does not remove the ultimate responsibility of the decision maker to choose a particular option from those available but it can make the process leading to the final decision more reasoned, participatory, and comprehensive—and, in the end, more just.

Conservation ethics in practice: the 3Rs principles in wildlife research

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The 3Rs principles for animal research (Replace, Reduce, Refine) have become a part of many animal protection legislations worldwide and should be used in any research on animals. However, the process of incorporating the 3Rs principles into research outside of the laboratory settings has been unfortunately rather slow and their importance overlooked. We critically examined the implementation strategies of the 3Rs principles in wildlife research, based on a review of research protocols published between 2021 and 2023 across diverse species, ecosystems, and countries. The analysis revealed a broad spectrum of approaches in applying the 3Rs across different projects. Some research protocols demonstrate innovative strategies that can significantly reduce the impact on animal welfare. However, a notable segment of the studies still shows a lack of understanding and application of these principles. Our findings therefore underscore the importance of integrating the 3Rs more effectively in conservation research. We advocate for heightened awareness and improved implementation strategies, emphasizing the need for ongoing education and policy development in this area. This project not only sheds light on current practices but also aims to drive a shift towards more ethical and responsible wildlife research, aligning scientific pursuits with animal welfare considerations.

136: Toward just and power-sensitive biodiversity conservation

Unraveling power dynamics in conservation and restoration for environmental equity

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The conservation and restoration of ecosystems are crucial for addressing biodiversity loss and climate change, as emphasized by the UN Decade on Ecosystem Restoration. However, ensuring their effectiveness requires integrating equity considerations to align with Sustainable Development Goals. Despite the importance of these interventions, power imbalances often lead to uneven distribution of benefits, causing conflicts with local communities' aspirations. The human dimension presents a significant challenge to these efforts, necessitating a holistic, social-ecological perspective that addresses underlying power dynamics. Genuine integration of diverse stakeholders is hindered by prevailing power imbalances concealed within local contexts. Addressing these imbalances requires more guidance from existing research, given persistent knowledge gaps regarding their role in shaping equitable outcomes. Drawing on a systematic literature review and case studies from Zambia and Rwanda, this discussion explores how power imbalances may co-occur with neo-colonial structures and biases, enriching discourse on governance mechanisms aligned with local realities. By promoting sustainability, equity, and inclusivity in conservation and restoration activities globally, this talk advocates for intersectional analysis that acknowledges and addresses power dynamics.

Mapping stakeholder power dynamics to inform effective wetland conservation in Australia's Murray Darling Basin

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Wetlands face severe decline, posing complex governance challenges due to their high exposure to anthropogenic stressors and resource commonality. Understanding the structure and function of power dynamics among the often, diverse stakeholders that manage these complex systems, is a key knowledge gap for ensuring environmental policy can achieve conservation outcomes. However, empirical research on stakeholder power dynamics in environmental governance systems is scarce. We developed an innovative mixed methods technique, to systematically characterise how different stakeholders implicitly perceived and exerted, different types of power in the environmental governance framework for an internationally listed RAMSAR wetland in Australia's Murray Darling Basin. We integrated quantitive and qualitative analyses of interview and perception matrix data to map behavioral patterns in community participation in wetland management. This identified several mechanisms through which stakeholders exerted power through relationships, disproportionately influencing water decision-making, with significant implications for long-term conservation efforts. We emphasis the importance of a functional understanding of stakeholder relationship dynamics in successfully implementing environmental policies with community participation. Our research develops much needed empirical methods for diagnosing significant, abeit often latent, environmental governance issues (e.g redistribution of risk, corruption) that undermine conservation goals, a crucial step in enhancing ecological resilience for all ecosystem types.

Feelings of justice towards conservation measures when owning and working the land - The case of landowners in southern Quebec

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The need to act in favor of biodiversity is increasingly leading to conservation measures on private land. However, their effective implementation depends on their acceptability. To prevent or manage conflicts linked to the implementation of conservation measures, it is necessary to understand landowners' feelings of justice. Here, we sought to understand southern Quebec landowners' perceptions of justice regarding conservation measures. Specifically, we: 1) determined how conservation measures are perceived using four dimensions of justice, and 2) assessed whether these perceptions depend on landowners' characteristics (e.g. income). We used Q-methodology to obtain and analyze the information. Feelings of justice were not related to the type of activity, but rather to economic dependence on the land. Years of experience and age also influenced justice-as-recognition. We found both consensus and contrasting perspectives in each dimension of subjective justice. We identified possible entry points for improving conservation measures, e.g. the consensual recognition of landowners' lands as wildlife territory, the idea that conservation is not an obstacle to economic development, and their willingness to engage in conservation. All the perspectives around the assessed dimensions of justice point to strengths and weaknesses of conservation measures that merit attention if they are to be acceptable and functional.

Understanding the diverse facets of power within stakeholder engagement to achieve effective biodiversity conservation

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Engagement of stakeholders is increasingly central to biodiversity conservation efforts, where power plays a pivotal role in determining outcomes. While power is often viewed in a one-dimensional, coercive manner, a nuanced perspective acknowledges its multidimensional nature, encompassing both structural and ideological dimensions, as well as its potential for productivity and facilitation. This presentation delves into the impact of various facets of power on participatory processes aimed at biodiversity conservation objectives. Drawing from six case studies across Europe and the Asia-Pacific region, an adapted framework is employed to explore the intricate interplay between "power over" and "transformative power," examining the scale, spatial dynamics, arenas, and modes of expression of power. By focusing on biodiversity, this analysis penetrates beyond surface-level issues and diverse stakeholder interests, such as wildlife concerns, to scrutinize underlying power dynamics. Diverse manifestations of power provide insights into how participants incorporate nature and biodiversity into their aspirations. Additionally, varying levels of power underscore the importance of examining participatory processes not only at the local level but also within broader national and international governance frameworks in our globalized world. Finally, this examination highlights two key challenges in participatory biodiversity processes: the representation of non-human interests and the integration of multiple knowledge systems.

Preliminary findings from a systematic mapping of the various dimensions of power in participatory processes for biodiversity

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Biodiversity conservation increasingly emphasizes stakeholder engagement to address conflicts, foster trust, and enhance learning, aiming for ownership and effective decision implementation. Participation in environmental governance typically yields positive outcomes when power is shared among participants, with communication intensity and participants' environmental stance also influencing results. However, we still need to better understand when, where, and how power dynamics can be considered in participatory processes regarding biodiversity and how they affect the outcomes. To develop the systematic review, we firstly adopt a multidimensional conceptualization of power, based on theories from social and political sciences, to move beyond a single interpretation of power. Secondly, we construct the participatory processes between different core units of analysis, including context, process design, process implementation, outputs and social outcomes and substantive outcomes and environmental impact. By systematically reviewing the evidence and context of individual case studies, this review maps the key dimensions of power in different contexts of stakeholder participation to better design future biodiversity conservation projects that can harness the positive potential of power in stakeholder participation. It can benefit researchers studying participatory processes and outcomes, institutional actors initiating such processes and often implementing their solutions, and facilitators designing and implementing participatory processes.

Enhancing participation practitioners' awareness: A Reflective Matrix for Navigating Power Dynamics within participatory process for biodiversity

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Despite decades of advocacy for increased stakeholder participation, systematic evaluations of its contributions to biodiversity conservation are only beginning to emerge. These studies scrutinize participatory design, process, and outcomes, providing insights into effective participation. However, while many acknowledge power imbalances, few delve into strategies for addressing them. This issue is pertinent to all involved in implementing participatory approaches, termed participation practitioners, including researchers using participatory methods and professionals in consulting firms or local authorities. Addressing power asymmetries entails reflecting on one's own position in interventions concerning these imbalances. In practice, implementers adopt specific stances on power imbalances, reflected in methodological choices. While some toolboxes propose methodologies, we emphasize reflective practices embedded in facilitation to understand power dynamics. Utilizing different stages of the participatory process, we propose a matrix to support facilitators' reflection on their own power, group power dynamics, and direct engagement with the group. This matrix is a work in progress, undergoing testing and adjustment by various facilitators. In this presentation, we introduce the matrix and share feedback gathered from facilitators' experiences. We also invite further input for improvement, aiming to compile perspectives on the utility of reflective practices in managing power during participatory processes for biodiversity conservation.

137: Biodiversity-friendly food labels and certification: perspectives for the European agriculture and conservation policy

Comparative case study analysis of biodiversity-friendly food certification schemes and businesses in Europe

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European Commission recently published several high-level documents, including the "Farm-to-Fork" and the EU Biodiversity strategies, which call for better food market transparency and higher ambition in fighting against biodiversity loss. It has also committed to empowering consumers to make informed, healthy and sustainable food choices and to promote certification schemes and standards for sustainable food systems. However, attempts to create biodiversity-friendly standards have often failed due to their inability to secure successful business models or to gain sufficient market access. Furthermore, the existing certification schemes, including organic farming, contain limited criteria in the field of biodiversity conservation. Setting up a biodiversity-friendly business requires adopting an innovative approach to organising producers, governance structures and marketing strategies. For such innovations to diffuse into wider use in the food systems, they need to demonstrate advantageous characteristics, enable utilisation by a suitable group of adopters and appear in a favourable socio-economic context. In our study, we use the diffusion of innovations theory as a theoretical framework to analyse eight biodiversity-friendly certification schemes. We aim to discern variables that may critically shape the mainstreaming of biodiversity conservation in the European food systems' certification and marketing strategies.

A Credit Point System for assessing and enhancing biodiversity at the farm scale - and beyond

Simon Birrer, **Judith Zellweger-Fischer**
Swiss Ornithological Institute, Switzerland

Farmland biodiversity cannot be easily and directly measured. Therefore, we developed the Credit Point System (CPS). This system acts as a comprehensive tool, capturing all biodiversity-promoting efforts at the farm level. By completing the CPS, farmers receive a point score, serving as a proxy for the overall biodiversity initiatives on their farm.

Farmers can accumulate points by applying 34 different measures. In Switzerland it is obligatory to manage at least 7% of the utilised agricultural area (UAA) as biodiversity promoting areas (BPAs). These mandatory BPAs contribute to the biodiversity score, along with factors like ecological quality and spatial distribution. Points are adjusted for farm size, land-use type and production zone. Furthermore, scores are weighted based on previously researched benefits for biodiversity; for example, larger-sized species-rich flower meadows yield more points compared to simple no-input meadows.

The Credit Point System was evaluated by the Swiss Ornithological Institute and the Research Institute of Organic Agriculture FiBL from 2009 to 2015. Since then, it has been implemented by the producer's organization for integrated farming, IP-Suisse. Achieving a minimum biodiversity score is now mandatory for approximately 10'000 farmers producing for IP-Suisse.

Farmers' preferences for biodiversity labelling in four European countries

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Biodiversity labels, designed to certify and highlight biodiversity benefits of agricultural practices to consumers, can provide new business opportunities for farmers. While some research exists on consumer preferences for biodiversity labels, no evidence exists on the acceptance of such labels among farmers. To assess the acceptance of potential biodiversity labels we run a large-scale survey among farmers in four countries across Europe (NL, RO, UK, EE). Via discrete choice experiments (DCEs) we assess the influence of biodiversity labels on the acceptance of dark green measures, i.e. extensive hedgerow (management and planting), and high nature value grasslands. We consider the options of international and regional labelling. We find varying preferences of farmers for biodivesity labelling between the different countries, ranging from a higher preference for the regional label in Estonia, to a preference for the international label in UK, to an overall aversion of the proposed labels in The Netherlands.

Do protected areas contribute to the shift of farmers cultural norms towards nature-friendly farming? A Slovenian Perspective

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Policy mechanisms, such as agri-environmental measures, have the potential to (re)shape farmers' cultural norms and behaviours in the context of nature conservation. Protected area (PA) management activities, as a backbone of European conservation efforts, are expected to exert a similar impact. While existing research has explored farmers' attitudes towards PAs, scant attention has been given to understanding how PAs and their management contribute to shaping farmers' norms regarding nature conservation. In our study, we interviewed 48 Slovenian farmers in three PAs, employing the Bourdieusian-inspired 'good farming' construct. Qualitative analysis reveals that the current PA management system in Slovenia may have a limited positive impact on shifting cultural norms or could even act counterproductively. The predominant productivism perspective significantly shapes the norms associated with being a 'good farmer.' Despite farmers acknowledging the importance of multifunctional agriculture, the adoption of nature-friendly farming norms is restricted. The findings underscore the need to strengthen collaboration between farmers and PA managing authorities, which could take place through the promotion of localized knowledge exchange, active involvement of the local 'good farmers' in the PA management, and result-oriented incentives that enable inclusion of the biodiversity conservation farming practices in the social capital of local farmers.

The Great Big Nature Survey: understanding public opinions of nature and conservation across the United Kingdom

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Public opinions shape the success of conservation efforts, yet remain understudied and poorly understood. In this talk I will introduce the Great Big Nature Survey, a large-scale, annual survey developed by the Royal Society of Wildlife Trusts in collaboration with academic researchers which aims to understand public opinions of nature and conservation across the UK. The survey, which includes questions on four broad themes - (1) actions taken to help nature, (2) nature's role in wellbeing, (3) attitudes about the goals of conservation, and how they should be achieved, and (4) the most significant threats to nature - was first launched in March 2023, and since then has been taken by >18,000 respondents. I will describe the process of creating the survey, which included the development of a set of novel psychometric scales for measuring public attitudes towards conservation interventions, present findings from the first year of the survey and describe our plans for future work.

139: Looking back to move forward: the potential of historical ecology for the future of biodiversity conservation

Shifting the conservation baseline with historical data: implications for decision making

Laetitia M. Navarro, Miguel Clavero
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Knowing past biodiversity distribution patterns is a key step to guide the conservation and management of natural resources. Yet, most indicators of biodiversity change designed to describe long-term and large-scale processes are based on relatively recent time-series, or space-for-time substitutions. Nonetheless, important historical information on biodiversity is often contained in a diverse and rich array of historical cultural sources (e.g. gazetteer, military maps) frequently ignored by environmental sciences, and within equally diverse natural archives (e.g. palynological records). Here, using the example of extensive data on biodiversity in the 16th and 19th centuries in Spain mobilized from geographical dictionaries, we will present the extent to which shifting the benchmark used to assess biodiversity change might affect our ability to detect this change and the resulting implications for decision making in conservation. We will discuss the implications of shifting the baseline for determining the conservation status of species, and the prioritization of certain areas for conservation. We will then discuss the overall potential of historical material for biodiversity conservation and address the identification, mobilization and integration of ecologically relevant historical data as well as pathways to further mine and share this information.

Spy Satellites for Ecology and Conservation

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Without a sound understanding of the past, it is difficult to design sustainable solutions for the future. Remote sensing data are an important tool for assessing ecological change, but their value is often restricted by their limited temporal coverage. Many major historical events that still have lingering legacies in current environments are not captured by modern remote sensing data. Here, we demonstrate the considerable potential of historical spy satellite images to expand ecological and conservation assessments back to the 1960s. These data can answer important questions related to long-term ecological change, shifting baselines, lag effects, and ecological legacies. We highlight the potential of declassified, panchromatic satellite imagery, which has global terrestrial coverage, to monitor ecosystem extent and structure, species' populations and habitats, as well as human pressures on the environment. Recent advances in image processing and analysis, combined with best practices in data sharing and archiving can now unlock this research resource. We encourage ecologists and conservationists to make use of this opportunity to address ecological and conservation questions, and we encourage the further release and open use of historical data archives for understanding long-term environmental change.

Unveiling the biodiversity conservation potential of mining centuries old written sources

Miguel Clavero
Estación BIológica de Doñana - CSIC, Spain

Knowing ecosystem states and species distribution patterns in past periods is crucial to understand the complex relationships between human societies and environmental change and guide biodiversity conservation. However, biodiversity researchers often consider that the trustable information needed to generate this knowledge is scarce. But people have in fact produced for centuries a huge amount of information on biodiversity, which is contained on a diverse array of historical sources that are frequently ignored by environmental sciences. Historical ecology approaches provide an adequate framework to integrate and synthesize historical information on species and ecosystems and inform biodiversity conservation planning.

Biodiversity records included in Iberian historical sources (back to the 1300s) are being mined, to provide useful information for biodiversity conservation. The resulting inventories are notable due the unprecedented combination of the fine grain and large extent (both in space and time), the taxonomic precision and diversity and the vast amount of data, with tens of thousands of localities providing hundreds of thousands of records. I will provide different examples of the application of historical information for biodiversity conservation, including species-focused conservation action in both freshwater and terrestrial systems, the management of biological invasions or the long-term reconstruction of landscape features.

The importance of multidisciplinary research in historical ecology: the case of the black francolin (Francolinus francolinus)

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Addressing the past patterns, dynamics and events is an ambitious but essential task to gain a thorough understanding of present-day biodiversity. Historical ecology is the emerging field of research which is rising to this challenge. Its markedly multidisciplinary nature is crucial in providing convincing answers to questions that would otherwise remain unsolved. We present here the paradigmatic case of the black francolin (Francolins francolinus), a prized gamebird presently ranging from Cyprus to India but historically also distributed along the European and African coasts of the Mediterranean. The combined use of museomics, archaeozoology, historical documentation - both textual and pictorial - allowed to ultimately assess the yet contentious nonnativeness of the black francolin to both Europe and Africa, while unveiling the extinct populations as originary from the Near East and the Indian subcontinent. If, on the one hand, the methodological advances of the last decades and archival DNA knowhow of molecular biologists were key, the information provided by historians about past diplomatic relationships, aesthetics and economics were equally important to confirm the trade of this gamebird along information long-distance trade routes. Remarkably, citizen science may play an important role in similar studies by helping to identify privately-owned and often neglected resources.

Circling back: To head into the future of whales' conservation we must go back in time

Cristina Brito, Patrícia Carvalho, Nina Vieira Vieira
CHAM / NOVA FCSH, Portugal

The blue humanities allows to combine multiple perspectives and methods to address historical trends of changes on ecosystems, sociocultural developments, impacts and the resulting consequences for marine populations. Within this dynamic field of research, we include both marine environmental history and historical marine ecology, and a series of species or populations can be analysed. The history of whales and whaling, that is the use of documentary, iconographic, cartographic sources and material evidence, to address past distributions, human practices and impacts on the ocean and its animals, is paramount to understand current environmental issues related to ocean conservation. Cultural products offer a sense of the importance of these animals to humans and the past and current state of interactions established. Analysing data from catches for Portugal since medieval times, and the former Portuguese colonial territories, we can draw a story of sequential use of targeted species of large whales. By exploring previously unknown natural history treatises, or other written sources alike, is now showing the scientific relevance of these animals for early modern society. Putting data together, we get an all-encompassing perspective on the historical, economic and cultural value of large whales up to the present day.

The IUCN Green Status of Species: assessing species recovery against historical baselines

Molly K Grace
University of Oxford, United Kingdom

The most widely-used global metric of species conservation status today is the IUCN Red List of Threatened Species, which assesses species' extinction risk. The timescales over which changes in species status are evaluated must necessarily be relatively short (10 years or 3 generations, depending on the species) in order to highlight rapid declines in population size or range which may signal acute threats to species persistence. However, this narrow temporal focus presents a danger of shifting baselines, since declines which have occurred in previous centuries often do not fall within the relevant time window for assessment.

This talk focuses on IUCN's response to the challenge of shifting baselines: The IUCN Green Status of Species. Launched in 2021, the Green Status of Species (a CBD indicator) is an assessment of species recovery, complementing the extinction risk assessment. Recovery is measured against a pre-impact baseline, often requiring historical sources of information. The Green Status promotes ambitions to restore species to historical levels, working in parallel with the crucial short-term focus on preventing extinction. This provides a more comprehensive conservation story that includes a species' past, present, and potential future.

140: The molecular carol: past, present and future of molecular tools in Conservation Biology

The eDNA analysis in conservation

Caterina Maria Antognazza
Università degli Studi dell'Insubria, Italy

Environmental DNA (eDNA) analysis has blossomed into an indispensable tool for monitoring and researching various ecosystems over the past few decades. Conservationists and researchers are constantly seeking innovative tools to better understand and protect our planet's biodiversity. Advancing in technology and methodology enabled eDNA analysis to broaden its scope of applications, thus gaining popularity, finding a vital role in conservation efforts. For example, by analysing DNA traces left behind by various species, the presence of endangered or elusive animals could be assessed, aiding in conservation planning and management. Early advancements in DNA-based taxon identification were also significantly boosted by next-generation sequencing technologies. The rapid evolution of eDNA analysis in the 2020s highlighted, though, the necessity for optimizing protocols to adapt to different conditions. The swift pace of advancements, however, brought forth challenges in maintaining methodological standards, which are essential for facilitating cross-study data mining. Conservation management and planning can greatly benefit from eDNA-driven ecological insights, particularly in enhancing strategies for connectivity, spatial prioritization, and habitat restoration. The available technologies and methods offer a non-invasive, efficient, and often more comprehensive means of assessing biodiversity and ecological health, which is crucial for informed conservation decision-making.

An integrative framework for Dark Taxa biodiversity assessment at scale: a case study using Megaselia (Diptera, Phoridae).

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Species extinctions increase at a global scale, rapid inventorying of our planet's biodiversity is becoming essential. It is a pressing need to investigate insect biodiversity and accelerate species discovery and description, especially for species belonging to megadiverse and understudied groups, also known as “dark taxa”. Phoridae (Diptera) are a great example of a "dark taxon". The use of an integrative methodology based on multiple data sources is probably the best approach to face up to the task of describing “dark” taxa. Here, we use the Large-scale Integrative Taxonomy (LIT) approach to sort 10,000 Megaselia Rondani (Phoridae) into 277 preliminary species hypotheses based on next-generation sequencing barcode clusters obtained with a 3% threshold. Each cluster was passed through predictors for incongruence indices between barcode clusters and morphology, and a subset of specimens were subsequently morphologically examined for each cluster. This study led to the description of twelve new species and a 12% increase in species for Germany. We provided species estimates and our results suggest that a 15% further increase in species richness may occour at the sampling sites. As this estimate was mostly based on samples from southern Germany, the species count will likely increase with expanded geographic sampling.

The Turtle Project de-siloes science and innovation for the protection of sea turtles

Christophe Eizaguirre
Queen Mary University of London, United Kingdom

Threats to biodiversity have escalated in recent years, and therefore science and innovation are urgently needed to address these challenges. Molecular tools can aid critical conservation efforts. For example, understanding how species with temperature-dependent sex determination, such as sea turtles, will be impacted by global warming is vital for their survival. To understand the risks of extreme population feminization, we used whole genome methylation analyses to identify biomarkers for monitoring primary sex ratios in loggerhead turtles nesting in Cabo Verde. Despite the major advance this sexing method represents, research should not occur in isolation. Instead, robust collaboration between scientists and the civil society is essential. The Turtle Project integrates R&D with NGOs' needs and community engagement to develop evidence-based strategies for sea turtle protection. In this talk, I will highlight the links between our research, conservation, and community outreach.

ORG.one: supporting rapid sequencing of any endangered species, anywhere, by anyone

Kara L Dicks
ORG.one, Oxford Nanopore Technologies, United Kingdom

Understanding, mitigating, and reversing biodiversity loss requires a broad range of tools and approaches. There is increasing recognition of the importance of genetic diversity as a vital component of biodiversity and on the utility of genetic tools, such as DNA barcoding and eDNA, to assess and monitor species and communities. Yet, lack of access to genomic tools to generate the data required to guide and improve conservation efforts can prohibit their utility. ORG.one is a project designed to support equitable, faster, and more localised sequencing of endangered species.

Existing projects to sequence endangered species have made good progress; however, they can be limited by complex workflows and the requirement to send samples to centralised, often overseas, locations for sequencing. ORG.one enables biologists to rapidly study those species close to the sample’s origin, using the latest sequencing approaches to develop high quality de novo draft genome assemblies. In this talk, I will discuss how these genomes are forming the foundations for developing biodiversity monitoring efforts, identifying conservation challenges (e.g. hybridisation) and solutions (e.g. disease resistance alleles), and upskilling a community of conservation geneticists. With its partners, ORG.one is focusing on delivering and demonstrating the impactful benefits of genomics for conservation.

Epigenetics as a new biomarker of stressors in conservation research

Suvi Ruuskanen
University of Jyväskylä, Finland

Epigenetic variation refers to reversible chemical changes involved in the regulation phenotypes without, modifying the nucleotide sequence of the DNA. Ecological epigenetics is a rapidly growing research field and epigenetics has been identified as a new tool also in conservation biology. One key research direction is using epigenetic changes as biomarkers of past or current exposure to environmental stressors and a marker of individual physiological stress. Interestingly, especially early life stressors may have long-lasting effects through epigenetic changes, even through generations, that could contribute to explain (slow) population responses to environmental changes. Along with a broader overview, I provide case examples of epigenetic changes to environmental changes, such as chemical pollution and radiation, using wild bird populations as the study systems. I also describe how early-life stress may have long-lasting consequences on the stress-axis via epigenetic changes. Our work demonstrates how various environmental stressors change DNA methylation in many key pathways. I also discuss future of using epigenetics as biomarker. All in all, epigenetics provides a fruitful new research area in conservation research.

An epigenetic toolbox for conservation biologists

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Biodiversity conservation calls for a comprehensive approach that spans multiple biological levels. Delineating conservation units and predicting population resilience is essential for effective conservation management. Yet the genetic tools required cannot always detect signals of short-term ecological dynamics. Epigenetic modifications carry valuable information to gain insights from the individual to the population and species levels. Here, we provide a toolbox for monitoring epigenetics signals that can be directly applied in various conservation contexts. The primary focus of our toolbox is on DNA methylation, for which conservation tools are already available. For instance, the identification of biomarkers associated with age or infection can facilitate the determination of an individual's health status. On the other hand, whole genome epigenetic information can identify epigenetic signatures of rapid selection linked to environmental stress and therefore facilitate the quantification of the adaptive potential of populations. Lastly, we introduce the upcoming use of methods, beyond sequence level information, as conservation tools, such as epi-eDNA (epigenetic-environmental-DNA) and benefits associated with understanding gene regulation. Overall, our proposed holistic approach refines conservation strategies, ensuring species adaptive potential and persistence. Epigenetic insights offer a transformative pathway to protect endangered species effectively, by considering their molecular dynamics within changing environments.

141: Managing hybridizing populations: threats or opportunities for conservation?

Wolf-dog hybridization and introgression in the Dinaric-Balkan region of southeastern Europe

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Anthropogenic hybridization is a risk to many wild species in diverse ecosystems. Where related domestic species are abundant, this can result in hybridization and, over time, a hybrid swarm. In Dalmatia in southern Croatia, and parts of Bosnia and Herzegovina, armed conflict during the 1990s caused large-scale human movements and abandonment of domestic animals, including dogs (Canis lupus familiaris), which are known to hybridize with wolves (C. lupus). Wolves at population expansion edges are particularly vulnerable, and wolves recolonized Dalmatia around the same time. Earlier studies in this area have identified hybrids and individuals with atypical phenotypes classified as wolves based on limited sets of microsatellite markers. With a recent panel of 96 single nucleotide polymorphism (SNP) markers to detect wolf-dog hybridization and introgression in Europe, we found several second-generation backcrosses to wolves (BC2w). Our results indicate that hybridization occurred over a decade ago, followed by introgression. Moreover, introgression appears spatially restricted, despite a wider area with similar environmental conditions. Importantly, the SNP panel can detect introgression up to and including BC2w, and later-generation backcrosses likely exist undetected. Whole-genome sequencing combined with ecological and behavioural research are needed to assess introgression and its long-term impacts on wolf genomes and phenotypes.

Hybridization, introgression, and conservation genetics of European wildcats

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The range of the European wildcat (Felis silvestris) extends into anthropogenic landscapes where it overlaps with domestic cats (Felis catus). Genetic monitoring has identified patch-like geographic variation in hybridization events across Europe, with several regions showing high rates of hybridization and even hybrid swarm formation. In contrast, hybridization rates appear low in other regions, and genome-wide studies have revealed overall limited long-term domestic cat introgression in the genomes of wildcats. Currently, new genomic marker systems optimized for high-resolution hybrid detection enable systematic assessments of regional hybridization rates. Here, we discuss how recent methodological improvements and genomic data coverage can be used to investigate the observed spatial variation in hybridization rates as well as the long-term consequences of domestic cat introgression for the persistence of the endangered wildcat. For instance, surveys of the hybrid swarm in Scotland suggest that its rapid formation was fostered through selective advantages for wildcats with domestic cat ancestry. Such findings raise the question under which conditions mixing between wild and domestic congeners may constitute a potential evolutionary advantage regarding rapidly changing anthropogenic environments.

Impact of hybridization and genetic introgression on the long term survival of the critically endangered European mink (Mustela lutreola).

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The European mink (Mustela lutreola) is one of the most critically endangered mammal species in the world. It only survives in few geographical spots situated in North Western Russia, in the Danube Delta in Romania, in Ukraine (Oriental population), and in South Western France and Northern Spain (Occidental population).

Our genetic analyses evidenced a signal of hybridization and introgression with the European polecat, in the Occidental population. Backcrosses were also evidenced, confirming that hybrids were fertiles.

This hybridization appeared asymmetric, as only pure polecat males mate with pure European mink females. Levels of hybridizations were low in the studied areas, with around 3% of the analysed individuals. This would suggest that hybridization is still a uncommon event. However, this trend could change rapidly and could have a deeper impact on the long term survival of the species.

With genomic methods, we might be able to identify current or historical introgressions at a finer scale. Whole-genome and RAD sequencing are presently performed in our laboratory to better understand the impact of hybridization on the European mink genome. This analysis is improved using a chromosome-scale reference genome created through the ERGA (European Reference Genome Atlas) pilot project.

Endangered hybrid swarms of caribou: glacial, interglacial climates, adaptation and current threats.

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Traditionally, hybridisation has been viewed as detrimental to population fitness and is often viewed as a result of anthropogenic actions. Concerns regarding hybridisation have often centred around the loss of genetic "purity" and local adaptation. However, in some cases, hybridisation between species or populations may be facilitated by entirely natural processes and/or may benefit species fitness by creating new genetic diversity, and thus adaptive potential, for selection to act upon. In Western Canada, glacial cycles have dictated the colonization-expiration-recolonization histories of terrestrial species. Here we document the hybridisation of two ancient lineages of caribou. Using SNP genotypes at ~43,000 loci for ~700 caribou, we examined: (i) how historical hybridisation post-glaciation contributes to genetic diversity of populations within the hybrid zone, (ii) whether selection favours ancestry from either linage at genomic regions, and (iii) whether greater

genetic diversity is positively correlated with variance in phenotypic traits. Several caribou populations in the area are endangered and declining due to habitat loss and human activities mediated by wolf predation. However, we also examined whether: (iv) genetically diverse populations had increased survival, reproduction and trends. Thus, our aim is to examine how hybridisation may provide the adaptive variance required for species persistence in a changing world.

Forgotten in the pond: hybridization with alien taxa induces polyploidization in native water frogs

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Water frogs of the genus Pelophylax have been widely traded by humans across all European countries for decades, and they have suddenly become invasive in most of them. Their spread threatens the persistence of native populations, mainly via competition and hybridization. As aliens show high morphological similarity compared to native taxa, they are often unnoticed in the wild, with dramatic drawbacks for conservation. Diagnostic molecular markers allow us to track both invasion patterns and their outcomes in invaded populations. During the last decade, we carried out an extensive survey of alien invaders throughout Italy, where hybridogenetic systems perpetuate ancient lineages via hemiclonal reproduction, providing the fact-finding background to evaluate possible managing strategies. Protected areas play a key role in reaching this goal. Recently, we surveyed water frog populations in the Aspromonte Mountain massif (Calabria, southern Italy) and surrounding areas, pointing out the presence of invaded populations. For the first time, we identified polyploid hybrids carrying alien genome, whose evolutionary fate is hard to foresee. We claim the urgent implementation of effective managing practices to prevent the further spread of aliens in this highly biodiverse region as a case in point for the conservation of Italian hybridogenetic systems.

142: Sharing space in multiple-use landscapes: aligning human and wildlife needs

Drivers of people's preferred population trend for different wildlife types across 15 countries

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Drivers of public management preferences are key levers for human-wildlife coexistence, but have not been studied systematically across different wildlife types and social-ecological contexts. To address this gap, we assessed drivers of preferred population trend for various wildlife types (including whales, gazelles, deer, lions, leopards, pumas, wolves, and dingoes) based on a representative online survey with >10,000 respondents from 15 countries.

Globally, preferred population trend was explained mostly by wildlife-type specific predictors, but some respondent characteristics also played a role. The drivers we identified suggest that measures to increase encounters with liked species and decrease encounters with disliked ones can foster human-wildlife coexistence. Increasing people's knowledge about biodiversity loss and wildlife, or their connectedness with nature, also seems promising.

Being unemployed or depending more strongly on natural resources had a negative effect on respondents' perceived benefit-cost ratio and preferred population trend. This finding adds to existing evidence that costs associated with wildlife presence are distributed unequally, and that this inequality must be addressed to improve human-wildlife coexistence.

Finally, average preferred population trend, and the strength and direction of predictor effects varied across countries, highlighting the importance of tailoring strategies for human-wildlife coexistence to different social-ecological contexts.

Mapping perceived benefits of coexisting with large carnivores in Spain through the environmental rangers' lenses

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The return of large carnivores is essential to restore trophic interactions, promote self-regulating ecosystems, and maintain biodiversity. Protective legislations, land use changes, and conservation projects have contributed to the recovery of the three large carnivores' species (brown bear, wolf and Iberian lynx) in Spain.

We compiled fine-scale information on perceived benefits associated with large carnivores across Spain through an online questionnaire to environmental rangers. These rangers, associated with each of the 15 mainland regions, are engaged in fieldwork and are familiarized with wildlife species. The response rate varied, but in most of regions it exceeded 35%. Overall, more than 1000 rangers participated in the survey covering >60% of the territory in each region. They believed that among the large carnivores, the Iberian lynx was perceived to have more benefits than the brown bear and the wolf. Throughout the territory, the answers were consistent in recognizing three main benefits of the lynx: increasing biodiversity, ecosystem value of control-regulating other species, and esthetic value. Such benefits were also mentioned for the bear and wolf, albeit less frequently. This information collected will be used to assess how anthropogenic factors influence the environmental favorability of these large carnivores across Spain.

The Ogiek's role in the socio-ecological landscape of Mount Elgon, Kenya

Stephanie Marie Brittain

University of Oxford, United Kingdom

The intricate relationship between indigenous communities and their natural habitats forms a crucial part of the socio-ecological tapestry of conservation. This presentation delves into the role of the Ogiek Indigenous people in shaping the shared landscape of Mount Elgon, Kenya.

Mount Elgon in Kenya is an area of rich biodiversity, known for its unique and diverse ecosystems. The Ogiek have been pivotal in community-led conservation efforts, protecting the biodiversity-rich forests and maintaining a resilient relationship with the land despite attempted evictions and destructive national policies.

This talk demonstrates how the Ogiek's traditional practices of honey production, livestock rearing, bamboo harvesting, as well as their belief system and deep knowledge of their land fosters wildlife and human well-being. It then demonstrates what could happen if the Ogiek are removed from their land, or are prevented from practicing their traditional management practices.

It highlights how their intimate knowledge of the environment contributes to the conservation of biodiversity and the synergy between traditional wisdom and modern conservation techniques, showcasing the Ogiek's unique contributions to Mount Elgon's shared landscape.

Attendees interested in interdisciplinary approaches to human-nature interactions will find this presentation a valuable addition to the ongoing dialogue on shared landscapes.

Cost-effectiveness of conservation interventions to maintain viable populations of top predators in a global deforestation hotspot

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Wildlife populations in tropical forests are declining due to habitat destruction and overexploitation. For the top predators in South America's deforestation frontiers, jaguar and puma, population viability is threatened by intensive deforestation and persecution. These threats vary among different land-actors. For example, large-scale ranchers tend to deforest and persecute predators, large-scale soybean producers to deforest, and some Indigenous Peoples to do neither. Here, we assess the cost-effectiveness of different conservation interventions to maintain viable large predator populations in the 1,100,000 km² Gran Chaco, a global deforestation hotspot due to beef and soy production. Based on a land system map structuring the diversity of land use actors and practices, we systematically test the cost-effectiveness of threat-specific interventions targeted at specific land systems. We spatially-explicitly modelled the populations' changes under different interventions for different budget scenarios. We find that for a given budget, reducing persecution is more effective than reducing habitat destruction, as hunting has stronger and faster impacts, while avoiding deforestation or restoring forests is costly across broad areas. However, combining targeted interventions against both threats in key land systems brings greater benefits. Such land-system and actor-specific interventions were more effective than blanket or area-based conservation in maintaining large carnivore populations.

Socio-economic shocks as challenges for large carnivore conservation

Ranjini Murali, Matthias Baumann, Arash Ghoddousi, Alfredo Romero Muñoz, Daniel Mueller, Tobias Kümmerle
Humboldt University of Berlin, Germany

Socio-economic shocks such as wars, pandemics, political regime shifts, and economic recessions, have devastating impacts on people. They are also challenging for biodiversity, but these impacts are insufficiently understood. Large carnivores, in particular, could be vulnerable as shocks could exacerbate the complex threats they face, especially where people and carnivores share space. In this talk, we present a conceptual framework to unpack socio-economic shock impacts on large carnivores. We illustrate our framework using three case studies built through expert elicitation and case-study specific literature review: 1) Asiatic cheetahs and economic sanctions in Iran, 2) Jaguars and global commodity price shocks in Bolivia, and 3) Snow leopards and the breakdown of the Soviet Union in Kyrgyzstan. Our framework helped us structure causal relationships and create a common language across the case studies. We found that institutional stability is crucial for carnivore conservation and identified multi-level linkages between the global market economy and carnivore populations. We underscore the importance of creating resilient institutions focused on augmenting intrinsic motivations for conservation, building local capacities, and enhancing social stability to successfully continue sharing spaces with large carnivores even during turbulent times.

Assessing the coexistence of snow leopard, its prey and pastoralists under climate change in Central Asia

Arash Ghoddousi[1], Juliana Eggers[1], Katrin Kirchner[1], Tatjana Rosen[2], Stefan Michel[3], Koustbuh Sharma[4], Maarten Hofman[5], Tobias Kuemmerle[1]
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Fostering human-wildlife coexistence depends on understanding the complex interactions that link people and wildlife, including land use and human-wildlife conflict. Climate change is predicted to further complicate these interactions, for example through altering wildlife habitat, land-use patterns or predator-prey dynamics, thereby modifying human-wildlife encounters. Exploring how human-wildlife interactions might change under climate change and proposing climate-smart solutions to coexistence are therefore conservation priorities. We focused on the multiple-use landscapes of Central Asia where climate change impacts are forecasted to be strong, and where snow leopard, its prey, and pastoralists share the landscape. To understand how climate change might impact the interactions, we assessed the distribution and spatial overlap of snow leopard and mountain ungulates, its main prey, using habitat modelling under current and future climate. To assess pastoral use of the landscape, we mapped current livestock corrals and used them to predict future grazing patterns. Our results indicated an overall increase in suitable areas for snow leopard while prey distribution remained stable. Livestock pastures, however, are expected to increase in Tajikistan but decrease in Kyrgyzstan, with varied consequences for conflict. Our study highlights the necessity to consider the social-ecological context of the human-wildlife conflict under climate change in conservation planning.

143 (Workshop): The fate of primary and old-growth forests in Europe: 2018 – 2024 – 2030?

The plight of European boreal primary and old-growth forests, taking Sweden as an example

Martin Jentzen
Independent consultant, Sweden

Martin Jentzen is a Swedish forest engineer. He gained first practical experience in conventional Swedish forestry through work as wood purchaser at the pulp industry. Since the last 15 years then, he has worked with establishment of close to nature forestry practices. The work has consisted of both practical management planning, but also educational work in basic forest ecology and forestry practices mainly focused on the sector of private forest owners. At the panel, Martin Jentzen will describe how initiative, finances and control have been transferred from individual forest owners to industrial interests in Fennoscandia. The composition of the landscape has changed so that today we see an increasing lack of species and substrate linked to older natural forests with long forest continuity. An important strategy to deal with the lack of substrates and habitats for biodiversity is to increase the proportion of strictly protected forest land. But it is at least as important to raise the overall ecological quality of the cultivated areas at the same time, and for that a radical change in forestry practice is required

Białowieża Forest - a pivotal moment for the protection of one of Europe's last primary forests

Augustyn Mikos
Forest Policy Expert, Association Workshop for All Beings, Poland

Augustyn Mikos is a Forest Policy Expert at the Association Workshop for All Beings, a Polish NGO involved in protecting Białowieża Forest - the best preserved temperate lowland forest complex in Europe. He co-authored several reports on forest management in Poland, including two analyzing the breaches of EU environmental legislation during logging in Białowieża Forest. In the panel, he will outline threats to this forest complex that have emerged in recent years including clearcutting of vast swaths of old-growth forest stands, the construction of a barrier on the Polish-Belarusian border, and plans to modify the zoning of the UNESCO World Heritage Site Białowieża Forest. On the other hand, he will discuss the perspective of placing the entire area of the Białowieża Forest under effective protection, which, thanks to the unprecedented support of Polish society towards forest conservation, is closer than at any time in the past 100 years of efforts to preserve this invaluable forest complex.

The last primary forests – a bridge between the past and the future

Gabriel Paun
Agent Green, Romania

Gabriel Paun is an ecologist advocating for strict protection of primary forests in Romania in the context of biodiversity preservation and climate change mitigation. His work covers all necessary strategies and tactics to achieve this objective: lobby, scientific research, media work, non-violent direct action and litigation. In the panel he will walk the audience through the current situation in Romania and hurdles that he has to overcome in his work, the biggest one being bankrupt public polices and rotten mentalities. He is keen to start a vivid conversation with the public in search of ideas and support for a joint European wide work to preserve that last remaining primary forests.

Natura 2000 as a tool to protect primary and old-growth forests - conflicts and hurdles

Matthias Schickhhofer
Independent consultant, Austria

Matthias Schickhhofer (1967) is an Austrian (Vienna) based strategy / campaign consultant, conservationist, photographer, book author, nature tourism developer.

He worked for 17 years with Greenpeace CEE and Greenpeace International and has been providing campaign and project consultancy support to various NGOs since 2008.

In cooperation with Euronatur, Agent Green (Romania) and the Rottenburg University of Applied Forest Sciences (Germany), he has been contributing to the mapping of primary forests in Romania - and to the protection of several thousand hectares of these forests.

He has planned and co-developed several projects to promote nature tourism as an alternative income source to the destructive exploitation of natural resources (Iseltrail, Bärentrail, initiative in Romania). As a photographer and author, he has published several books on primary forests and wilderness in Europe.

In the panel discussion, he will talk about his experiences with efforts to protect primary and old-growth forests (in EU) and the conflicts and hurdles he has encountered in this context.

EU Forest Strategy for 2030 and the way forward for Europe's primary forests

Thomas Waitz
Member of the European Parliament for the Austrian Greens and co-chair of the European Green Party

Thomas Waitz is a member of the European Parliament for the Austrian Greens and co-chair of the European Green Party. In his political work, he focuses on sustainable agriculture, healthy food and climate protection, the Animal Transport Directive's reform, and a strong foreign and peace policy, especially regarding relations with the Western Balkan Region. He is an organic farmer, forester and beekeeper. In his contribution he will focus on the EU Forest Strategy for 2030 and outline the way forward for Europe's primary forests.

145: Conservation of genetic diversity for resilient ecosystems

Beyond SNPs: A holistic assessment of genome-wide diversity in New Zealand's rarest breeding bird

Jana R Wold, Tammy E Steeves

School of Biological Sciences, University of Canterbury, New Zealand

Genetic diversity assessments are routine for many conservation programmes. Single nucleotide polymorphisms (SNPs) are often used to measure genome-wide diversity. However, structural variants (SVs, chromosomal rearrangements ≥ 50bp) represent a higher proportion of genomic variation, intersect more often with genes and gene regions and, like SNPs, can be associated with both adaptive and maladaptive traits. Despite this, SVs are rarely included in holistic assessments of genome-wide diversity due to the significant resources required to characterise them with confidence. However, emerging sequencing technologies and bioinformatic approaches are putting SVs within reach for highly threatened populations. We combine a long-read reference genome and short-read whole-genome sequencing with an emerging variant graph approach to measure the relative levels of SNP and SV diversity within–and the extent of population genomic structure between– New Zealand's rarest breeding bird, the New Zealand fairy tern | tara iti and the Western Australia (WA) population of Australian fairy tern. These combined data are being used to develop a position statement regarding the efficacy of genetic rescue for tara iti. We argue that the routine characterisation of both SNPs and SVs will ultimately lead to more accurate assessments of genetic risks of inbreeding and outbreeding depression in imperiled populations.

Monitoring genetic diversity through effective population size (Ne) in plant populations with complex life-history traits

Roberta Gargiulo[1], Alex D. Twyford[2], Michael F. Fay[1]

[1]Royal Botanic Gardens, Kew (United Kingdom); [2]University of Edinburgh (United Kingdom)

Effective population size (Ne) is a fundamental parameter used to predict genetic diversity loss in populations. The ability to infer Ne from census size (Nc) data, especially when genetic data are unavailable, has favoured the inclusion of an Ne-based indicator in the Kunming-Montreal Global Biodiversity Framework, for monitoring infraspecific genetic diversity. In some species, particularly those with complex life-history traits, inferring Ne from Nc is hindered by the lack of knowledge of Ne/Nc ratios, which are often population-specific. In this study, we used SNPs derived from ddRAD sequencing to estimate contemporary Ne in British populations of three terrestrial orchids: Cephalanthera longifolia, C. damasonium and C. rubra. These orchids exhibit different reproductive strategies, and their populations are isolated to varying extents. We discuss the Ne estimates obtained in the context of specific reproductive strategies (selfing in C. damasonium vs. outcrossing in C. longifolia), extent of gene flow, and degree of isolation (from little in C. longifolia to extreme in C. rubra). We consider potential biases and analytical constraints associated with the methods used. Our findings advance the knowledge of Ne/Nc ratios and contribute to informing conservation practices for declining terrestrial orchids and other species with similar life-history traits.

Conserving genetic diversity during climate change: Niche marginality and discrepant monitoring effort in Europe

Peter B. Pearman[1,2], Olivier Broennimann[3,4], Antoine Guisan[3,4]

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Genetic monitoring of populations currently attracts interest in the context of the Convention on Biological Diversity but needs long-term planning. Until recently genetic diversity had been largely neglected in biodiversity monitoring, and if addressed, was treated separately and detached from other conservation issues, such as effects of climate change. We describe an accounting of efforts in Europe to monitor population genetic diversity (GME), the evaluation of which can guide capacity building and collaboration towards the areas most in need of expanded monitoring. We identify where GME likely coincides with anticipated climate change effects on biodiversity. Our analyses suggest that area, financial resources and conservation policy influence country GME, high values of which only partially match species' joint patterns of limits to suitable climatic conditions. Populations at trailing climatic niche margins probably hold genetic diversity that is important for adaptation to changing climate. Thus, our results highlight the need in Europe to expand investment in genetic monitoring across the climate gradients occupied by focal species, a need arguably greatest in southeastern European countries. The European Union's Birds and Habitats Directives should be expanded to fully address the conservation and monitoring of genetic diversity.

Uneven genetic data limits biodiversity assessments in protected areas globally

Ivan Paz Vinas

University Claude Bernard Lyon 1, LEHNA Laboratory, France

Increasing the extent of protected areas (PA) through 30x30 and other area-based conservation initiatives can help to achieve global biodiversity conservation goals across all biodiversity levels. However, intraspecific genetic variation, the foundational level of biodiversity, is rarely explicitly considered in PA design or quality performance assessments. Repurposing existing genetic data could rapidly inform area-based conservation planning and improve the preservation of genetic variation. Through a global compilation of population-level nuclear genetic data (>2 million individuals; 36,356 populations; 2,809 species), we identified both data-rich areas, and substantial geographic and taxonomic gaps. These gaps are within many protected areas and hotspots of species biodiversity, and may preclude robust protection of genetic diversity. Addressing data unevenness through efforts to collect, gather, harmonize and share genetic data globally could help support integration of genetic information into PA design, PA performance assessments, and genetically-oriented global conservation policies.

Emerging genomics tools and technologies: enhancing biodiversity conservation management with community insights

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Recent advancements in genomics technology present a diverse range of opportunities and challenges for conservation practitioners and decision-makers.

Some of these technologies are discussed to be applied to the most pressing conservation challenges, such as small population management, or controlling invasive species. However, choosing the right tools from the genomic toolbox can be a challenging task for the conservation community. We thus here highlight the advancement of the field and for which applications, new technologies might be helpful not only for researchers, but also to managers. In each case, ethical, and political considerations must be considered to ensure responsible and informed implementation.

In addition, we here present results from a survey during a webinar where we presented several case studies to the audience of more than 50 professionals from the field of applied conservation. Our aim was to increase the understanding and application of genomic and biotechnological advancements. While the community is highly interested in topics such as gene drive and editing, or application of eDNA, many participants identified these topics as challenging, underscoring the need for more targeted information and training. This feedback highlights the critical role of continuous education and dialogue about the implementation of new genomic tools.

Genetic diversity affects ecosystem functions across trophic levels as much as species diversity, but in an opposite direction

Simon Blanchet[1], Laura Fargeot[1], Delphine Legrand[1], Raffard Allan[2], Géraldine Loot[3]

[1]CNRS, France; [2]INRAe, France; [3]UPS, France

The relative effects of intra- and interspecific diversity on ecosystem functions are poorly understood, especially under natural and multi-trophic conditions. Here, we assessed the relationships between species diversity, genetic diversity and ecosystem functioning across three trophic levels (trees, shredders and fishes) in natural aquatic ecosystems. We estimated species diversity and genetic diversity within each trophic level, as well as seven ecosystem functions, and we assessed the strength of each possible relationship between biodiversity and ecosystem functions (BEF). Although BEFs effect sizes were similar at both the genetic and species levels, we found that genetic diversity was positively and consistently associated with ecosystem functions, whereas species diversity was negatively associated. However, these antagonist effects of species and genetic diversity were only observed when BEFs were measured within trophic levels, not across trophic levels. This demonstrates the importance of considering both species and genetic diversity loss to predict ecosystem dynamics. This further calls for developing novel integrative estimates of biodiversity allowing to jointly reveal functional genomic diversity at both the intra- and interspecific levels within community, which can be achievable using phylogenetically-conserved candidate genes.

146: Understanding compliance for fairer conservation

Ethical challenges of asking people directly about compliance

Harriet Ibbett
Bangor University, United Kingdom

To develop interventions that provide positive outcomes for both people and nature, conservationists need to better understand human behaviour, particularly the factors that influence compliance. However, research in this area is often hindered by the challenging nature of the topic; people are rarely willing to reveal their involvement in illicit acts, meaning it is difficult to collect reliable data. Moreover, conducting research in this area raises a range of ethical and methodological concerns, which if not addressed, can have significant impacts on biodiversity outcomes, as well as human well-being. Here, we provide a broad overview of these challenges and outline how their consideration can help move conservation research, policy, and practice towards more socially just, biodiversity positive agenda.

Human Dimensions from the blue horizon: behavioural insights for compliance and deterrence

Ana Nuno
NOVA University Lisbon, Portugal

Illegal fishing threatens fish populations and marine habitats, affecting the livelihoods and food security of coastal communities worldwide. It also undermines conservation and management in large Marine Protected Areas (MPA), such as the British Indian Ocean Territory (BIOT) MPA. Despite its designation as a non-fishing MPA, the abundant fish and shark populations of BIOT attract Illegal, Unreported and Unregulated (IUU) fishing from surrounding countries. To manage this, it is key to understand the social context of non-compliance.

By bringing together a diverse team and building an extensive regional network of researchers, policymakers, government bodies, fisheries managers, and fisher communities, our ongoing project focuses on: gaining behavioural insights on the fishers' non-compliance and deterrence effects; identifying barriers which hinder the implementation of evidence-based enforcement; and exploring actions to reduce the level of illegal fishing in the BIOT and other protected jurisdiction in the Indian Ocean. Overall, we aim to provide critical insights into how to enhance the robustness of MPA management decisions, particularly when illegal behaviour is involved.

Perceived cost and benefits impact support for protected area conservation

Leejiah Dorward[1], Harriet Ibbett[1], Asri A. Dwiyahreni[2], Edward Kohi[3], Ika Augustin[1,2], Joseph Kaduma[1], Rose Mawenya[1], Jesca Mchomvu[1], Karlina Prayitno[1,2], Humairah Sabiladiyni[1,2], Stephen Sankeni[1], Jatna Supriatna[2], Tyas Trywidiarini[1,2], Andie Wijaya Saputra[1,2], Freya A.V. St John[1]
[1]Bangor University, United Kingdom; [2]Universitas Indonesia, Indonesia; [3]Ministry of Natural Resources and Tourism, Tanzania

Protected areas play a vital role in the long-term protection of global biodiversity and ecosystems. They can generate substantial benefits through mechanisms such as tourism, and the protection of ecosystem services. However, they can also impose significant costs, particularly on those living near their boundaries, and questions concerning the just distribution of costs and benefits remain. Drawing on social psychology we developed a novel psychometric tool measuring levels of perceived costs and benefits of living near protected areas. We investigate the relationships between individuals' perceived cost and benefit scores, their support for protected area rules and their multidimensional poverty status. Collecting data from people living near protected areas in Tanzania and Indonesia, our results revealed higher levels of poverty are associated with higher perceived costs and lower perceived benefits, and higher perceived benefits are associated with higher support for protected area rules. Our study highlights the importance of ensuring the impacts that conservation policies have on people are evenly distributed and thus socially just, and how this can increase support for conservation policies.

How conservation rules are enforced matters: lessons from criminal psychology

Freya St John[1], Harriet Ibbett[1], Edward Kohi[2], Stephen Sankeni[4], Joseph Kaduma[3], Jesca Mchomvu[4], Rose Mawenya[3], Leejiah Dorward[1]
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Urgency to save species from extinction has prompted increased focus on law enforcement in conservation, including through militarised approaches and punitive sentencing policies. However, evidence that tough-on-crime policies deter rule-breakers is limited. Moreover, it can contribute to conflict between people and conservation authorities. Rule-breaking in conservation ranges from small-scale transgressions to organised crimes targeting high-value commodities, with considerable resource focused on the former, particularly in protected area contexts of highly biodiverse countries. However, limited attention has been given to enforcer-citizen encounters and their potential to generate support for conservation. Gathering data from >600 residents living around the Rungwa-Ruaha ecosystem, we investigated how principles of procedural fairness, such as perceptions of ranger behaviour, influences residents' sense of obligation to comply with protected area rules. Preliminary results indicate that when rangers are perceived to treat citizens fairly and act within the bounds of their authority, respondents are more inclined to comply with protected area rules. Further, contrary to deterrence theory, as the perceived probability of being caught and punished for breaking protected area rules increased, respondents' reported obligation to comply with rules decreased. Our results emphasise the importance of fair and professional ranger behaviour in encouraging conservation compliance.

148: Pollination in agricultural systems

Landscape and climate effects on pollinator diversity and their traits: how to increase the diversity of agricultural landscapes?

Cristina Ganuza, **Sarah Redlich, Ingolf Steffan-Dewenter**
University of Wuerzburg, Germany

Studies on pollinators and pollination primarily focus on agricultural areas due to their pivotal role in food production. Yet, understanding the current and future state of pollinator communities in agricultural areas requires a comparison of their status with that of other habitat types. For instance, the impact of climate warming on pollinators could vary across land uses and spatial scales, information that can be important for designing climate-resilient landscapes. Here we address this topic through a multiscale space-for-time approach spanning extensive climate and land-use gradients in Bavaria (Germany). We used DNA metabarcoding of Malaise trap samples and trap nest data collected in 179 study plots (forest, grassland, arable land, and settlement) embedded in 60 study regions (semi-natural, agricultural, and urban).

Malaise trap samples yielded 3,218 flower-visiting species from seven taxa, and trap nests contained 88,696 insect brood cells from 97 species. We analyzed community composition, abundance, taxonomic diversity (alpha, beta—community dissimilarity—, and gamma diversity) and functional diversity throughout land uses, climates and spatial scales, as well as the resulting pollination service. Our study reveals contrasting trends in pollinator diversity and pollination in different land-use types with climate, which give us hints of management options across spatial scales.

Pesticides and pollination; from impacts to mitigation

Dara Anne Stanley
University College Dublin, Ireland

Pesticides are widely used in modern agriculture to produce food on large scales and at low cost. Concerns exist around impacts pesticides could have on biodiversity and associated ecosystem services, with a particular focus on bees in recent research and policy action. Here recent research investigating the hazards that pesticides may pose to pollination services provided by bees at field-realistic levels is discussed. We find that insecticides, but also fungicides and herbicides, can have implications for bee ecology and behaviour, and make recommendations for further research to inform risk assessment. We also investigate the range of mitigation measures available to reduce impacts of pesticides on bees, finding many commonly implemented measures lack full empirical support. For example, choosing times of day when pollinators are less active is recommended for application of many pesticides but is not widely supported in the literature. In addition, deciding when this is and whether it will reduce risk is complex and differs for different pollinator groups. Results are discussed in the context of both pesticide use and pollinator conservation, with the aim of integrating pollination service provision with crop protection.

Consequences of using managed bumblebees for pollination on wild bees

Henrik G. Smith[1], **Joachim R. de Miranda**[2], **Rachael Dudaniec**[3], **Lina Herbertsson**[1], **Cecilia Hjort**[1], **Peter Olsson**[1], **Josie Paris**[4], **Thorsten Pedersen**[5], **Ullrika Sahlin**[1]
[1]Lund University, Sweden; [2]Swedish University of Agricultural Sciences, Sweden; [3]Macquarie University, Australia; [4]University of Exeter, UK; [5]Swedish Board of Agriculture

There have been increasing concerns that the use of managed bees contributes to the spread of non-native genes and diseases, as well as depresses local bee populations through competition for nectar and pollen. A special situation is when the managed bees are a con-specific to a wild bee, yet a different sub-species. We studied the consequences of the multi-year use of managed bees for pollination of tomatoes, berries, and fruits in Sweden, with half of the matched sites having managed Bombus terrestris of non-native origin to boost pollination. Using genomics, we verified that escapees from the managed colonies appeared in the landscape, but we found no evidence of genetic introgression. When screening for eight pathogens and two parasites, our preliminary results (early part of the season) could not establish that introduced cultivated bumblebees have a negative impact on the prevalence and distribution of pathogens in local wild bumblebees. However, open screening found evidence of some viruses not appearing in native bees, and even very low levels of exotic pathogens and parasites in introduced bumblebee colonies can pose a risk. We discuss why our results may differ from other recent studies of the consequences of using managed non-native bees for pollination.

Effects of urban agriculture on pollinator species-habitat networks

Francesco Lami, **Agata Morelli, Giovanni Burgio, Giovanni Giorgio Bazzocchi**
University of Bologna, Italy

The proper management of urban green areas is pivotal for the protection of biodiversity and ecosystem services within cities. Urban agricultural areas are peculiar in this respect, as they are dominated by plant species cultivated for human consumption rather than wild species, yet can often harbor high levels of taxonomic and functional plant diversity. Due to the interdependency between flowering plants and pollinators, agricultural productivity is largely reliant on this interaction; there is thus particular interest in understanding how urban agriculture can contribute to pollinator conservation and benefit from the service they provide.

In this study, we sampled pollinators in 8 urban parks and 7 urban agricultural areas in the city of Bologna, in Northern Italy. The main goal was to model a city-wide pollinator species-habitat network. Specifically, we wanted to investigate the different roles of parks and urban agricultural areas in the structuring of the network (including their role as pollinator sink and source habitats towards each other), how these roles changed through the sampling season, and how local habitat features modulate these phenomena. Our work will contribute to the improvement of biodiversity-friendly management practices for urban green areas, especially for urban agriculture.

A global meta-analysis on the contribution of animal pollination to food crop quality

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Animal pollination directly benefits the production of a wide share of crops consumed by humans. Despite the importance of pollinators in contributing to global food security and to diverse and nutritionally balanced diets, a comprehensive quantification of their role in determining food quality is lacking. Here, we conducted a systematic literature review and performed a set of multi-level meta-analyses to quantitatively summarise 190 experimental studies on the contribution of animal pollination to the quality of 48 globally important crops. Results indicate that pollinating animals significantly enhance the quality of food crops. In particular, they greatly contribute to improving crops organoleptic and marketability traits, such as size and shape, besides their nutritional value. In most cases, current activity of wild and/or managed pollinators is sufficient to ensure optimal food quality, although we report weak signals of a pollination deficit for organoleptic traits, which might indicate a potential pollination service decline across agroecosystems. Understanding the contribution of animal pollination to crop quality highlights the role of pollinators for global food security and promotes opportunities to conserve and manage pollinators in agricultural landscapes.

Evaluating the impact of pollinator efficacy and interactions on pollination services

Karen Santos[1], Manu Saunders[1], Ulrika Samnegård[2], Abby Davis[1], Liam Kendall[2], Emma Goodwin[1], Blake Dawson[1], Lena Schmidt[1], Romina Rader[1]

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Pollination services are crucial for many wild plants and global food crops, but different crop species can vary in their dependence on pollination and pollinator species interactions can impact crop quality measures in different ways.

First, we present a comprehensive review of pollinator interactions with European honey bees (Apis mellifera) from 39 countries over the last 60 years. Results indicate that many honeybee interaction studies (39%) were not specifically designed to test competition, yet 86% of them discussed interactions between pollinator species, reported potential competition consequences, or linked honey bee behaviours to outcomes.

Second, we present field trial results focused on the efficacy of honey bees and native Australian stingless bees (Tetragonula carbonaria) to three model crops: blackberry (Rubus fruticosus), blueberry (Vaccinium virgatum), and raspberry (Rubus idaeus).

We found that the amount of conspecific pollen deposition is influenced by pollinator species identity and visit number, with native stingless bees outperforming honey bees in conspecific pollen deposition. Overall, these findings underscore the complexity of plant-pollinator relationships and the need for integrated management practices that consider both honey bees and native insects. Such an approach is crucial for optimizing pollination services in crops and ensuring resilient agricultural systems.

Agricultural intensification at local and landscape scale impacts sweet cherry production through altered pollination services

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Fruit production strongly depends on insect pollination for fruit development. However, intensification of fruit production both at the local and landscape scale can influence pollinator communities, potentially impacting the corresponding pollination services. In this study we explored how agricultural intensification at local (organic vs. conventional) and landscape (distance from seminatural habitats) scale affect pollinator diversity, pollination services and production in sweet cherry orchards (Prunus avium) in Mediterranean areas. We found conventional orchard management (compared to organic) and distance from seminatural habitats to negatively affect both abundance and diversity of pollinator communities. Wild pollinator abundance and flower visitation was also negatively correlated to honeybee abundance, indicating potential competition for flower resources. Sweet cherry fruit set was positively influenced by pollinator diversity but not by honeybee abundance. These findings suggest that agricultural intensification both at the local and landscape can impair pollination services in cherry orchards. Interestingly, we found cherry quality (sugar content) to be negatively correlated to fruit set, highlighting a potential trade-off between cherry production and biodiversity conservation. Sustainable management strategies to support sweet cherry production need to consider wild pollinator communities and necessitate both local and landscape interventions.

The outcome of interactions among flower visitors on Australian berry farms

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Understanding the behaviour of insects when interacting at flowers is important because some taxa can impact the movement of others. We observed flower-visiting insects in raspberry and blackberry farms in the Coffs Harbour region, New South Wales, Australia. We recorded the behaviour of bees and non-bees on flowers as “resident” and “incoming” and determined the outcome of all interactions. Aggressive behaviour and subsequent response (e.g., move to another flower or fly away) was recorded for 619 interactions. In general, interactions between hymenopteran (honeybee, stingless bee, ants) taxa were aggressive (> 78%; n= 312), resulting in most of the resident and incoming individuals departing the flower, apart from when ants were resident. When flies interacted with hymenopterans, hymenopterans were less aggressive and shared 10% of flowers (n= 67). After interacting, Eristalis tenax and Apis mellifera commonly departed from the flower (E. tenax 80%; n= 264, A. mellifera 73%; n= 84) and some individuals moved to another flower as a result of the interaction (A. mellifera 27%; n= 84, E. tenax 20%; n= 264). This study demonstrates that interaction outcomes varied according to the identity of both incoming and resident individuals, and this has the potential to impact pollination success.

Addressing pollination deficits on smallholder farms in India through floral interventions

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Research has shown that introducing floral resources through agri-environments schemes can increase pollinator abundance and diversity in agro-ecosystems with improvement in crop pollination reported. Most of these approaches, however have been developed and tested in large scale intensive production systems. Smallholders, often in tropical biomes, represent the majority of farmers globally, yet there is a lack of research into effective tools to promote crop pollination in these contexts. We tested co-designed floral interventions alongside tree crops on smallholder farms in India. Measuring effects on pollinators and pollination, we show that co-cropping with flowering crops increased abundance of pollinators by 50%, species richness by 30% as well as significantly reducing pollination deficits. Our results provide clear evidence that floral interventions in the form of intercropping and border cropping can enhance pollinator communities and the services they provide in tropical smallholder systems but that these interventions must be co-designed with farmers. These findings underpin a practical management option for farmers to enhance pollination as well as providing additional co benefits, improving livelihoods and sustainable production.

Does pollinator conservation promote environmental co-benefits?

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Agricultural intensification is among the most important causes of pollinator decline. Nowadays, many initiatives have been implemented to promote conservation actions for these key organisms, however, interventions aimed at safeguarding pollinators can have ripple effects on multiple ecosystem services that are equally important for human well-being. In this work, we investigated whether environmental conditions favouring pollinators were positively associated with the provision of multiple ecosystem services across habitats. We selected sites belonging to three habitat types with different roles in supporting pollinators, i.e., crop field margins, semi-natural patches, and urban green areas, along a gradient of flower cover. We sampled wild pollinators and seven ecosystem services, which included provisioning, cultural, and regulatory services, using which we calculated two ecosystem multi-functionality metrics. Crop field margins and semi-natural patches exhibited both the highest diversity of pollinators and ecosystem multi-functionality, i.e., habitats that supported pollinators also delivered a higher number of environmental co-benefits. However, increasing flower cover benefitted pollinators, but did not result in increased multi-functionality, indicating that single ESs exhibited non-linear responses. Therefore, conservation practitioners should carefully evaluate interventions in order to improve pollinator diversity while generating multiple environmental co-benefits.

Incorporating biodiversity, pollination and other ecosystem service metrics into industry sustainability reporting

Romina Rader
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Understanding the impacts of corporate agricultural activities upon biodiversity remains a significant challenge under rapidly developing sustainability reporting frameworks.

While many sustainability indicators focus on carbon and water, few outline the specific role of biodiversity in providing services and functions that support environmental sustainability in agroecosystems. Here, we review the literature to evaluate the relationship between agricultural production activities, management practices and biodiversity. We highlight the need to go beyond traditional metrics of species richness and abundances to include the complex interactions that directly or indirectly underpin agricultural production and the resilience of land and water systems. We present case studies of corporate horticultural production to demonstrate key concepts and findings. There is an urgent need to improve assessments of corporate environmental impacts to include complex biological interactions to reflect the high level functioning of natural systems. Appropriate indicators will better support decision-making and ensure compatibility with the stated intentions of investors.

Revisiting the importance of pollinators for world crops

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Animal pollinators play an important role in global crop production by enhancing the quantity and quality of yields, but the strength of this relationship between animal pollinators and yield varies widely across different crop types. Using quantitative crop production data obtained through a systematic review and meta-analysis, we update and expand Klein's 2007 study to provide pollinator-dependency estimates including varietal information of 250 crop species. Through combining meta-analysis results with global crop production values, we estimate 9.1% of global crop production, which is equivalent to $378 x 109 USD of farmgate monetary value, is dependent on animal pollination. Moreover, we found that for the subset of crops cultivated for human food, the relative proportion of production reliant on animal pollination is greater than this value, largely owing to extensive cultivation of wind-pollinated crops for industrial and livestock-feed uses. While these values provide a valuable indication of the importance of animal pollinators to global agriculture, we discuss the methodological limitations and uncertainty surrounding these estimates to highlight that a much greater understanding of the role of animals in crop pollination is needed to guide policy decisions and crop management practices into the future.

149: Mobilising knowledge for conservation policy and action

Proposing indicators for the Global Biodiversity Framework: preparation, output and next steps for the phylogenetic diversity indicators

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The United Nations Convention on Biological Diversity's Kunming–Montreal Global Biodiversity Framework (GBF) presents the opportunity to preserve nature's contributions to people (NCPs) for current and future generations by conserving biodiversity and averting extinctions. Phylogenetic diversity (PD) represents the evolutionary history of species, a history that has produced the benefits biodiversity provides to humanity. There is therefore a need to safeguard the tree of life—i.e., the unique and shared evolutionary history of life on Earth—to maintain the benefits it bestows into the future. We developed two indicators for the GBF to monitor progress toward safeguarding the tree of life: the phylogenetic diversity (PD) indicator and the evolutionarily distinct and globally endangered (EDGE) index. Here, I discuss the journey to achieving the adoption of these indicators in the GBF, from developing the technical underpinnings of the indicators to the advocation and engagement with various stakeholders along the way. The adoption of the indicators is just the beginning, and represents an unprecedented opportunity to bring species' evolutionary history, and its link to maintaining NCPs, to the core of public biodiversity policies. I will present our next steps for ensuring we realise this potential.

From science to policy: the long journey of genetic diversity indicators

Ivan Paz Vinas
University Claude Bernard Lyon 1, LEHNA Laboratory, France

Genetic diversity within and among populations of all species is necessary for nature and people to survive in a rapidly changing world. Yet, genetic diversity conservation has been long overlooked in major conservation policy mechanisms, including pre-2020 United Nations Convention on Biological Diversity (CBD) strategies where genetic diversity targets, wording and indicators were undeveloped and only focused on species of agricultural or economic relevance. In December 2022, the CBD adopted the Kunming-Montreal Global Biodiversity Framework, which now includes strong wording and targets on genetic diversity conservation, and specific genetic indicators to report on the status of genetic diversity for all species. This presentation will provide an overview of how science and policy have been interfacing during the last years to evolve wording, targets, and indicators of the GBF related to genetic diversity, lessons learned from this process, and ongoing and future steps that are needed to maintain, protect, manage and monitor genetic diversity.

Towards evidence-based implementation of the Global Biodiversity Framework: challenges for African, Caribbean and Pacific countries

Claudia Capitani, Falko Buschke, Paolo Roggeri, Michele Conti, Luca Battistella, Cristina Lazaro, Simona Lippi, James Davy, Panagiotis Politopoulos, Stephen Peedell
Joint Research Centre, Italy

One year after the ratification of the Kunming-Montreal Global Biodiversity Framework, countries are grappling with the challenges of updating their national biodiversity strategies, as well as establishing a systematic monitoring system, while simultaneously implementing conservation actions that build upon the previous decade's efforts.

To address these challenges, it is essential to implement knowledge management systems that integrate both biodiversity state assessment and the measurement of progress towards national and global biodiversity targets, in accordance with the adopted moniotoring framework.

Over the past decade, the BIOPAMA program has developed and implemented a knowledge management system, the Reference Information System (RIS), across sub-Saharan Africa, Caribbean, and Pacific regions. This system has been designed to monitor both biodiversity state and global-to-national conservation targets achievements by bridging local and global datasets.

In this presentation, we will share the lessons learned from this process, with a focus on the following key areas: governance of knowledge management systems; diversity of needs of stakeholders across regions and countries; tradeoffs between technology, credibility, and relevance; top-down versus bottom-up information flow and global versus local data in biodiversity monitoring; and role of regional international centers in closing the knowledge gaps and reducing inequalities.

Which conservation actions have led to reductions in species extinction risk?

Ashley Thomas Simkins, Lynn Dicks, Silviu Petrovan, William Sutherland
University of Cambridge, United Kingdom

With >1 million species estimated to be threatened with extinction, urgent conservation action is needed to achieve the newly agreed Global Biodiversity Framework's mission of “halting and reversing biodiversity loss”; but which conservation actions work and for which species? For many species, there is no evidence on what conservation actions are needed. The IUCN Red List as the largest dataset on species' conservation information offers an opportunity to understand this question. Two key subsets of this dataset were used to explore (i) which types of species have improved in status and (ii) which actions are responsible for the improvements. We used two sources to measure improvements in conservation status: genuine improvements in Red List status and impacts of past conservation from the Green Status of Species. In general, birds and mammals with smaller distributions, and those threatened by residential or commercial development or invasive species, are more likely to have improved in status. Direct conservation actions, such as species reintroductions or translocations, rather than protected or conservation areas, more often led to improvements in species status. We discuss possible reasons for these findings, and how they can inform future conservation decisions.

Mining threats in high-level biodiversity conservation policies

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Amid a global infrastructure boom, there is increasing recognition of the ecological impacts of the extraction and consumption of construction minerals, mainly as concrete. Recent research highlights the significant and expanding threat these minerals pose to global biodiversity. To what extent is this pressure acknowledged in biodiversity conservation policy? We investigate how high-level national and international biodiversity conservation policies, including the 2011-2020 and post-2020 biodiversity strategies, the national biodiversity strategies and action plans, and the assessments of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, address mining threats with a special focus on construction minerals. We find that mining appears rarely in national targets, but more frequently in national strategies with greater coverage of aggregates mining than limestone mining, yet it is dealt with superficially in most countries. We then outline 8 key components tailored for a wide range of actors for addressing the biodiversity impacts of construction minerals, which comprises actions such as improving reporting and monitoring systems, enhancing the evidence-base around mining impacts on biodiversity, and influencing the behavior of financial agents and businesses. Implementing these measures can pave the way for a more sustainable approach to construction mineral use and safeguard biodiversity.

Beyond Baba Dioum's words: unpacking the relationship between biodiversity knowledge and conservation attitudes

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During the 1968 General Assembly of the IUCN, Senegalese Baba Dioum delivered a widely quoted statement: "In the end we will conserve only what we love, we will love only what we understand, and we will understand only what we are taught." This statement has been frequently referenced in the literature but has not undergone empirical scrutiny. In our investigation, we assessed the potential relationship between biodiversity knowledge and conservation attitudes in several distinct cohorts: Austrian high school students and university students majoring in disciplines such as chemistry, biology, geography, English, and German. Our analysis revealed no statistically significant correlation between biodiversity knowledge and the inclination towards conservation. Based on these results, we deduce that contemporary society widely perceives nature conservation as a positive imperative, and therefore, possessing specialized knowledge about biodiversity does not appear to be a prerequisite for recognizing the importance of conservation efforts.

Introducing the progress monitoring tools of the EU Biodiversity Strategy for 2030

Martina Marei Viti[1,2,3], Georgios Gkimtsas Gkimtsas[3], Camino Liquete[3], Grégoire Dubois[3], Silvia Dalla Costa[4], Janica Borg[4], Anne Teller[5], Rayka Hauser[5], Marine Robuchon[3]

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The European Union's Biodiversity Strategy for 2030 (BDS) represents a pivotal step forward in the commitment to protect and restore biodiversity, not only within Europe but also at a global scale. In order to reinforce its implementation, an innovative biodiversity knowledge governance has been established. It includes, among other measures, a progress monitoring system that fosters transparency and can inform corrective action to be taken when progress is being reviewed. The two main online tools at the core of the tracking system are a biodiversity action tracker and a dashboard with indicators. The action tracker is designed to track progress on the implementation of 104 actions stemming from the BDS, while the dashboard monitors progress across 16 targets using the best available indicators. However, while the action tracker is a mature tool, the work on the dashboard is still in progress, as indicators are missing for several targets. New scientific and expert input is needed to propel policy tracking and ensure transparent and data-driven monitoring of the 16 BDS targets. This represents an opportunity for the scientific community and experts to actively participate in the policy monitoring process.

Scenario-making for supporting the EU Biodiversity Strategy

Piero Visconti

International Institute For Applied System Analysis, Austria

Scenarios and models are useful to explore the consequences of real-world decisions before these are enacted, to choose between alternative policy options or formulate new ones. Typically, scenario simulations are limited by the capabilities of the models involved, the data available, and by the hopeful assumptions of the scientists involved. How relevant and useful are the scenario results is then depedent on close these assumptions are to reality. Effective engagement of policy makers and other stakeholders in the design of policy scenarios and the adequacy of modeling assumptions is essential to aid this process. In this talk I will discuss the challenges faced in some European projects concerned with ex-ante evaluation of EU policies and policy proposals. I will also reflect on the lessons learned towards better matching scientific knowledge and tools for integrated assessments with the policies and socio-ecological systems dynamics they are meant to simulate in order to provide policy guidance.

Towards an EU Biodiversity Observation Centre to consolidate biodiversity knowledge for conservation policy and action

Camino Liquete, Dimitrios Bormpoudakis, Marine Robuchon, Daniel Kissling, Ian McCallum, Henrique Pereira

European Commission, Joint Research Centre, Italy

Despite the relatively advanced and comprehensive EU legislation on environmental protection and natural resources, Member States and EU institutions still struggle to meet the minimum biodiversity monitoring requirements and to get consistent and comparable observations and assessments. The EuropaBON project, together with the Knowledge Centre for Biodiversity, has investigated the present situation, the weaknesses and the possible solutions to enhance biodiversity monitoring in Europe.

This presentation describes the proposal for an EU Biodiversity Observation Centre that, relying on national biodiversity hubs, should: help coordinating institutions and organizations involved in data collection; support data mobilization, integration and sharing; and analyse the information to fill policy objectives.

The EuropaBON proposal has been taken up by EU institutions (the European Parliament and the Commission) and will be tested in the coming months and years with the objective of deploying a coordination centre for an EU biodiversity observation network. We will discuss in the symposium the present policy context and the potential role of the research community and knowledge holders in such a centre.

Mobilizing knowledge for the Common Agricultural Policy and the EU Biodiversity Strategy: an expert perspective

Karine Princé

Muséum National d'Histoire Naturelle, France

In the dynamic landscape of European Union (EU) policymaking, the role of knowledge mobilization is crucial for informed decision-making and effective policy implementation. This talk aims to provide an expert perspective on the mobilization of scientific knowledge within the context of both the Common Agricultural Policy and the EU Biodiversity Strategy.

Drawing on real-world examples and case studies, this talk will delve into the mechanisms through which knowledge can be effectively mobilized for EU policy development.

Based on my expert perspective, I wish to provide a comprehensive understanding of the challenges and opportunities associated with mobilizing knowledge for EU policy frameworks, and further inspire fruitful discussions on how to strengthen the connection between science and policy.

150: Assessing and managing the resilience of arthropod-driven ecosystem functions in agroecosystems

Biodiversity and Stability in Plant-Pollination Systems and its Implications for Food Security

Daniel Montoya
Basque Centre for Climate Change (BC3), Spain

Despite agricultural intensification increased global food production for several decades, the benefits of this approach have started to be challenged. For example, although larger amounts of cultivated land have been promoted to raise crop yields, the spatial pattern of land conversion and its effects on biodiversity and crop production have received little attention. Another fundamental, yet often overlooked factor relates to the stability of crop production, as food security will be achieved by high crop yields that are also stable over time. The benefits of agricultural intensification have come at a cost to biodiversity, which is responsible of the provision of important agricultural services, such as crop pollination. In this talk, I will discuss the role of biodiversity on the provision and stability of ecosystem services in agroecosystems. I will introduce the different forms to quantify stability and I will discuss how recent advances in stability theory are applied to agroecosystems and crop production. Using a model of crop yield dynamics, I will explore how changes in biodiversity affect crop pollination. This information is relevant to ensure food security in a world where human population is growing and agriculture is shifting towards more pollinator-dependent food production.

Enhancing the resilience of smallholder food and nutrition security through management of pollination services in rural Nepal

Thomas Timberlake[1], Sujan Sapkota[2], Alyssa Cirtwill[3], Daya Bhusal[4], Kedar Devkota[5], Naomi Saville[6], Susanne Kortsch[3], Matthew Smith[7], Samuel Myers[7], Sushil Baral[2], Tomas Roslin[3], Jane Memmott[1]
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Pollinator declines are predicted to reduce the yield of nutritious crops and increase rates of micronutrient deficiency across the world. However, previous studies have only modelled these effects at a broad global level, making it challenging to predict effects on individuals and identify local solutions. Working in ten smallholder villages in rural Nepal, we use a network approach to quantify the links between insect pollinators, crops, and the nutrients consumed by 200 smallholder families throughout an entire year. We show that approximately 25% of consumed food items are pollinator dependent and substantial proportions of key dietary nutrients including folate and vitamin A are reliant on insect pollinators. The domesticated Asian honeybee (Apis cerana) and various wild pollinators including bumblebees, solitary bees and flies are essential for supporting the production of these nutrients but agricultural specialization is likely to reduce the resilience of pollination services. We identify management options for enhancing the resilience and provisioning of pollination services and predict the resulting benefits for human health and nutrition.

Disentangling and mitigating the effects of mowing on grassland arthropods

Johanna Lina Berger, Michael Staab, Nico Bluethgen
TU Darmstadt, Germany

Insect declines have been documented increasingly, with intensive land use being the primary cause. In grasslands, mowing machinery has a strong negative impact on arthropod abundance and diversity. Mowing causes arthropod mortality but also induces consequences such as changes in microhabitats and increased predation. It is therefore important to disentangle the effects of mowing techniques on arthropods in real-world grasslands to improve management for biodiversity.

Using extended data from grasslands in Germany, we analyzed the influence of different mowing techniques on arthropods. We found strong negative effects of mowing on arthropods with the lowest abundances directly after moving. 100 days after mowing, arthropod abundances increased strongly, indicating a potential for recovery over time. Furthermore, different mowing machines caused different levels of damage, with the mulcher being the most detrimental.

Mowing itself has the strongest negative effect on arthropods, while our results show that changes in mowing techniques can also have positive effects. Therefore, to reduce the overall negative effects of mowing, we suggest not only the use of more arthropod-friendly machinery, but also management changes such as less mowing, partial mowing, and extensive grazing.

Increasing the resilience of biological pest control through agricultural management

Cassandra Ezra Vogel, Benjamin Feit, Mattias Jonsson
Swedish University of Agricultural Sciences, Sweden

High biodiversity is thought to increase the resilience of ecosystem services under changing conditions. This is largely because diverse communities host more species that can contribute to ecosystem services (functional redundancy) and because species respond differently to disturbances in their environment (response diversity). As agricultural landscapes become increasingly disturbed, for example through climate change or intensified agricultural management, maintaining or even enhancing the resilience of ecosystem services in agriculture becomes more and more important. However, empirically assessing the resilience of ecosystem functions like biological pest control was formerly challenging as no solid framework existed to do so. However, a new framework linking feeding interactions, metabolic theory and climatic niches made it possible to assess the functional redundancy of predators important for biological pest control in Swedish cereal crops. We expand on this framework by collecting additional feeding interaction and climatic niche data from four countries across a North-South gradient in Europe as well as applying it to existing predator datasets from agricultural landscapes in Sweden. The aim of this work is to improve our understanding of how to best manage agricultural systems to support resilient biological pest control into the future.

Resistance and recovery rates of pest control after agricultural disturbances in fields with different agrobiodiversity

Claudia Paul[1], Cassandra Vogel[3], Matteo Dainese[4], Phillippe Belliard[2], Oskar Rennstam Rubbmark[2], Michael Traugott[2], Mattias Jonsson[3], Emily Poppenborg Martin[1]
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Increased agrobiodiversity is expected to provide more resilient ecosystem functions and services in farmland. This is largely because in diverse communities there are more species that can contribute to the functions (functional redundancy), and because different species are likely to respond differently to environmental variation (response diversity). However, attempts to actually measure ecosystem resilience to disturbances, including those related to climate change and agricultural practices, are rare. Notably, to date, we almost entirely lack studies of how farm diversity and landscape complexity contribute to resilience of biological pest control. Here, we present results of an empirical assessment of how natural enemy communities and biological pest control resist and/or recover from disturbance under different agrobiodiversity conditions in cereal fields across Europe. We show that recovery of natural enemy communities and subsequent impacts on biological pest control depend on in-field management practices and may be modulated by surrounding landscape structures. These results are a step towards better understanding the drivers of biological pest control resilience in European agricultural landscapes in order to ensure resilient biodiversity and ecosystem functioning in future landscapes under global change.

How to maintain stable crop production while reducing pesticide use in agricultural landscapes?

A conceptual framework for maximising the stability of

Lucile Muneret[1], Eirini Daouti[2], Nicolas Guilpart[3], Ute Fricke[4], Mattias Jonsson[2], Emily Martin[5], Ricardo Perez-Alvarez[5], Adrien Rusch[1], Mathieu Siol[1], Sandrine Petit[1]
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Designing pesticide-free agricultural landscapes based on stable provision of ecosystem functions becomes of paramount importance for fostering sustainable crop production. Drawing upon the conceptual framework derived from the stability of plant productivity in natural systems, we formulate some working hypotheses to evaluate how to maximize the stability of ecosystem service provision and underlying ecological communities in heterogeneous agricultural landscapes. Specifically, in this draft, we explore the relationships between the variability of the landscape heterogeneity in terms of composition and configuration and the stability of (i) ecological communities, (ii) intermediate ecosystem service, such as pest control, and ultimately (iii) crop productivity. We also examine the empirical validation of these hypotheses and outline potential avenues for future research.

151: Synthesizing data and knowledge to improve the performance of conservation translocations

First insights from Transloc, an extensive database of conservation translocations of plants and animals in the Western Palearctic

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Conservation translocations have been widely used in Europe to reverse, slow down or counterbalance the effects of population extinction of natural populations. However, valuable insights from case studies often remain unpublished or lack standardised results, which prevents effective comparisons and hampers both the assessment of the relevance of translocations and the appropriateness of their methodology. To address this gap, the TransLoc database has been under development since 2013, focusing on compiling and standardising data related to plant, lichen, and animal translocations in Europe and the Mediterranean (Western Palearctic). The database aims to centralise scattered information from scientific and grey literature, as well as non-computerized field notebooks, making it accessible to researchers, practitioners, and stakeholders. Using this database, we explore taxonomic and phylogenetic biases (compared with general floras) in plant translocations across four European countries. Focusing on angiosperms, our analysis reveals biases towards specific plant groups, with certain orders over-represented across countries. Additionally, translocated plant species exhibit higher-than-expected phylogenetic diversity in Spain, France, and Switzerland, and greater evolutionary distinctiveness in Spain and France. This research underscores the importance of TransLoc in addressing knowledge gaps and promoting informed decision-making in conservation translocations.

Using a serious game to address the social and economic aspects of translocation

Anna Deffner
Biotope, France

The European research project Transloc aims to document, quantify and analyse translocation efforts and their effectiveness for flora and fauna conservation, as well as their socio-economic benefits or negative impacts. As part of the social component of this research project, the experts of Biotope, a French ecology consultancy, have developed a cooperative serious game to help practitioners explore and anticipate the main principles, limits, difficulties and success factors of a conservation translocation project. During a game session (2-3 hours), players collaborate and explore the multiple challenges of translocation projects, within a limited budget and timeframe. They build a translocation project for a target species, implement actions (restoration, protection, stakeholder engagement, research, monitoring, release of individuals, etc.) and have to deal with random events (extreme weather events for instance). Several test sessions have been carried out with conservation researchers and have shown that the serious game works well and generates rich discussions. It will be now used to facilitate discussions among translocation practitioners on the success factors, levers and obstacles to translocation projects, and if relevant to contribute to the design process of new translocation projects.

Effectively assessing the success of conservation translocations

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How to effectively assess the success in conservation translocations is still unclear. However, taking into account relevant success indicators during the different phases of a population establishment and growth are key to ensure its long-term viability. This underlines the need to develop a clear definition of success criteria, applicable to the widest range of species and relevant to life histories, management techniques, environmental conditions and conservation contexts. We summarized the currently used success criteria in a review and looked for variation between different biological and environmental factors. We developed recommendations to be embedded in a unified framework for success assessment centered on population viability and accounting for the transient dynamics of any translocation. We also investigated further correlations of success and failure at the community and ecosystem level in past translocations to develop a more comprehensive view of translocation success for the purpose of conservation and restoration. This allowed us to provide new indications to increase the efficacy of translocations.

How do translocated populations face global changes?

Anne-Christine Monnet[1], **Fernando Ascensão**[2], **Carmen Bessa-Gomes**[3], **Marc Dufrêne**[1]
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Conservation translocations are often locally designed actions involving various actors, constraints and motivations. In addition, these actions generally occur in the context of high impacts of human activities and climate change threats. The release sites are then often spatially restricted, but their locations can have profound consequences on the persistence of the translocated populations when considering future conditions of climate and land use. In this context, we examined two specific questions to better understand the relevance of translocation sites. We first assessed how the current and future climate conditions match in translocated sites, considering the climate tolerance of the focal species (plants, birds, and mammals). This information provided an overview of how the effects of climate change threaten translocation programs. We then assessed if and how a collection of focal species (mammals) can disperse through the landscapes over time and reach areas with necessary conditions to prevail, accounting for land use conversion, climate change, and anthropogenic barriers such as roads and railways. Our results suggest that range shift is species-specific and mostly related to habitat specialization and dispersal capacity traits. We discuss how translocation programs should incorporate information on global change effects to foster the efficiency and success of conservation.

152: Multifunctional landscapes for people and biodiversity in Sub-Saharan Africa

Ecosystem services provided by birds in the agroecological niche and mangrove restoration in the oil-polluted Niger Delta region of Nigeria

Nyimale Grace Alawa
Rivers State University, Nigeria

The critical role birds play across multifunctional landscapes in sub-saharan Africa necessitates the dynamic relationship between them, the indigenous peoples and local communities. They are excellent environmental indicators alerting man of a pollution problem. They are an integral part of the ecosystem as they serve as mobile links within the vast food chains and webs that exist in an agroecological mangrove environment. Recent surveys in an oil-polluted mangrove community- Bodo, Rivers State, Nigeria revealed that mangrove restoration success attracted a diversity of bird species thriving in the environment. The diverse habitats found in an agroecological mangrove landscape; edges, shrubs, patches, mangrove trees are good sites for roosting, nesting and foraging for birds. Proper monitoring of the mangrove restoration and farmland management practices need to be adopted to preserve and conserve this landscape of high conservation value and refugia for bird species.

Combined effects of cropping system, soil fertility, and landscape cover on biodiversity, pest control, and crop yield in East Africa

Grace Mercy Amboka, Mattias Jonsson, Sigrun Dahlin, Benjamin Feit
Swedish University of Agricultural Sciences, Sweden

Ecological intensification can be used to enhance crop yield while supporting biodiversity and ecosystem services. Push-pull cropping is a type of ecological intensification that was developed in East Africa to protect maize from stem borers and that subsequently was found to also reduce fall armyworm and Striga weeds and to improve soil fertility and crop yield (www.pushpull.net). We, however, still have a poor understanding of when and where push-pull works best. We studied how soil fertility and landscape composition determine the efficacy of push-pulls in increasing the diversity of invertebrate predators, reducing the abundance of pests and weeds, and enhancing crop yield. Data was collected in Ethiopia, Kenya, Rwanda, Tanzania, and Uganda. In each country, twelve to sixteen pairs of push-pull and non-push-pull maize and sorghum fields were selected along gradients of landscape-level grassland cover and soil type. In each field, we measured the diversity of predators, pest pressure (stem borers and fall armyworm), Striga weeds, a range of variables contributing to soil fertility, and maize yields. Data will be analyzed using PCAs to summarize soil and landscape variables and SEMs to evaluate the direct and indirect cascading effects on diversity of invertebrate predators, pest and weed control, and maize yield.

Forest-agriculture mosaic landscapes for ecosystem services and conservation: a case from social-ecological systems of southwestern Ethiopia

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Woody plants in the forest-agriculture mosaic provide many different ecosystem services. They provide house construction wood, fuelwood and medicine for local people. They also provide erosion control, climate regulation, and biodiversity maintenance services, which can further underpin ecosystem integrity and functions. Using a case study from southwestern Ethiopia, for example, we found that such services significantly increased with diversity. We also found that local people greatly depend on many species for such services. Nevertheless, deforestation and land-use intensification endangered species maintenance. For example, we found that native species richness decreased with coffee management intensity and in secondary forests but increased with current distance from forest edge in primary and secondary forests. Similarly, the richness of forest and dietary specialist bird species increased with forest naturalness, distance from edge and amount of forest cover. In farmland, we found agricultural land use legacy effects on plants. Local people felt limited property and use rights, and most widely used species appeared to have been overharvested. Therefore, multifunctional landscape maintenance requires safeguarding primary habitats and fostering cultural landscape development. Specifically, it entails to recognize local people, their needs, and experiences, and to clearly define their property and use rights, and responsibilities to resolve misuses.

153: Peoples and natures for a transformative change

Understanding biodiversity: the role of the plurality of meanings

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Biodiversity means many things, and for this reason, the concept of biodiversity can be described as multifaceted, multidimensional, polysemic, polyvalent, versatile, and open: Sahotra Sarkar recognizes that the concept is "remarkably vague" (Sarkar, 2002), Carlos Santana, who advocates for the elimination of the term, argues that biodiversity is a "slippery concept" (Santana, 2014).

My aim is to investigate whether this vagueness in defining the concept of biodiversity, mainly due to its complexity, is a problem or rather a strength, especially in the socio-political context. In fact, the plurality of meanings can contribute to enhance the "integrative power"(Toepfer, 2019) of the concept. Indeed, “biodiversity” is a “performative” (Casetta,2019) concept; that is, it can link together heterogeneous discourses, adapt to changing situations and contexts, and mediate between disciplinary boundaries considering scientific facts, ethical-moral issues, cultural views, and political, social, and economic matters. So, investigating the various ways of defining, describing, and representing biodiversity can be helpful to its broader and more complete understanding by the general public. This can be a basis for identifying ways to make the issue of conservation more meaningful and usable and lay the grounds for attentive and aware citizenship.

Bird migration and nesting in time: designing for nonhuman temporalities

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The monitoring of animal movements through tracking devices and environmental sensors has produced particular forms of knowing environmental change. Animals not only have become sensors in a network of data collection on their behaviours and locations, but thereby also became part of an extended computational infrastructure. An infrastructure that in turn can start to govern their lives, as technological environments that inscribe temporalities and particular modes of planning and predicting. This paper thinks through several situations of infrastructural adjustments to bird migration and nesting to trace the ways in which possible animal temporalities and nonhuman ways of engaging with the future are either ignored, cut short and erased from the subjectivities that are granted to animals, or sometimes allowed or even actively made to emerge and differentiate. Taking a lead from Isabelle Stengers' reading of Alfred North Whitehead and drawing on Michel de Montaigne's writings on animals, it proposes a more-than-human speculative approach to designing for and with animals that builds on traditions and practices of living with wildlife through time. Through iteratively posing particular questions of animal temporalities across different sites, disciplines and historical moments, conservationists are invited to design temporally open infrastructures for migrating and nesting birds.

Integrating palliative approach into conservation sciences: questioning the crisis paradigm

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Conservation sciences, born as a crisis discipline, now stand at a crossroad, facing the imperative for transformative change. After four decades, it is crucial to reevaluate the conventional crisis narrative. While this narrative effectively mobilizes action and offers hope for solutions, it also hinders deep contemplation and implies temporary problems, which does not align with the persistent degradation of our environment.

Drawing inspiration from the stages of grief, a radical alternative of the “hope of the hopeless" is here articulated. This does not mean resignation but rather acknowledges the need for transformative change, even in the face of disconcerting challenges. To address the systemic nature of environmental issues, it is recommended to expand the crisis framing to include a palliative approach. Palliative care can foster reconciliation with friends, family and environment. Could this not be an ignition to the transformative change that we require?

Flourishing diversity along sacred paths: unveiling habitat conservation through remote sensing analysis in the Henro Pilgrimage, Shikoku, Japan

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Rapid urbanisation, spurred by an expanding global population, poses a significant threat to biodiversity. This study focuses on the role of sacred areas, specifically Buddhist temples within the urban areas along the Henro Pilgimage of Shikoku Island, Japan, as potential refuges and habitats for the preservation of urban biodiversity. Diverging from conventional protected areas, typically distanced from urban centres, these temples are woven into the urban fabric. The study aims at discerning whether sacred spaces engender heightened environmental heterogeneity relative to the adjacent urban matrix, positing that amplified landscape heterogeneity correlates with heightened biodiversity, facilitated by the presence of varied semi-natural habitats. Using landscape metrics and high-resolution land cover maps, the research analysed habitat fragmentation proximal to the temples and across the urban expanse. Additionally, Sentinel-2 satellite imagery was used to compute spectral vegetation indices (NDVI, NDWI, SAVI), enabling the calculation of spectral heterogeneity indices (Rao's Q). Results indicated that, within a 100-meter buffer around sacred sites, heightened land use diversity can be observed, promoting a spectrum of connected semi-natural habitats with higher biodiversity. Amidst Shikoku Island's predominantly rural landscape, temples function as fundamental hotspots for biodiversity in urbanised regions, offering mitigation against urbanisation impacts on natural and semi-natural ecosystems

Restorative perceptions of natural soundscapes: Relationships with acoustic complexity and anthropogenic noise

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Natural soundscapes are a key aspect of nature contact experiences and can provide valuable mental well-being benefits. However, there is a poor mechanistic understanding of the acoustic properties that promote these benefits, the impact of traffic noise and the applicability of acoustic metrics in quantifying and potentially predicting restorative soundscapes.

To address these gaps, we conducted an online study in which N=1529 UK residents (representatively sampled for age and gender) listened to nine simulated soundscapes of UK natural habitats with low, medium, and high levels of three acoustic metrics: Acoustic Complexity Index (ACI), Bioacoustic Index (BIO) and Entropy (H), with either no, low or high traffic noise overlays. After each sound recording, participants then responded on a range of affective and acoustic perceptions of these sound recordings, along with self-reported measures of mental well-being, such as perceived restorativeness.

Preliminary analyses indicate that BIO was associated with the highest perceived restorativeness scores, along with a medium acoustic metric level. Notably, results also indicated greater acoustic complexity, as indicated by metric level, was associated with higher perceived restorativeness, even at low levels of traffic noise. These results can provide valuable insights which may inform the management of beneficial soundscapes in natural areas.

Seeds of Change: Unveiling the transformative potential of a gardening citizen science intervention for insect conservation

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The alarming decline of insect populations and their crucial role in sustaining ecosystems have been persistently overlooked by the wider public (Cardoso et al. 2011). Unfavourable attitudes towards insects and negative emotions such as fear and disgust continue to prevail (Kellert 1993; Lorenz et al. 2014; Shipley and Bixler 2017), resulting also in lower conservation efforts (Martín-López et al. 2007). In this contribution, we explore the potential of a citizen science intervention as a gateway to encourage interest in insect conservation. Together with a renowned weekly newspaper, a Germany-wide campaign was conducted over four months, combining a citizen science project with an information campaign on insect-friendly gardening practices. We examined the impact of this intervention on insect-related attitudes, problem awareness, knowledge, and behaviour. A before-after comparison and an additional control group with a total of 1124 people participating in the surveys enabled a quasi-experimental design. Using a difference-in-differences analysis, we demonstrate that the intervention has a positive impact on the knowledge level and insect conservation behaviour, particularly for people with a low initial level. We conclude that the transformative potential unfolds in a target group that is initially less aware of and involved in insect conservation.

The components and traits of urban nature that contribute to mental wellbeing

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Urbanization, a key driver of biodiversity loss, also separates people from the experience of nature, and this in turn, erodes wellbeing and diminishes people's connectedness and care for nature. Designing biophilic cities to promote nature-related wellbeing offers a way to strengthen our bond with nature and addresses urban lifestyle-related mental health issues. However, current research often explores nature as a 'black box' and studies exploring the biodiversity-wellbeing relationship yield inconsistent results. Using a systematic review covering over 10,000 peer-reviewed papers, this study aims to understand which nature components and their traits can contribute to mental wellbeing in the urban context. Our findings indicate that most studies are observational rather than experimental, primarily focusing on green coverage in residential areas.The effect of exposure to nature/greenspaces shows mixed or no effects on depression and perceived wellbeing, while studies examining mood states and restoration generally show a positive effect. Limited efforts are directed to explore the wellbeing benefits derived from specific components or traits of nature, showing that trees and birds enhance mental wellbeing compared to components such as lawns. Altogether, our results provide insights that can inform the design policy of biophilic cities to foster nature connectedness and improve human wellbeing.

Environmental memory in Ferlo : nostalgia might favor local biodiversity knowledge and conservation will

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One of the many challenge in the fight to tackle environmental crises is raising awareness among people. We questioned the presence and the role of environmental literacy to do so, and especially the power of people lived or transmitted memories of their past environment.

We studied it in the Ferlo, Senegal. Mainly inhabited by Fulani living from breeding, this Sahel area suffered an important desertification and aridification and extreme loss of biodiversity since droughts in the 1970s. We conducted 40 semi-structured interviews with a Fulani interpreter. Interviews were then transcribed in French before thematic analysis.

Results showed that environmental memories in the Ferlo referred to the former way of life of inhabitants in interaction with their environment and lost species. Respondents were nostalgic about their past environment as they saw many benefits from it, and were aware about biodiversity importance for ecosystem functioning. This resulted in a strong desire to recover past biodiversity, including species once considered harmful, such as predators. In addition with sensitizing people to environmental change, environmental memories might complement ecological studies, reviewed for this work, to assure biodiversity and environmental change monitoring in the time, as the former could provide very local, precise and recent information.

154: Ecological and biogeographical drivers of human-wildlife conflicts under global change

A perspective on human-wildlife conflicts in the context of global change

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In the last decades, human activities have become a major force of biophysical changes in our planet, leading to unprecedented consequences for the ecological processes that govern our natural environments. Scientific knowledge about the impact of global change on ecological communities and ecosystems primarily focuses on human actions affecting the relationships between non-human species. However, though largely overlooked in the literature, these effects certainly also play an important role in shaping complex ecological dynamics in human-dominated landscapes and mediating the intensity and occurrence of negative human-wildlife interactions. In this presentation we will review the different mechanisms by which the components of global change can drive human-wildlife conflicts. We will focus on the different ways by which climate change, land-system dynamics, biodiversity loss, altered biogeochemical flows, biological invasions and other components of global change can influence existing conflicts or result in new ones. Our final goal is to propose a novel perspective about which pathways can force terrestrial vertebrates to enter in conflict with humans due to altered environmental conditions.

Nearly 40% of carnivore ranges threatened by human pressures

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In the Anthropocene, the prevalence of human modification (HM) within a species' range can help to identify vulnerable populations and implement conservation strategies. We assessed the extent of HM in relation to carnivore global species richness and within the distributional range of 255 terrestrial carnivores. We also evaluated the spatial heterogeneity of HM across regions and determined which carnivore traits influenced HM prevalence using regression trees. We found that ~6% of terrestrial areas comprised high carnivore species richness that corresponded to low HM. However, globally, 37.8% of all carnivores' ranges experience high to very high human pressures raising concerns about population persistence and conservation effectiveness. The average human modification index (meanHMI) across all carnivore species was 0.331 with species ranges within East Asia and West and East Africa being most vulnerable to rampant HM. The meanHMI was predicted best by range size, family, and temporal activity pattern of the species. Ultimately, our findings highlight carnivore populations that both appear resilient and are vulnerable due to HM, helping to identify areas where adaptation and consistence strategies persist and other populations likely experiencing human-wildlife conflict and at-risk of range contractions, respectively.

Spatial temporal dynamics of wildland-urban interface as a driver of conflicts – the case of the Polish Carpathians

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The wildland-urban interface (WUI) is an area where natural vegetation is located close to settlements. Usually, it is divided into two types: interface and intermix. In interface, settlements abut natural vegetation, while in intermix houses are located within natural vegetation. WUI is a global phenomenon and its existence may support human-wildlife interactions, or wildlife damage to humans. In this study, we used a set of WUI maps of the Polish Carpathians to analyse the impact on the occurrence of damages caused by wolves, bears and lynx. We found that although the proportion of WUI in the commune does not directly explain the high number of damages, most of the damages occurred in WUI. While most wolf-dependent damages are located in Interface, bear-related incidents happened in Intermix WUI. We also found that a significant part of the damages took place in areas that were WUI many decades ago, which shows the existence has a strong legacy effect. There is a need to avoid settlement expansion into wildlands, especially in areas where large carnivores are recovering, to reduce the potential negative impact of their presence in human-dominated landscape.

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A 700-years historical perspective on the ecological regression of bears and wolves

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Wildlife comebacks have motivated controversy over the convenience to downgrade the conservation status of species after certain baselines are reached. The debate often downplays the relative magnitude of recent recovery as compared to historical declines. Historically, human activities have displaced large carnivores from the most productive landscapes. Therefore, marginal lands may have acted as Anthropocene refugia, allowing the long-term persistence of species in habitats with less conflict with humans. We analysed the magnitude of historical brown bear and wolf ranges, and how contractions may have been driven by people's historical occupation of land. We modelled fine-scale bear and wolf occurrences over 700 and 170 years, respectively, using unique historical records from Spain. In the Late Medieval and Early Modern periods, bear distribution covered much broader bioclimatic conditions. The signal of land-use on species occurrences could be detected as early as in the 14th century, while only two relict populations persisted since the 18th century. In contrast, wolf was widespread two centuries ago and experienced a 70% reduction since then. Remarkably, the most suitable areas for recolonization coincide with historically suitable areas. Our work supports the land-use refugia hypothesis and calls for full consideration of historical decline patterns in modern conservation.

Human-caused mortality can prevent range expansion of a large carnivore. The case of wolves in the Iberian Peninsula

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The conservation of large carnivores in human-dominated landscapes is challenging for multiple reasons. For instance, carnivores like the grey wolf (Canis lupus) need to move frequently across multi-use landscapes, and human-caused mortality can have substantial effects on population dynamics, which in turn can affect conflict occurrence. We built a spatially-explicit individual based model (SE-IBM) to simulate the dynamics and dispersal of the wolf population in the Iberian Peninsula, where wolves have not expanded their range in the past 30 years despite ample suitable habitat. Our IBM shows unexpected high mortality rates for residents and dispersers. High mortality rates create vacant territories and social openings in packs, which lead to short dispersal events and high turnover of territories. We also showed that reductions in mortality rates lead to wolf expansion across currently unoccupied habitats, and that potential changes in land cover and resource availability are expected to affect recolonization processes. Human attitudes towards wolves may greatly determine the extent of conflicts under recovery scenarios. Our study enables a better understanding of how human-caused mortality influences population dynamics in wolves and vulnerability to conflict, thus allowing prioritization of management actions to foster coexistence.

Climate change as a global amplifier of human-wildlife conflict: a quantitative review of case studies across our lands and oceans

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Climate change and human-wildlife conflict are both pressing challenges for biodiversity conservation and human wellbeing in the Anthropocene. Climate change is a critical yet underappreciated amplifier of human-wildlife conflict, as it exacerbates resource scarcity, alters human and animal behaviors and distributions, and increases human-wildlife encounters. Such conflicts disrupt both subsistence livelihoods and industrial economies, and may accelerate the rate at which human-wildlife conflict drives wildlife declines. We synthesize evidence on climate-driven conflicts occurring among 10 taxonomic orders, on six continents, and in all five oceans. We further highlight incredible diversity in the forms of conflict occurring and climate drivers underlying such interactions. We introduce a framework describing distinct environmental, ecological, and sociopolitical pathways through which climate variability and change percolate through complex social-ecological systems to influence patterns and outcomes of human-wildlife interactions. We conclude by discussing how explicit consideration of climate change can aid conflict mitigation and climate change adaptation to limit the impacts of human-wildlife conflict on biodiversity conservation and human wellbeing in a changing climate, drawing upon lessons learned from case studies.

155: Combining scientific evidence, local knowledge and practitioner experience for decision-making and learning in conservation

Tackling the inefficiency paradox: delivering effective conservation through combining evidence sources

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University Cambridge, United Kingdom

It is clear from multiple lines of evidence that are potential substantial gains in the effectiveness of practitioners, policy makers and funders from learning from the experience of researchers and others. It should be unthinkable for practitioners to make serious decisions without reflecting on the evidence or for funders to support such proposals. However, despite the likely substantial gains in effectiveness many practitioners, policy maker and funders do not routinely reflect on the evidence ('The Inefficiency Paradox'). I will outline the magnitude of the problem, describe the types of evidence available, including scientific evidence (in all languages not just English), practitioner experience and local and indigenous knowledge, then consider how evidence can be assessed and embedded into decision making process. I will describe how the quality of decisions can then be described to distinguish those that are rigorous from those that are weak, incompetent or corrupt.

Sharing practical conservation insights in a practitioner knowledge database

Vanessa Cutts, Nigel Taylor, William Sutherland, Howard Nelson
University of Cambridge, United Kingdom

Scientific and practical knowledge are equally important for advancing conservation but are not equally accessible. While scientific articles can be systematically searched for and cited at a global scale, the knowledge and experience of conservation practitioners is less easy to access and share.

Practitioners' experience of practical management is highly valuable to others doing conservation, both locally and globally. In particular, they hold knowledge of practical implementation of conservation actions that is often not recorded in the scientific literature. Furthermore, conservation actions are not necessarily 'one-size-fits-all' solutions because their success can be dependent on site-level conditions and how they are implemented. Knowing what works in conservation is one thing; knowing how to implement what works is another. Having multiple experiences aids the assessment of what works where and when.

We have created a prototype platform for collecting and sharing such information. The prototype database – which we are actively developing in the Fens National Character Area, UK – comprises discrete, citable pieces of practitioner knowledge in the form of 'insights', each one being linked to its source and details of what was observed. The insights include novel solutions, modifications of existing solutions and practical means of delivering solutions.

Enablers and Barriers to Embedding Indigenous and Local Knowledge and Voices in Conservation: Insights from BirdLife Partnership and the Global South

Poshendra Satyal
BirdLife International, United Kingdom

Drawing on insights from the BirdLife Partnership and experiences in the Global South, this presentation delves into the complexities associated with integrating indigenous and local knowledge (ILK) and voices into conservation and restoration efforts. Grounded in a recent study, it examines findings from semi-structured interviews (n=20) with 11 BirdLife partners, highlighting the enablers and barriers to incorporating local perspectives in conservation practices. Additionally, the speaker shares lessons learned from active involvement in the Asia Pacific Forest Governance project, emphasising the significance of integrating community-based forest monitoring in conservation initiatives. The presentation also integrates insights from the speaker's diverse research collaborations, spanning case studies from community forestry in Nepal, restoration efforts in Europe, pastoralist communities in East Africa, and Uganda's Batwa group. This compilation serves as a showcase of BirdLife Partnership's institutional experience and the presenter's extensive research and advocacy endeavours, all dedicated to decolonising conservation. By exploring both successful strategies and challenges encountered in embedding ILK and voices, the session provides valuable takeaways for practitioners, policymakers, and researchers involved in conservation planning and implementation. The narrative underscores the critical imperative of fostering inclusive and culturally sensitive approaches, advocating for a paradigm shift towards a more equitable and collaborative conservation framework.

Assessing and compiling diverse evidence for conservation actions and strategies

William Hugh Morgan
University of Cambridge, United Kingdom

To succeed in protecting and restoring the natural world, conservationists must do more of the things that work and less of the things that don't. But determining which conservation actions are right for a particular context is challenging. In many cases there is a lack of evidence, and the evidence that does exist comes in many different forms, was gathered in very different contexts, and via a variety of methods. As such, approaches that can accommodate this complexity are vital. We have developed an approach to weighing and assessing the full variety of evidence that might underpin core assumptions of conservation projects, strategies, and actions: the Balance Evidence Assessment Method (BEAM). By considering the relevance and reliability of evidence, and the support it provides for a particular assumption, diverse types of evidence can be brought together to reveal the overall strength of support. We have applied this approach to assess a wide diversity of evidence gathered in the Conservation Learning Initiative, including evidence from the published literature, responses to questionnaires, and discussions with expert groups. This approach will facilitate the use of a broader selection of evidence in a transparent and flexible way to help improve conservation practice.

The Conservation Learning Initiative – evidence-based learning on key conservation actions

Nicolas Boenisch
FOS Europe

The Conservation Learning Initiative is a collaboration between Foundations of Success and Conservation Evidence. Our shared goal is to bring together practitioners and researchers in learning networks to improve the implementation of conservation strategies by filling knowledge gaps. To achieve this goal, we use an innovative five-step approach to evidence-based conservation decision-making and learning.

Our approach involves identifying a well-defined learning topic that relates to a specific conservation action, asking relevant learning questions, and testing explicit assumptions with evidence. Our method features five steps:

- Define the overall learning topic

- Develop learning questions and formulate assumptions

- Collect evidence related to the assumptions

- Assess the evidence to determine its weight and whether it supports the assumptions

- Compile and conclude learning

In this presentation, we present how we have applied this method using evidence from 30 years of conservation funding by the MAVA Foundation, complemented by published evidence. We will share key findings from five topics: capacity-building, partnerships and alliances, flexible funding, research and monitoring, and policy impact.

Translating learning outcomes into practice: improving conservation capacity building

Daniela Aschenbrenner

CCNet Europe, Germany

The Conservation Coaches Network (CCNet) is a global network of coaches trained to support conservation teams and projects to apply the principles of adaptive management. CCNet's key activities are training conservation practitioners as coaches and providing peer support to existing coaches. CCNet is both a capacity-building organisation and a community of practice facilitating the exchange of experiences between its members.

The Conservation Learning Initiative has collected, assessed and compiled evidence for capacity-building efforts in conservation. CCNet has used the findings to improve its practice. This talk will share CCNet's experience of translating evidence into practice using the steps: (1) Compare Theories of Change, (2) Compare Learning Questions, (3) Review results for Learning Questions, and (4) Draw practical conclusions building on learning results.

The evidence confirmed that CCNet's trainings include elements that support the application of acquired skills, like using a mix of learning methods or relevant case studies. Practical conclusions to improve CCNet's activities are better understanding the trainees' context, establishing post-training measures and facilitating opportunities to apply acquired skills. CCNet recognises that combining data from more capacity-building organisations could help to answer some learning questions. Cross-organisational learning communities could facilitate such collaboration and help to overcome learning in isolation.

156-1: Conservation of freshwater ecosystems: Can we be biodiversity positive by 2030?

Global conservation of groundwater biodiversity

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Groundwater constitutes a crucial component of the global water cycle, hosting unique biodiversity and offering indispensable services to societies. Despite being the largest unfrozen freshwater resource, groundwater environments are facing depletion due to extraction, pollution, and climate change. Unfortunately, they have frequently been neglected in global biodiversity conservation agendas. Overlooking the significance of groundwater undermines its pivotal role in safeguarding distinctive subterranean biodiversity and the associated surface biomes. We contend that it is both timely and imperative to evaluate general criteria for the conservation of groundwater biodiversity. Consequently, we explore global solutions aimed at mitigating anthropogenic impacts on groundwater ecosystems, enhancing the inclusion of groundwaters within the global network of protected areas, and raising awareness among people about these often overlooked ecosystems.

Small fish, small streams, big challenges: how fish populations have evolved in the upper Po basin and what can we do to reverse their decline?

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Freshwater fish is the most diverse and rich group among European vertebrates and at the same time one of the most endangered. The LIFE Minnow project (LIFE21-NAT-IT-LIFE Minnow/101074559) aims to improve the unfavourable conservation status of six small freshwater fish species included in Annex II of Habitats Directive in tributaries of the upper Po River basin. The target species are Po brook lamprey (Lampetra zanandreai), South European nase (Protochondrostoma genei), Italian nase (Chondrostoma soetta), Italian riffle dace (Telestes muticellus), Italian golden loach (Sabanejewia larvata), and European bullhead (Cottus gobio).

One of the first objectives of the project was to reconstruct the temporal and spatial variation in the distribution area and abundance of the six target species in the Piemonte region. This work was carried out using data mostly from the four regional fish surveys from 1988 to 2019 and provides a comprehensive picture of the local situation of the species, allowing to identify areas affected by population declines or local extinctions. Finally, we also hypothesize some of the causes of range contractions and we suggest the most appropriate conservation measures for each species.

The demise of springs: A silent global crisis

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Spring ecosystems occur where groundwater is exposed at the earth's surface and springs are abundant in subaqueous and both mesic and arid terrestrial settings. Widely recognized as among the most productive, biologically distinctive, and individualistic ecosystems, springs often have complex intrinsic and extrinsic functionality and provide critical headwater baseflow for many rivers. Springs constitute a unique biome-like global archipelago of small, important freshwater point-sources of bio-cultural diversity. Human evolutionary, cultural, and socio-economic development are deeply related to springs, but anthropogenic impacts over recent centuries profoundly threaten their ecological integrity through groundwater extraction, pollution, diversion, livestock management, geomorphic alteration, recreation, balneotherapy, and the desuetude of cultural memory. The extent and intensity of impacts constitute an enormous but little-recognized environmental crisis. However, springs are among the most sustainable and resilient ecosystems. We present reasons for this crisis and outline local to international solutions to recover springs in both ecological and socio-cultural domains. This strategy is based on local conservation actions that enhance functionality while still providing ecosystem goods and services in an environmentally just manner. By emphasizing springs, this strategy also can enhance aquifer and groundwater protection. We encourage improved scientific understanding, stewardship education, and actions across societal scale.

Rivers: critically important for nature and people but increasingly stressed by many impacts

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Lotic environments are of great interest for research as they are a small percent of the available fresh water, while also being a dynamic habitat by draining and connecting distant areas.

Rivers are pivotal in development of human civilizations and are intimately connected to many human activities, meaning they are also exposed to all insults of a booming Anthropocene. Assessments of environmental conditions with river biota composition can be used as an indicator of river health, where sustained high diversity infers high ecological integrity. In particular, in biomonitoring programs benthic communities (i.e. macroinvertebrates and algae) have long been used profitably. While autotroph and insect richness and abundances are unknown in rivers, for zoological biodiversity, rivers are home to 6% of all known species and as much as 30% of vertebrate species. Here we review current trends of biota conservation in rivers. Taxonomic work on organisms from economically important rivers has documented thousands of species and allows understanding of their biology. For example, documented changes in mobile freshwater primary producers, help with the understanding of the river ecosystem function, which allows these environments to provide important ecosystem services. Rivers have unique biota with diverse adaptations and need for conservation.

The fundamental contribution of lakes to global fresh waters and to the conservation of their biodiversity and ecosystem services

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Lakes come in a variety of shapes, sizes, geological and geographic situations and support an incredible diversity of habitat and biota. Ancient lakes are outstanding for their endemic biodiversity, with Lake Baikal alone supporting over 2500 endemic taxa. However, lakes globally face severe impacts, for which economic, sustainability, and management choices are crucial. An emblematic case in this respect being the demise of Lake Aral, once the 4th largest lake in the world, where all 24 endemic fish are now thought extinct. Climate-related stressors including warming and extended stratification and water-level fluctuations, together with changes in turbidity and input of nutrients all contribute to changing community patterns, in some cases facilitating mass developments of undesired species such as toxin-producing cyanobacteria. Typically, lakes are exposed to multiple stressors and climate change acts as a threat multiplier, though sometimes mitigating other impacts (e.g., acidification in high-mountain lakes). The littoral zone, which provides unique ecosystem services even in large and deep lakes, is often the tension zone where many human activities affecting the lake unfold. Using literature and our own case studies, we identify five major challenges and discuss how effective conservation of lakes can benefit from systematic analyses of ecosystem service stressors.

Representativeness and conservation value of Mediterranean temporary ponds in Europe. Local and large-scale issues.

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Temporary ponds are ephemeral water bodies that play a crucial role in the Mediterranean region, providing unique ecological conditions. They harbour a highly specialized biota that includes rare and threatened plants and animals. Understanding their ecological status is essential for effective ecosystem management and biodiversity conservation facing climate change and anthropogenic pressures. Focusing on the habitat "3170* - Mediterranean Temporary Ponds" (that includes species-poor beds of low-growing water-fringing or amphibious vegetation), in the framework of the Directive 92/43/EEC, we used information archived in the Natura 2000 standard forms, we derived a synoptic snapshot of this habitat at the European scale. The available data suggest that there are several gaps in the knowledge on 3170* habitat in Europe especially in terms of distribution and conservation status. Using data collected at regional scale, our aim is to contribute to solve the problems deriving from the lack of a common view on the ecological characteristics, indicator species and geographical distribution of habitat 3170* in order to apply to the new 2030 EU Biodiversity Strategy. Furthermore, we provide new data on the occurrence of Habitat 3170* outside the Natura 2000 network usable to increase the amount of protected areas at regional and national level.

How do native plants withstand the competition with invasives? A functional and environmental comparison in freshwaters

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Macrophytes are a key component of freshwaters and fundamental mediators of their functioning. However, native macrophytes are facing a worldwide decline due to multiple pressures: one of the main threats is the spread of invasive species. Hydrilla verticillata is a submerged macrophyte native to Asia and Australia, but it's invasive in other continents. Egeria najas is also a submerged macrophyte native to South America, and it's co-occurring with H. verticillata along the Paraná River (Brazil). This study aims to understand the adaptive responses of E. najas in habitats invaded by H. verticillata, by comparing functional and environmental niches of monospecific and mixed populations. The two species, though structurally similar, show a distinct niche based on leaf functional traits. Both become more plastic when co-occurring, adopting more competitive strategies. This suggests that they are highly efficient and can exploit the available resources differently, allowing their simultaneous presence. Besides, H. verticillata tends to occupy a subset of E. najas' environmental niche, indicating a more generalist behavior of the latter species, explaining its success despite the presence of the invasive. Overall, a wide variability in terms of functional traits expression and environmental tolerance seems to ensure the persistence of the native species.

What do we know about the ecology of aquatic Isoëtes species? Data gaps and opportunities to improve the global protection of truly iconic plants

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The genus Isoëtes includes iconic plants, characteristic of a wide range of ecosystems including nutrient-poor aquatic waterbodies. They are wetland obligates which have suffered severe losses globally over time mainly due to alterations and loss in colonized habitats. This is due to their sensitivity to habitat alteration and eutrophication of water and sediment. Despite this, a global review of the ecological knowledge about aquatic species belonging to this genus is missing, and overall, we know very little at the global scale. An assessment of aquatic Isoëtes ecology is therefore important, particularly for a better understanding of what the main threats to their conservation are. Through a global, collaborative initiative a first global ecological assessment focusing on aquatic Isoëtes was carried out. It includes a literature review, an extensive new database on Isoëtes distribution and growth conditions, and ecological niche analyses. We first compiled a global aquatic Isoëtes database including all known environmental data collected between 1935 to 2023 (for a total of 1880 georeferenced records). We then used ordinations to quantify ecological niches and environmental drivers for a subset of species. Both well-established findings and unexpected results emerged, opening new perspectives for the conservation of aquatic Isoëtes.

The functional role of spring-ecosystem biodiversity

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Spring ecosystems are hotspots for biodiversity, often connecting aquifers to headwater streams. In this work, we investigate the functional role of periphyton biodiversity on carbon processing, in spring-fed streams of the southeastern Alps. We sampled four sites in the Adamello-Brenta Nature Park (Trentino, Italy), from June to August 2023, and monitored changes in periphyton biofilms' structural characteristics and carbon cycling dynamics, both in the spring head and further down into the spring-fed stream. We collected periphyton for taxonomic determination, measured spring-stream metabolism by deploying O2 sensors, and measured dissolved CO2 concentration with a gas analyzer. We found that spring-fed streams have high CO2 concentrations, and that spring periphyton biofilms biodiversity could have an important role in assimilating CO2 from the supersaturated waters emerging from the aquifer before it is degassed to the atmosphere. Conserving spring biodiversity thus becomes an important strategy also for climate change mitigation.

Diatoms from the Mire of Fiavé: Their contribution to a multidisciplinary study to assess the conservation biology problems of the mire

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Peatlands are ecologically important sites for carbon sequestration, provide a valuable refuge for many sensitive threatened species of the Alpine foothills, and can be hotspots of biodiversity. The Fiavé Nature Reserve, a Natura 2000 site, is an alkaline fen (main occurring vegetation, Caricion davallianae), and includes the UNESCO World Heritage Site of the Bronze-Age pile dwellings of Fiavé. This study aims to assess the influence of surrounding farmlands on the quality of local biotopes using diatoms, chemistry, and vegetation (mapped with drones) as indicators and proxies. For this purpose, three 50-cm deep peat cores (in the Alps roughly representing the last 500 years), and surface and piezometer water samples were collected. Peat cores were cut while frozen into 3-cm samples, which were characterized from the physical and chemical point of view. Moreover, subsamples were processed to create permanent diatom mounts. Diatoms were identified, counted, and evaluated from the perspective of a link to the concentration of nutrients and a possible negative impact of eutrophication or chemical pollution in the studied area. The results will also be used to inform and support best management practices, such as the establishment of buffer zones.

Impact of cattle grazing on alpine mires as recorded by peat properties and diatoms: Insights for a sustainable conservation

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Peatlands are highly vulnerable and play a crucial role in carbon sequestration and biodiversity conservation. Cattle grazing and trampling contribute to peatland degradation and pose a significant threat to habitat integrity and biodiversity, especially in the southeastern Alps, where mires are habitats at the southern margin of their global distribution. The main objective was to examine the impact of grazing on the physical, chemical, and biological characteristics of peat, with a focus on diatoms to gain insights for a sustainable management and conservation of these habitats. Seven 50-cm deep peat cores were collected from mires located in the Adamello-Brenta Nature Park (Trentino, Italy) along a grazing-induced disturbance gradient. Results revealed that grazing, primarily affected the upper 15 cm of the peat resulting in increased density, reduced water content, elevated nitrogen concentration from cow manure. Over 200 diatom taxa were recorded and several of them fall under threat categories in the Red List for central Europe. Highly-grazed areas exhibited a higher percentage of eutraphentic species, linked to increased nutrients from cattle manure, and aerial species, which survive in environments with unstable water availability. This research provides useful indications on the effects of grazing in terms of biogeochemical cycles and nature/habitat conservation.

Cultural aspects related to Mediterranean springs and their reflections in the stewardship and

management of these unique but fragile ecosystems

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Cultural and economic attitudes of societies have always impacted freshwater ecosystems' conservation. Today the ecology and biodiversity of groundwater and springs are more studied, instead of their interconnection with culture, that has been a low priority. Analysing different case studies and the current literature of springs in the global mediterranean climate zones, cultural and socio-economic impacts on these unique aquatic ecosystems and their ecohydrogeology were examined in depth. The focus was on deep traditions, history, religion, law, economy of Mediterranean springs, and on the constantly growing and frequently unsustainable demand of these resources for water supplies, agriculture, energy, causing their degradation and loss, in particular happening when economic values equal or exceed cultural values. Therefore, the achievement of an improved and sustainable stewardship of springs and their aquifers is an important goal to reach, together with an essential conservation challenge for modern society dealing with climate change worldwide.

157: Bringing biodiversity to cities: conservation challenges in the urbanized world

The New Normal: Ethnobiology of cities and urban ecological knowledge

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Urban ethnobiology is a scientific discipline focused on relationship and interactions between people and living things in urban ecosystems. In the face of overpopulation, climate change and Capitalocene, those relationships and interactions, part of people's systems of beliefs, values and perceptions and embedded in urban ecological knowledge, it is of great importance to identify, document and interpret this type of knowledge, especially in major cities, including those of people's living in the capital city of Albania, Tirana. In this article we will try to give insights on today's major trends in urban ethnobiology and the basic notions which accompany them, and to address the why's and how's to conduct future ethnobiological studies in our cities. That is because these kinds of studies are absent. Additionally, in line with today's scientific methods and communications technologies developments, we recommend that during ethnobiological fieldwork it is crucial the involvement and engagement of communities living in cities, through community-based research approach and citizen science projects for a meaningful and sustainable future.

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Insects in cities: A within-cityscape ecological systems approach to reveal the mechanistic processes that shape urban flying insect communities

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Urbanisation is one of the main drivers of land-use change with negative effects on biodiversity. Yet, insect communities have been shown to have contrasting responses to urbanisation with varying effects on their species richness and abundance. Here, we used a multiple spatial scale (small-scale mechanistic to landscape scale), interdisciplinary (ecological and socio-economic) within-city approach to investigate the impact of urban development on flying insect communities in three German cities. For this, we used pan traps in the cities of Hamburg, Leipzig, and Halle at 350 sites that spanned from the edge to the city centre and collected several local patch (temperature, nesting and floral-food resources) and landscape ecological variables, as well as socioeconomic factors that could affect insect communities. Overall, we collected more than 10,000 insect individuals and identified more than 21 hoverflies, 33 Coleoptera, 160 Hymenoptera, and 4 Lepidoptera species. Preliminary analyses revealed a negative relationship between impervious surfaces and species richness and a strong positive effect of local flower richness on insect biodiversity. Further analyses will provide insights into how environmental and socioeconomic factors can influence insect species and their functional traits and highlight key processes necessary to inform strategies to restore and maintain diverse urban insect communities.

What factors drive the presence of ant communities in mediterranean unsealed schoolyards ?

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The process of removing the impermeable top layer of soil, i.e. soil unsealing, is increasingly advocated by public policy. Despite recognized anthropogenic advantages such as water cycle regulation, the role of unsealed areas in soil biodiversity conservation remains understudied.

The objective of this study is to elucidate the impact of specific attributes of unsealed areas on ant colonization, a prominent group within soil biodiversity. We thus sampled 14 unsealed schoolyards in and around the city of Montpellier (France), investigating ant communities through the placement of 655 baits on unsealed plots. We tested two variables: the duration since soil unsealing (1 or 2 years) and the type of soil cover (wood chips, mulched plantations or grassed areas).

Our study facilitates an initial inventory of a previously unexplored environment. Remarkably, these areas act as habitats for ants from their very first years of creation: a rich diversity has been observed and notable changes in ant communities were evident within a single year. Additionally, wood chip-covered areas are significantly less rich and abundant in ants compared to other ground cover types. These preliminary findings signify a promising starting point for soil biodiversity conservation but require further exploration before guiding future unsealing operations.

The hidden ecology of urban garbage: food waste may indirectly simplify urban bird communities

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Urbanization is now a leading cause of biodiversity loss. Yet, the processes structuring urban ecological communities are poorly understood. Most urban ecology investigates direct effects (e.g., competition, fragmentation), though ecologists have long recognized that indirect effects (e.g., trophic cascades) contribute to community composition in "wilder" spaces. We explored direct and indirect mechanisms that determine bird community composition in a case study of Vancouver, Canada. We hypothesize that, by inadvertently augmenting populations of scavengers (e.g., American crows) via food waste, people subsidize nest predation and undermine Vancouver's bird diversity.

We surveyed bird diversity, abundance, food waste availability, and microhabitats across 14 varied transects in Vancouver. We triangulated these data with high-resolution land cover data. We then fit Bayesian hierarchical models to infer the relative effects of food waste and other variables (e.g., land cover, seasonality) on bird diversity and abundance.

Preliminary results indicate that food waste availability is positively associated with crow abundance and negatively associated with species richness, and crow abundance is negatively associated with species richness.

Our findings indicate that complex, indirect interactions likely structure urban communities, and warrant greater research attention. Additionally, interventions that reduce the food waste available to wildlife may augment urban biodiversity.

Urban development type drives differences in avian-mediated regulating ecosystem services

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The fast expansion of urban areas drives multiple impacts on ecosystem such as the loss of biodiversity and the process of biotic homogenization, having direct consequences in animal-mediated ecosystem services such as regulating ecosystem services (RES). Urban areas are developed in a gradient that varies between two extremes: land sharing (small and fragmented green patches) and land sparing (large and continuous green areas). This landscape gradient and other local urban attributes (e.g. vegetation cover type) are related with changes in urban bird community composition. However, little is still known about whether they can affect animal-mediated ecosystem services. To investigate this, we carried out bird censuses in nine cities in Europe during breeding and winter season. We extracted diet information from each species identified, allowing us to calculate four RES: fruit dispersal, pollination, pest control and scavenging. The results show that land-sharing favor higher levels of avian-mediated RES, although there are differences between seasons. We also found an important effect of certain vegetation types and perturbance characteristics. These results provide new insights on the discussion on how to build more biodiversity-friendly cities by improving ecosystem functioning.

How much are Eastern European city parks buffered against urbanization?

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Human-induced habitat alteration is among the greatest threats to global biodiversity. Urbanization and associated habitat loss pose enormous pressure on native ecosystems. But at the same time, urban areas open new opportunities for biodiversity conservation, as protected areas alone are no longer sufficient. We studied bird communities and their functional traits in 10 medium-sized cities in the Carpathian Basin, spread over two countries (Hungary and Romania). Our study design focused on urban and suburban parks and agricultural and deciduous forest edges neighbouring the studied cities, representing an urbanization gradient. Our results showed that bird species richness was highest at the forest edges, and lowest in the urban parks, whereas urbanization did not affect abundance. Regarding the functional traits, mainly small-bodied birds were present in the cities and at the forest edges, just like species nesting on higher levels. Suburban parks favoured granivores, and those species that feed on higher locations were only observed at the forest edges. Non-migratory species were significantly more numerous in urban and suburban parks. Our finding demonstrates a strong urbanization effect in these mid-sized cities, but in some cases, urban parks harboured functionally important species as well, emphasising the positive role of urban green infrastructure.

Wealth and wildlife in cities: understanding economic and demographic influences to aid urban biodiversity conservation

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Urban biodiversity enhances quality of life and can foster conservation actions, but its benefits are not shared equitably among citizens. The positive correlation between biodiversity and socioeconomic status within cities (the Luxury Effect) represents a measure of environmental injustice. Understanding the drivers of this common but not universal relationship will help to promote more equitable cities and biodiversity conservation worldwide. We undertook a meta-analysis examining links between the strength of environmental injustice and socioeconomic variables in terms of terrestrial biodiversity. There was evidence for the Luxury Effect within cities. This relationship was stronger in wealthier cities and in countries with a lower GDP. There were non-linear relationships between human population size and the Luxury Effect, but no support for an effect of income inequality. The results suggest that poorer societies do not have the economic resources to confront environmental injustice, likely investing less in conservation actions. Non-linear models generally provided a better fit, supporting the theoretical background of the association between economic development and its environmental impacts. We suggest that non-linear associations are considered routinely in Luxury Effect studies. Further research is needed in under-represented countries in the developing world, which are likely those with greater environmental injustice.

A new tool to assess urban biodiversity: a non-disruptive protocol to characterize the root systems and their interactors.

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Plants attract and support microbial and animal communities and play a key role to guarantee functional and healthy urban habitats based on biodiversity. The mutual interactions among the components of the plant-centered holobiont are basilar for resilience and their comprehensive analysis would be beneficial to link the functionalities with the plant performance, especially

for trees. In this perspective, evaluating the root system health and role in the plant-centered holobiont ecosystem would be crucial not only to stability and management but also for conserving/monitoring/managing biodiversity and for environmental safety. Thus, we developed an innovative non-invasive protocol to characterize the root systems and their interactions with the abiotic/biotic components of the holobiont unit. With aim of characterizing urban biodiversity, as part of the recovery and resilience plan (PNRR) driven by National Biodiversity Future Center (NBFC) of which the University of Molise is partner, we applied in urban contexts this protocol combining traditional root morphology and physiology descriptors with advanced methods relying on omics approaches integrated with imaging-based data and modelling assisted by bioinformatics. Data were collected and used to implement a database of root functional traits to be exploited for the modelling and prediction of developmental trends by machine learning.

The impact of urbanisation on diversity, performance and fitness of cavity-nesting Hymenoptera: insights from a large-scale citizen science project

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Urban development can affect population dynamics, ecological interactions and fitness and challenge the persistence of many species, including bees. Yet, how and which urban environmental features affect bee diversity, foraging patterns, parasitism, life history, and fitness remain unclear. Here, we used a citizen science approach and cavity-nesting Hymenoptera in insect hotels as a model system, to investigate Hymenoptera community diversity, larval diet, parasitism, mortality, and reproductive output. In total, 286 insect hotels were used in two German cities at sites that span from the edge into a city's core and several environmental variables were collected from each site. Overall, more than 10,000 and 2,000 individuals belonging to 12 cavity nesting bee and 23 wasp species, respectively, were sampled in all insect hotels and cities. Preliminary statistical analyses revealed a strong negative relationship between impervious surfaces and cavity-nesting Hymenoptera species richness and reproductive output. In addition, the proportion of urban green land uses was positively related to species richness and parasitism rate and indirectly to mortality. As cities expand worldwide, our study aims to highlight the main urban environmental factors that influence cavity-nesting bees and wasps and can help guide conservation management to reduce the adverse consequences of urbanisation on Hymenoptera.

Bringing nature to urban gardens: studying attitudes of garden owners towards environmental friendly practices

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Gardens are often decorated with non-native plants, which make them potential starting points of invasions. Using native plants adapted to the regional soil and climatic conditions instead of non-natives can decrease the invasion risks. In our project (https://www.vadviragoskertem.hu/), we ask people to choose 5 of 24 native wildflower species and offer seeds for decorating their gardens. In a questionnaire, we ask about reasons for choosing the certain set of species and about attitudes towards environmental-friendly practices in gardening. We aim to create a community of people interested in environmental-friendly gardening and will address follow-up questions about the establishment of the wildflowers. So far >5,000 people from 946 settlements in Hungary joined the project. We aim to increase social awareness and raise the profile of native plants as important components of urban biodiversity, and develop a seed mixture that can successfully establish in gardens and offer attractive alternative to non-native species.

Urban grassland habitats for the conservation of insect diversity

Stephen Venn
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Urban areas are very challenging for the conservation of biodiversity. Urban green infrastructure can contain mosaics of diverse habitat types, often including habitats with high potential for biodiversity, though urbanization also filters assemblages. This filter retains taxa that are resilient, and excludes taxa that are vulnerable. I hypothesize that taxonomic and specific traits determine this level of resilience or vulnerability of different taxa. In this study, I use data on selected insect taxa (bees, butterflies and carabid beetles) from subsets of a network of approximately 40 grassland habitats in Helsinki, Finland, sampled between 2008-2012. Using data on traits of species and taxa, I determine which environmental factors, and which traits, are most critical for determining urban grassland insect assemblages. I then use this information to make recommendations on planning green infrastructure for conserving insect diversity.

159: The Nature Futures Framework: alternative positive futures for Nature and People

Nature Futures narratives for the Trans-European Nature Network (TEN-N)

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A key goal of the EU Biodiversity Strategy for 2030 is the design of a connected Trans-European Nature Network (TEN-N) of protected areas across Europe, built on the existing Natura 2000 sites. Within the NaturaConnect project, we have developed narratives of possible nature futures for Europe that provide a socio-cultural context for a TEN-N blueprint, where local systems, cultural values, and a more sustainable use of natural resources are emphasized. Societal perspectives on future biodiversity conservation in Europe have been integrated through a process of co-design with stakeholders. The narratives are equivalent in terms of economic and demographic drivers, are aligned with European policy objectives and targets, and use the IPBES Nature Futures Framework (NFF), that account for multiple values and perspectives of nature. Each narrative is distinct in its value of nature (intrinsic-Nature for Nature; instrumental-Nature for Society; relational-Nature as Culture) and presents contrasting priorities for seven topics: Protected areas, Connectivity and Restoration, Forestry, Freshwater ecosystems, Urban system, Agriculture, Energy. Despite these differences, the narratives share some commonalities across the topics which include solutions that accommodate biodiversity conservation and ecosystem services provisioning or support the achievement of all three NFs, for example, reducing the space for artificial surfaces.

Land sparing: A key urban development strategy for a nature-positive future - Insights from extensive regional survey and scenario modelling

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Accelerated urbanization leads to inevitable city expansion, emphasizing the need for development strategies that minimize ecological impact. Current debate centres on two strategies: land sharing, promoting larger, greener cities, and land sparing, focusing on dense development to potentially free land for nature beyond city limits. In this study, we explored the impact of urban growth on biodiversity in Tel-Aviv metropolitan area, Israel, using simulated scenarios of land sharing and land sparing. This region (>300 km²) includes 12 cities along with rural and natural landscapes. An extensive systematic bird survey with over 2,000 points was conducted across the region. We simulated 2050 urban growth using densification and sprawl strategies, altering land cover pixel by pixel. Using MAXENT, we modelled the distributions of 77 bird species and applied them to these scenarios. Results show that land sharing markedly changes regional bird distributions more than land sparing. It leads to an 80% increase in building cover and predicts a 30% decrease in non-synanthropic species' occupancy and a 50% increase for synanthropic species. Conversely, land sparing results in a mild 2% decrease for non-synanthropes. Our findings demonstrate the need for urban densification strategies and highlight the value of considering regional dynamics in urban design.

Nature Futures Framework for driving societal development in Italy according to the 2030 EU biodiversity strategy

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Preserving key areas for conserving biodiversity and nature services provided to humans is crucial in guiding society toward sustainable development. To capture different societal preferences about the role of nature, IPBES formulated the Nature Futures Framework (NFF), applicable across multiple spatial and temporal scales. It brings out three values of nature: the utilitarian value in the “Nature for Society” (NfS), based on the services provided by nature, the relational value, relying on personal connections between humans and nature, in the “Nature as Culture” (NaC) perspectives, and the intrinsic value in the “Nature for Nature” (NfN). This work aimed to identify no-go areas in Italy, using the recently developed NF narratives for Europe, adapted to the Italian context. In particular, for NfN, we collected a map of areas important for species conservation based on the distribution of Italian vertebrates; for NfS, a map of important areas for the provision of ecosystem services, such as the mitigation of climate change, the regulation of environmental hazards, and air quality; for NaC, a map of natural areas that are relevant at cultural level or for recreational activities. By overlapping them, we found consensus no-go areas, useful for driving a conservation-oriented development in Italy.

Rewilding the Oder Delta, Germany, diving into pluralistic value perspectives with nature futures scenarios

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Rewilding has gained traction as an approach to restoring wildlife, mitigating climate change, and creating transformative change. However, scaling up rewilding efforts is challenging due to complex nature-people relationships. Effective stakeholder engagement is crucial for successful rewilding. Participatory scenario planning can help understand the benefits and trade-offs of rewilding. We conducted workshops and interviews with local stakeholders to develop narratives linking social and natural values, using the Nature Futures framework to reflect on the positive futures of nature. We studied the German Oder Delta, using participatory methods to identify perspectives on rewilding. Our approach helped us understand the benefits and challenges of rewilding by considering diverse nature values. We discussed the importance of rewilding peatlands in the area, highlighting the need for tailored strategies that address diverse landscape values. These strategies range from restoring dried peatlands close to protected areas to improve landscape connectivity to restoring peatland water dynamics for vital ecosystem services like water regulation. By recognizing the multiple values of nature, we can expand the scope of rewilding actions and challenge the conventional narratives surrounding biodiversity conservation. This value-driven approach can lead to a successful implementation of rewilding measures and scale up such efforts to larger areas.

160: Human-carnivore coexistence: challenges, opportunities, and potential paths forward

The importance of scale in managing human-wildlife conflict

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Wildlife damage to human property can lead to significant economic and emotional losses, opposition towards wildlife conservation, and even direct persecution of conflict-prone species. In this presentation, we evaluate multiple natural and anthropogenic drivers of human–wildlife conflicts as a means to find science-based and effective solutions that foster coexistence. We use the case study of brown bear (Ursus arctos) damages to human properties in Europe at multiple spatial scales to illustrate how compensation programs, landscape features, and forest productivity can influence the occurrence of damages at different temporal and spatial scales. At the continental scale, our findings emphasize the crucial role of proactive and preventive measures in reducing damage occurrence while highlighting that socio-cultural factors can heavily influence management policies and hinder conflict mitigation efforts. At the local scale, we deepen into the ecological drivers of conflicts. The results of our analyses show how natural resource pulses can percolate through food webs and impact human-wildlife coexistence, especially in areas where both the broader landscape context and household conditions favor damage occurrence. We will provide clear recommendations for reducing bear damages in the area and also offer a practical approach applicable in other places and to other species.

Spatial priorities for the conservation and coexistence of carnivores with humans

Enrico Di Minin

University of Helsinki, Finland

Carnivores have suffered the biggest range contraction among all biodiversity and are particularly vulnerable to habitat loss and fragmentation. They also suffer from conflict with humans over limited space and resources. Here, I will explain where the priority areas for the conservation of carnivores are globally and how expected agricultural and urban expansion will affect them. I will also describe how effective carnivores are as surrogates for 23,110 species of amphibians, birds, mammals and reptiles and 867 terrestrial ecoregions. I will then introduce which areas are at highest risk of human-carnivore conflicts in sub-Saharan Africa and what are the economic costs for humans to live alongside large carnivores. Finally, I will introduce how digital data (e.g., online news) and methods can be used to provide novel insights on opportunities for coexistence between humans and carnivores.

Can wolves provide ecosystem services in European human-modified landscapes?

Dries Kuijper, **Marcin Churski**, **Jakub Bubnicki**

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The wolf (Canis lupus) is highly successful at recolonizing its now human-dominated former ranges in Europe and N-America. Over the centuries while the wolf was absent, humans have transformed ecosystems to a large extent. This includes changes to (meso)carnivore communities, wolves themselves (genetics, behavior), woody plant communities and the playing field for predator-prey interactions (landscape structure). We argue that the recognition of the novelty of human-modified ecosystems logically leads to novel pathways of how wolves can influence ecosystem functioning. Thus far, the ecological impacts of wolves have largely been predicted based on the documented effects they have in well-preserved systems with low human impact. However, wolves in human-modified ecosystems will engage in an array of novel interactions and potential novel trophic cascades that do not occur in more natural ecosystems with lower human impact. A promising direction for future studies is exploring what novel interactions establish and under what conditions wolves can exert their ecosystem impacts in the human-modified ecosystems. This knowledge could guide us to act to improve conditions to enable wolves to exert their ecosystem impacts again. These novel interactions may be the true ecological and societal value of having wolves returning to human-modified landscapes.

The direct and indirect ways in which humans shape large carnivore populations: Restoring biodiversity and managing coexistence

Robert Alistair Montgomery

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For the last 100 years, trophic system ecology has depicted food webs that are devoid of humans. In the 21st century, it is abundantly clear that humans impact trophic systems in a diversity of ways via top-down and bottom-up pathways. When humans behave as predators, for instance, they sit above trophic systems where they are capable of turning even apex predators into prey. However, while the direct effects of humans on animal populations have been widely investigated, the indirect effects have only been assessed via emergent research. Thus, while it is widely understood that humans have unparalleled ability to reduce animal populations via lethal pressures, it is not yet clear how humans might induce defences in animals that carry fitness costs with subsequent demographic consequences. This talk explores these fundamental knowledge gaps by demonstrating how humans may shape animal populations in direct and indirect ways. It also articulates how these lethal pressures can be ameliorated to restore biodiversity. Providing that conservation interventions are successful at scale then, recovering biodiversity and human population growth may increase human-wildlife conflict. Thus, the talk concludes by discussing how the positionality of humans within trophic systems is essential to effective management for coexistence.

Human disturbance on brown bear behavior in human-dominated landscapes

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Human-induced mortality and disturbance of wildlife can be studied in a predator-prey framework. Predation affects the demography and behavior of animals, which trade off foraging efficiency and vigilance against predation risk. Mortality rates of large carnivores, like bears and wolves, are largely driven by people, which also influence their behavior. We have studied how bears of different European populations react to human activities at various spatial and temporal scales. Bears generally select for rugged terrain away from human settlements, relying on dense vegetation when they are closer to people. Bears become more nocturnal when and where there is more human activity. Overall, we have found a consistent pattern of human avoidance by bears, yet this pattern seems to be adapted to the human-modified landscapes that bears inhabit. The behavioral adaptations of large carnivores to human-induced risk and disturbance has effects in the short term (e.g., in habitat use) and, potentially, also regarding their evolution and ecological functionality. Behavioral and ecological issues, not only mere demographic trends, should matter for the management of large carnivores and human activities, to favor the role of such species in the ecosystem and to minimize negative effects of coexisting with people in human-dominated landscapes.

Quantifying the social-ecological drivers of human-carnivore interactions

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Human-carnivore conflict is a major conservation challenge that drives declines of large carnivore populations and impacts human livelihoods and major industries. Carnivores and other wildlife spend considerable time outside of protected areas, and climate change is contributing to increasing overlap between people and carnivores. Yet rarely are ecological and animal behavior data integrated with social and attitudinal information describing people's perceptions of risks and benefits from carnivores, despite the importance of these societal factors for carnivore conservation. Elevating local community perspectives and histories and incorporating them with data on ecology and animal behavior can help us to understand how people and carnivores may successfully share landscapes over the long term despite expanding human development and activity. Here, we discuss case studies on human-carnivore interactions and carnivore movement in Nakuru, Kenya and California, USA, and explore how an intersectional lens can complement applied science for more holistic and socially just conservation outcomes.

161: Managing and conserving intraspecific genetic diversity under global changes: challenges and applications

Challenges and opportunities of inferring spatial genetic patterns of amphibians and reptiles for conservation planning across six global regions.

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Intraspecific genetic diversity stands as a crucial pillar of biodiversity, playing a vital role in species adaptation, survival and ecosystem resilience. Despite its importance, there remains a gap in understanding the broad-scale patterns of genetic diversity, hindering the assessment of how well Protected Areas represent it. A notable challenge stems from the inconsistent storage of genetic data in repositories, particularly concerning geographic information and other metadata. Here we focus on the genetic diversity of amphibians and reptiles in six regions: the Iberian Peninsula, Northwestern Africa, the Arabian Peninsula, Madagascar, Northern Australia, and the Brazilian Atlantic Forest. To address this, we developed an automated workflow to extract data for species in these regions, encompassing raw genetic data, corresponding geographic locations, and relevant literature. Spatial patterns of genetic diversity were analyzed in these regions, comparing results between the automated and the combined automated dataset plus data manually retrieved from literature. We also identified cryptic diversity within species, assessed which species had sufficient genetic data for inferring spatial patterns of intraspecific genetic diversity , and examined potential biases in genetic sampling (geographic, taxonomic, and conservation status). The study concludes by outlining challenges and opportunities in repurposing existing genetic data for effective conservation planning.

Conserving genomic diversity in tropical trees from French Guiana

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French Guiana is an overseas territory of France which harbours a tropical rainforest with a vast biodiversity, including ca. 1800 tree species. This forest suffers pressure from mining, climate change, and logging in the permanent forest domain. Conserving the rainforest and achieving sustainable timber production to meet the demands of a growing human population is a considerable challenge. We present an overview of our ongoing research in ecological and conservation genomics in several tree species of French Guiana. We showed how tree species complexes of the genera Symphonia and Eschweilera are adapted to microenvironmental conditions relating to moisture, soil chemistry, and light. In the most harvested timber tree Dicorynia guianensis we use estimates of regional and local population genetic structure, population demographic histories, and genomic signatures of adaptation to derive sustainable management guidelines under future climates. We have used a combination of microsatellites, genomic, and transcriptomic approaches to characterise the genetic diversity of the highly endangered Aniba rosaeodora, and identify genes implicated in the production of rosewood essential oil. We also present tools under development for simplified field delimitation of morphologically similar species of Eschweilera in view of sustainable harvesting of common species while conserving rare related species

Conserving genetic diversity of at-risk species across the data-availability spectrum

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Genetic data have been used for decades in conservation decision-making, including for the identification and recovery of species listed under the U.S. Endangered Species Act. Technological advances have made much larger genomic datasets available for at-risk species, improving the precision and resolution of metrics such as genetic diversity, while bringing previously inaccessible parameters like adaptive differentiation and individual inbreeding within reach. The advantages of these data are clear for the targeted species, yet the vast majority of at-risk species will never benefit from genetic studies. In this talk, I will discuss how genetic and genomic data can be leveraged across the data-availability spectrum to inform at-risk species conservation: from direct molecular studies that inform conservation questions such as delineating management units and evaluating evolutionary potential, to the use of proxies for genetic diversity and genetic erosion within unsampled species. The magnitude of the biodiversity crisis requires the application of rapid, large-scale assessments of intraspecific diversity to stem diversity losses. Genetic and genomic studies combined with population genetic theory and proxies can be leveraged to expand the reach of these data beyond sampled species to prioritize conservation and avert these ongoing losses.

Using genomics to inform bat conservation under global change

Orly Razgour

University of Exeter, United Kingdom

Intraspecific genetic diversity is a fundamental component of biodiversity, contributing to ecosystem function and resilience, and determining the capacity of populations to adapt to global environmental changes. Yet, genetic/genomic data and approaches have not been widely applied in conservation management and decision making. In this presentation I will explore the use of genomic approaches in bat research and conservation. Research carried out in my group integrates genomic tools with ecological and geographic data and modelling approaches to assess and predict how climate and land-use changes affect biodiversity. Working closely with conservation practitioners, we developed genomic approaches capable of providing evidence of historic population changes and their drivers, and have applied our results to set species recovery targets. Our work has highlighted the importance of incorporating adaptive variation, movement processes and

historic population changes when assessing biodiversity vulnerability to global environmental changes and informing adaptive conservation management.

Conserving evolutionary potential under global change: efficacy of the Italian protected areas for terrestrial vertebrates

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Genetic diversity is fundamental for ensuring species' persistence by preventing inbreeding depression and preserving the evolutionary potential to face environmental challenges. Understanding the spatial distribution of intraspecific genetic diversity is therefore essential in spatial conservation planning. We investigated the spatial distribution of genetic diversity for 22 vertebrate taxa endemic to the Italian peninsula and evaluated the effectiveness of protected areas (PAs) in preserving areas of high genetic diversity from a climate change perspective. We i) modeled taxa distribution under current and future climate conditions, ii) identified current and future locations of taxon-specific areas of high genetic diversity, iii) evaluated the PAs coverage of those areas at a single- and multi-species level. PAs covered averaged < 20% of the areas of high genetic diversity. In an intermediate future emissions scenario (SSP 2-4.5), these areas are predicted to lose total and protected surface by 2100 for >70% of the taxa. These results identify a gap in the Italian PAs' coverage of genetic diversity and should be considered when planning their expansion according to the European Union biodiversity strategy for 2030.

163: From knowledge to impact: overcoming barriers to biodiversity conservation in agricultural landscapes

Tackling farmland biodiversity loss: Lessons from transdisciplinary research in Saxony, Germany

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University of Bonn, Germany

European agroecosystems are facing a severe biodiversity crisis. Despite a growing body of academic and practical knowledge on management practices, conservation measures, and policy instruments to enhance farmland biodiversity, existing efforts have fallen short in curbing the loss of farmland biodiversity. One of the primary obstacles is the limited adoption of such approaches by key stakeholders. This presentation aims to provide an overview of methodologies employed, results achieved, and lessons learned from the transdisciplinary ECO²SCAPE research project. Focusing on an agricultural study area in Saxony, Germany, the project aims to strike a balance between ecological, economic, and social considerations in the development of biodiversity enhancing practices. The presentation will touch upon several key aspects, including: (1) The co-design process involving farmers and other stakeholders in the development of biodiversity conservation measures. (2) Findings from semi-structured interviews using adapted photovoice techniques to explore farmers' values and relationships. (3) Lessons derived from network meetings with farmers and collaborative efforts with biosphere reserves. The goal is to stimulate discussion among fellow researchers with similar or contrasting experiences, to shed light on the main barriers to implementing biodiversity conservation measures, and to pave the way for establishing a roadmap to mitigate farmland biodiversity loss.

The farmer I want to be: assessing farmer perspectives on their role in multifunctional agricultural landscapes

Malin Gütschow, Bartosz Bartkowski
Helmholtz Center for Environmental Research, Germany

As the salience of environmental issues rises in Europe, multifunctional agriculture calls for farming practices that consider more ecosystem services than just food, feed and biomass production. Alongside changing daily practices, multifunctionality implies changes in the contributions that farmers make to society, i.e. their societal role. Within the vast literature on farmer behavior, factors related to farmer (role) identity and the concept of the "good farmer" (Burton et al., 2008) are recognized as major driver of behavior and therefore deserve attention in this context. This study examines farmer perspectives on their ideal societal role, as defined by multiple social, economic and environmental functions associated with farming. We extracted 71 of these functions from interviews, scientific and grey literature and party programs, among others. We use Q method to capture the participants' subjective opinion on the relative importance of these functions. With the help of a by-person factor analysis, we are able to distinguish groups of participants that share a similar perspective on their ideal societal role. This provides the basis for a typology of farmer role identities, without, however, revealing the prevalence of each type in the study region Eastern Germany.

Optimal design of payments for ecosystem services in the era of weeding robots

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Payments for ecosystem services (PES) are a common tool to reduce negative impacts from intensive agricultural production on biodiversity. The efficiency of PES, whether process- or result-oriented, hinges on cost-effective monitoring, the actions farmers are rewarded for, appropriate biodiversity indicators, and farmers' acceptance. Despite expectations that novel technologies such as weeding robots reduce monitoring costs, the potential impact of their widespread use on optimal PES design for biodiversity conservation in arable farming remains unexplored. Our study aims to investigate 1) the influence of weeding robots on optimal scheme design and 2) the challenges and options arising for future PES design. To reach these aims, we use a simulation model to systematically compare how the availability of weeding robot changes the preferability of action-based versus results-based payments under various conditions. This study sheds light on the transformative potential of weeding robots in optimizing PES for biodiversity conservation in arable farming. Results reveal that the difference in efficiency between action- and results-based schemes vanishes if robots are able to carry out biodiversity-sensitive actions. Additionally, our results highlight the necessity for clearly defined multi-dimensional biodiversity targets future scheme design when weeding robots are available.

Access to knowledge and land tenure security promote adoption of diversified farming systems: evidence from a global meta-analysis

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Diversified farming systems (DFS) have been recognized as effective strategies in the shift to sustainable food production, however factors enabling their adoption are poorly understood and unsustainable monocultures persist in many places.

We conducted a comprehensive meta-analysis of 154 peer-reviewed articles to understand how socio-demographic, economic, biophysical, behavioral, and contextual factors influence the adoption of 10 DFS (i.e., agroforestry, agri-aquaculture, agro-silvopasture, cover crops, fallow, intercropping, crop rotation, embedded natural, rotational grazing, and combined systems).

Results showed that among 45 factors studied in 44 countries, increasing access to extension services and agricultural training, farmers' formal education and income, secure land tenure, and positive attitude toward sustainable farming practices, had a positive impact on DFS adoption. However, farm biophysical factors, and household socio-demographic characteristics seem to not affect DFS adoption.

These findings emphasize the importance of holistic initiatives and policies that encompass socio-economic empowerment, knowledge dissemination, capacity building while ensuring farmers' land rights and stability in driving sustainable agricultural transformations.

164: Conservation insights from the ALPMEMA project: Alpine mountain hay meadows management

Synergies and tradeoffs for biodiversity and tourism - in the Alpine meadows, and beyond?

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The presentation will introduce the EU-cofunded 3-year Biodiversa + project ALPine mountain hay MEadows MAnagement (ALPMEMA) and present first findings from the field excursions of the project implemented during summer 2023. ALPMEMA addresses win-win situations in the agricultural sector to learn from best practices. Mountain hay meadows are a protected habitat type under the EU Habitats Directive and host several endangered species. The favorable conservation status of these meadows is often threatened by reduced human activity, e.g. farmland abandonment. Thus it can also be positively or negatively influenced by tourism. In a four-country (Armenia, Austria, Germany, Sweden) transdisciplinary mixed-method meta-analysis, three main components are combined: governance analysis, GIS/remote sensing, and future-scenarios co-creational workshops.

First findings indicate synergies and challenges between tourism and meadow management. Synergies for example relate to production/consumption that financially contribute to the successful maintenance of mountain hay meadows in a favorable conservation status. Examples are direct sales of consumables or activities to tourists as well as indirect sales such as accommodation rent in mountain hay meadow areas. Tradeoffs are for examples related to increased pressure from tourism leading to environmental degradation and intimidation of livestock. The presentation will also point out future research opportunities.

When is an 'A' truly an 'A'?

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Within the ALPMEMA project, mountain hay meadows (MHM) are under investigation. MHM is a habitat covered by the Habitat Directive, and the EU aspires to protect it. The development is monitored through assessments of conservation status (CS). The conservation goal is to achieve a favorable conservation status (FCS). CS is evaluated based on three aspects: the habitat's area and range, typical species, and its structure and function. Member states interpret these aspects differently. Also, the definition of the habitat differs. To assess trends effectively, robust follow-up and error-free methods are crucial. The purpose with this study is to potentially streamline conservation efforts.

The key questions we seek to answer include: Is the definition of MHM consistent? Are the methods assessing FCS comparable and possible to follow up? What are the features of MHM with FCS?

Our foundation consists manuals for MHM assessments and actual investigations. The study is conducted in Austria, Germany, and Sweden. Regional differences are also in focus.

Based on our experiences and field visits with participants from all three countries in 2023, we assess differences in field methods and note variations both within and across countries and over time.

How to preserve grassland in the context of underuse? An international solution scanning

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Species-rich grasslands, such as mountain hay meadows (MHM), make an important contribution to the conservation of biodiversity. As semi-natural meadows, they often suffer from infrequent human activity (mowing) or grazing animals to maintain their species composition. In order to increase knowledge to counteract this trend and to develop effective strategies to maintain MHM in good conservation status, we are conducting an international Solution Scanning. This presentation will provide first results and insights from this research. Attempting to adequately account for the diversity of MHM types and the associated diversity of management practices, a typology of practical measures on the meadow and subsequently a typology of the underlying organisational structures that ensure the maintenance of the practical measures will be developed. In order to achieve this goal, a mixed method approach will be employed in the form of a systematic literature review and semi-structured interviews. The typologies will serve as a basis for a subsequent Delphi study with international experts. The experts will first discuss the determinants of successful management of MHM based on the typologies and synthesise them into best management practices. The transferability of these practices to different contexts will then be analysed.

Towards mapping multifunctional landscapes in high-nature value mountain areas

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Mountainous landscapes in Europe, known for smallholder-based, multifunctional land uses in high-nature value areas, often face issues of underuse, farmland abandonment, and land degradation. Mapping these multifunctional high-nature value areas using satellite imagery is challenging due to their spatial and spectral complexity and limited cloud-free observations. Our goal was to evaluate remote sensing techniques for mapping these complex landscapes, especially focusing on mountain hay areas. Utilizing the freely available radar Sentinel-1 and optical Sentinel-2 time series, we successfully mapped 11 thematic classes, including hay and improved meadows, fruit orchards, vineyards, and shrubland. This study, centered on the Armenian part of the Caucasus Mountains, explored various combinations of satellite and ancillary data, i.e., elevation, texture, and vegetation indices. Results demonstrated an overall mapping accuracy of up to 82%, with user accuracies varying between 57% and 88%. Integrating texture measures with the Sentinel-2 series improved the classification of meadows while including nighttime lights, elevation, and slope data enhanced the differentiation of vineyards. Sufficient Sentinel-2 time series data was key for achieving plausible classification accuracies. In conclusion, the freely available Sentinel-2 is effective for mapping multifunctional landscapes in European mountain regions on classification resolutions of 10–20 meters in thematic maps.

The impacts of global changes on the distribution of mountain biodiversity

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Mountain species are shifting to higher elevations or latitudes following climate change. These shifts can lead to range reduction with consequent increase in extinction risks, especially for those with narrow high-elevation ranges. Therefore, land cover change and topographic complexity hinder species movement toward suitable climates, accelerating species decline. Species distribution models (SDMs) can be used to analyse potential range shifts by comparing species distribution data with environmental characteristics, assuming population locations reflect species' preferences. We estimated the distribution change of > 400 species of mountain mammals and birds worldwide using an ensemble SDM approach and predicted potential future distributions by 2050 and under three emission scenarios (SSP-126, SSP-370, SSP-585). Considering species' dispersal ability and habitat preferences, we also assessed the role of land use change in shaping potential future distributions. On average, we showed that tropical and sub-mountain species are more vulnerable to global change and more exposed to land-use change impacts than the rest of analysed species. Climate mitigation policies and targeted conservation interventions are crucial to prevent high-risk loss, especially for vulnerable mountain species.

Effects of passive restoration of degraded mountain grasslands on plants and butterflies

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European semi-natural mountain grasslands are currently threatened by both land abandonment and management intensification, which calls for more research in theses biodiversity hotspots. In this study we investigated the resilience of grasslands to relaxation of intensification, i.e. their ability to progressively return to a biodiversity-richer stable state. Thirteen study regions were selected in the southwestern Swiss Alps in spring 2019. Each region included three meadows that have been intensively managed for at least the last 20 years. Adopting a randomised block design, two out of three meadows per study site are now being restored by shifting their mode of exploitation towards low-intensity (1/3 of the fertiliser dose applied beforehand) or extensive management (no more fertilisation application). In 2023, four years later, plant species richness increased by 7–9% in extensified meadows. Nonetheless, butterfly abundance almost doubled, and butterfly species richness increased by 21% and 62% in low-intensity and extensive meadows respectively. This was mostly driven by a strong increase in forb cover and higher light availability as shown by the Landolt indicator value. Altogether results indicate that the butterfly community can response rapidly (faster that plant species richness per se) to management changes, following passive restoration.

166: Emerging technologies in conservation biology

Dronespot: Empowering citizen science with drone video processing software for wildlife monitoring

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The demand for large-scale research in ecology and conservation has given rise to extensive citizen science projects, aiming to harness collective efforts for wildlife monitoring. Despite the integration of intuitive technologies, challenges persist in terms of capacity, standardization, and replicable protocols. Aerial drones have gained popularity as cost-effective tools for surveys, yet the manual processing of drone footage remains time-consuming and labour-intensive. Although automated systems exist, they often struggle with accuracy when processing against complex habitats such as marine environments and may diminish the interactive involvement of citizen scientists. Here, we introduce Dronespot, a semi-automated software designed to streamline the processing of drone footage (videos) with a simple click, emphasising data collection by citizen scientists. Our results reveal that Dronespot outperforms manual methods in detecting loggerhead sea turtles (Caretta caretta) in terms of speed, precision, and recall. Notably, participant experience in video processing made no difference in turtle detections across tests. Dronespot emerges as a potent tool for engaging citizen scientists in drone wildlife monitoring projects, serving as an efficient database generator. By providing an accessible and semi-automated solution for marine wildlife monitoring, Dronespot is positioned to strengthen the link between citizen scientists and the development of effective conservation policies.

Developing a UAV-based method for detecting and monitoring newly established populations of the Eurasian beaver (Castor fiber)

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After a series of successful reintroductions, the Eurasian beaver (Castor fiber) is expanding its range throughout Europe. Timely monitoring can contribute to early detection of environmental impacts and aid in mitigating human-wildlife conflicts and other threats. The signs of beaver presence are difficult to detect in some environments e.g. densely vegetated river banks or when water levels vary considerably. In these cases, new technologies can offer opportunities for easier and faster monitoring. In the current study, we tested the application of unmanned aerial vehicles (UAVs) to detect species' presence and observe population expansion through the Danube ecosystem in Northern Bulgaria. We found that UAVs may be less effective in detecting frequencies of occurrence, but can reliably detect the overall presence of beavers, particularly in winter and autumn when vegetation, such as dense tree crowns, does not obscure visibility. UAVs were also more effective in smaller tributaries than in the Danube River. We further discuss other factors that may affect detection and provide tips on piloting. When also considering the time efficiency (approx. 5 min per 300 m transect), using UAVs might be an effective method for monitoring current beaver population distribution and recolonisation patterns.

Mapping nature's contributions to people from species distributions, a novel perspective for conservation?

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The degradation of climate and biodiversity are two major crises humans are facing and for which rapid action is needed. Scenarios of changes were developed for both facets. Nowadays it's essential to find efficient strategies to protect key areas for biodiversity and Nature's Contributions to People (NCPs). Studies at various scales have already been proposed to identify the most suitable areas for combining NCPs and biodiversity as a trade-off, yet was is still lacking is evaluating how change in species distributions could affect NCPs. Based on the establishment of relationships between more than 2,000 species and 17 NCPs, we proposed a novel approach combining species and NCPs interactions to map NCPs for 5 time-scenarios based on the SDM predictions. Thus we finally create synergies between these two components. In our case study, in a large mountain region of the Swiss Alps, this relationship permits to better understand and highlight how the loss of biodiversity can directly impact the loss of NCPs. It's an opportunity to aware citizens with the evolution of their potential well-being linked to species evolution, but above all this new instrument is an opening for decision-makers and policies to act efficiently with full knowledge of the facts.

New approaches to vertebrate detection: use of iDNA obtained from flies for vertebrate detection in Abruzzo, Lazio and Molise National Park

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In recent years, wild vertebrate populations have suffered severe declines. Monitoring many species is challenging due to their small size, elusiveness, and arboreal nature. Innovative techniques are necessary to complement traditional methods for biodiversity monitoring. One promising tool is iDNA metabarcoding which uses DNA from vertebrates that invertebrates feed on and allows for characterization of vertebrate community. One source of iDNA are scavengers, including carrion flies that are baited using rotten meat or dung in a habitat that needs to be monitored. DNA is usually extracted from the gut contents of insects and amplicon obtained using vertebrate specific primers are sequenced. Recently, a faster, scalable and cheaper approach was described where dissolved fly feces and/or regurgitates can be directly used as template for PCRs. In this study, we focused on Diptera community collected by different baits in the Abruzzo, Lazio and Molise National Park. Based on barcoding of ~1700 flies, we assessed the impact of using different baits (rotten fish, and dung from herbivorous and carnivorous mammals) in different habitats (forests vs pastures) on the fly community captured. We furthermore examined the iDNA using metabarcoding of fly feces/regurgitates These findings are discussed in terms of their implications on vertebrate monitoring.

Development of a portable and cost-effective laboratory system for in situ for species identification via DNA metabarcoding

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The current rate of biodiversity loss calls for immediate actions to assess the response of natural communities to increasing anthropogenic pressures, and support the implementation of effective conservation measures. In this context, recent advancements in portable sequencing technologies and the commercialisation of miniaturised laboratory equipment open to possibility utilise DNA metabarcoding analysis for the identification of species in field-laboratory conditions.

Here, we present a portable and cost-effective laboratory system to monitor terrestrial arthropod communities shifts in response to increasing anthropogenic pressures on the remote islands of the Aeolian archipelago (Southern Italy). This is based on the analysis of the COI region of the mitochondrial genome via Oxford Nanopore Technology plc (ONT) MinION™ sequencing for in situ arthropod identification. This approach allows to reduce costs and time of sequencing, while also enabling researchers to establish on-site programmes for the monitoring of animal species in remote and biodiverse areas of the world.

167: Exploring Europe's role in the international wildlife trade: A multidisciplinary approach to conservation

Setting the scene: Challenges and opportunities of wildlife trade in Europe

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Wildlife trade in Europe poses a complex challenge, impacting thousands of native and exotic species across diverse taxonomic groups, with implications for human health, biological invasions, and global biodiversity. This presentation offers an introduction to this critical issue exploring both challenges and opportunities associated with wildlife trade in the European context.

Unique challenges include navigating the complexities of the European single market and managing the expansive land and sea borders of the European Union. The absence of systematic species-level record-keeping hinders reliable data collection, compounded by the rise of online markets that are challenging to monitor. The exact scope of individuals and species traded both legally and illegally into Europe remains unclear, impeding impact analyses. Despite existing EU-wide databases like EU TRACES and EU TWIX, data coverage is limited. While the new EU Action Plan on Wildlife Trafficking addresses some of these challenges gaps remain.

Addressing these gaps necessitates novel methodologies, including artificial intelligence, alongside changes in environmental policy and data collection. An interdisciplinary approach, as exemplified by this symposium, becomes crucial to ensuring that European trade aligns with global biodiversity goals.

Exploiting the European eel: How a green criminological approach can shed light on wildlife crimes and harms

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European eels have been on this planet for millions of years; their ancestors have outlived the dinosaurs. Yet today, this once resilient species is recognized as critically endangered and faces mounting threats from numerous fronts. As with many commercially exploited fish species, European eel populations have been overfished and international trade has shifted into criminality as demand has soared and profits risen. The species is also victimized by damaging corporate environmental practices including (but not limited to) land-use change, pollution, and infrastructure development. This presentation draws attention to these converging threats and highlights how a green criminological focus on wildlife and environmental harms and crimes can better situate, recognize, and respond to the drivers of demand that threaten the species. I show how the eel's transatlantic, transboundary existence across marine and freshwater spheres challenges conventional environmental governance, segregating issues of fishery crimes and industrial harms, and obscuring the impact from institutionalized and socially normalized patterns of demand and consumption in the Global North. By examining these issues from a green criminological standpoint this presentation invites a specific focus on the role of European economies and cultures of demand as drivers of both direct and indirect harms toward the European eel.

Fish per Click: A closer look at retailer transparency in Germany's online trade with marine ornamental fish

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The rising popularity of private aquariums has increased the demand for diverse ornamental fish, leading to a shift from physical pet stores to online marketplaces. However, a significant concern is that online retailers rarely provide information of their offered species, making it difficult for customers to make sustainable choices. Despite growing concerns over unsustainability, the trade of marine ornamental fishes remains largely unmonitored and understudied.

As Germany is one of the major global importers of marine ornamental fish, we used modern web scraping tools to analyze data from eight German online shops selling marine ornamental fish. The study identified 767 species and 59 families in the trade, revealing that 12% of the 2,400 products were captive-bred and 88% were wild-caught, with captive-bred products being 29.3% more expensive. Most traded species were imported from Indonesia (102 spp.) and the Philippines (65 spp.). Our findings highlight a lack of transparency from retailers regarding species-specific information, care, and required trade documentation, posing a potential threat to animal welfare. Additionally, we discovered the sale of threatened fish species sourced from the wild, which underlines the urgent need for more comprehensive monitoring and research into the collection and trade of marine ornamental fishes.

Europe's ongoing challenge in adequately monitoring the century-old trade of colourful marine ornamental fishes derived from endangered coral reefs

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The centuries-old, multi-billion-dollar trade in marine ornamental fishes has never been reliably monitored, making analysis difficult. Estimates range from 15 to 30 million fishes from over 2,000 species traded annually but could be as high as 150 million without accounting for mortality, which can be high depending on the species.

Most traded coral reef fishes are native to Southeast Asia and almost all are wild caught. The consequences of removing millions of these fishes each year are poorly understood. Europe, a major importer, uses TRACES (Trade Control and Expert System) to monitor live animal imports for disease prevention. From 2014 to 2021, over 3 million ornamental fishes entered Europe annually. Unfortunately, one third of specimens lacked species names. The susceptibility to trade was assessed using the number of specimens traded, trends in trade volume, IUCN Red List conservation status and vulnerability according to FishBase. The urgent need to monitor this trade has been highlighted by scholars in the past. With a few enhancements TRACES would provide accurate and timely information on the number and species of marine ornamental fishes in trade, the origin of specimens and whether they are wild-caught or captive-bred.

www.procoralfish.org

Wild for Orchids: empowering citizen science for orchid conservation in the Maltese Islands

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Launched in 2019, 'Wild for Orchids' (WfO) is an award-winning Citizen Science (CS) campaign dedicated to the conservation of wild orchids on the Maltese Islands. This initiative uses a data-driven approach to conserving the Orchidaceae family, threatened by habitat degradation and harvesting poaching.

The primary objectives of WfO are to monitor the phenology, distribution and population trends of orchids in Malta, focusing on native and endemic taxa. This initiative engages the public in scientific research and raises awareness about orchid conservation. Trained volunteers use a specialised mobile application to collect spatial, temporal and taxonomic data, employing ad hoc sampling and structured surveys for comprehensive coverage. Data quality is ensured through a 2-stage Quality Control, focusing on location accuracy and taxonomy.

With over 4,100 orchid specimens recorded, WfO currently holds the largest spatial dataset for the Maltese Islands for wild orchids. The data provides critical insights into orchids' distribution and population dynamics, informing conservation strategies.

Wild for Orchids has effectively engaged the public in biodiversity conservation, building a community of citizen scientists committed to Malta's natural heritage. It underscores the importance of CS in linking research with community participation and enhancing environmental stewardship.

How can we assess harvesting risks and identify conservation issues associated with wild-plant harvesting in metropolitan France ?

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Wild-plant harvesting, an ancient practice integral to food and medicine, has gained renewed interest as societies seek more "natural" products. However, reliance on wild-plants raises concerns about impacts on biodiversity. A 2018 report by NGO TRAFFIC revealed alarming facts: 60-90% of global aromatic and medicinal plants are wild-sourced, only 7% have an IUCN assessment, with one in five facing extinction threats.

In France, ~10% (700+ species) of the wild flora is commercially harvested, with little known about associated impacts. Our goal is to identify harvesting risks and set conservation priorities to better manage harvesting. We ranked ~700 harvested species using criteria combining biogeographical data and sensitivity to harvesting :

- Species rarity (country and county scales).

- Innate vulnerability, using plant biology and ecology (survival strategies, resource allocation…).

- Habitat vulnerability, using the IUCN Red List.

- Harvesting pressure, including harvesting frequency (number of appearances in harvest lists), uses, and harvested parts.

Preliminary results show that while France is overall impacted by harvesting, some counties are overly rich in harvested species. Spreading harvesting pressures could help limit impacts on vulnerable populations. Furthermore, certain rare taxa suffer high pressures without any regulation of these practices. Our results will help set policy recommendations promoting sustainable harvesting practices.

From South America to Southeast Asia: Exploring the consequences of international trade on seedeaters and leafbirds

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In recent years, there has been increasing calls on addressing the international songbird trade however, a significant portion of this trade remains under researched, impeding our ability to fully understand its impact. This study delves into a detailed examination of the repercussions of trade on two songbird groups on conservation concerns: Seedeaters (Sporophilla spp.) and Leafbirds (Chloropsis spp.).

Seedeaters, a genus indigenous to South America encompassing 43 species, display a notable prevalence in international trade, with at least half of these species implicated. For many within this genus, trade is a primary threat to their survival, persisting even in the presence of regulatory measures, with instances of illegal trade observed in the US and the EU.

Leafbirds, mainly found in Southeast Asia, comprise 13 species, with nine of them identified in the trade, including the endangered Greater Leafbird (Chloropsis sonnerati). Surging demand within Indonesian bird markets has precipitated cross-border transactions, potentially imperilling populations in neighbouring countries.

This investigation underscores the imperative for an in-depth exploration of vulnerable songbird groups in the international trade including investigating the potential efficacy of CITES listings for their conservation.

Bird's aesthetic attractiveness in the human eye predicts their trade, but the association is not consistent across product types or trade regions

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Understanding the drivers of wildlife trade is crucial for designing conservation interventions that minimize potential harmful impacts on ecosystems. Animals are traded for various reasons such as their visual aesthetic appeal to humans. We explored whether a citizen science derived birds' attractiveness score, combined with their range size, could predict the level at which a species is traded. We combined different data sets with bird trade information to gain a comprehensive understanding of which bird species are traded or not. The visual aesthetic attractiveness of birds serves as a predictor for whether a bird species is traded. This phenomenon is observed globally and across all bird species; however more detailed results indicate that the correlation depends on the type of traded products. Attractiveness most effectively predicts the trade of live birds, and decorative derivatives of birds (e.g. clothing, feathers) linked to attractiveness. Nevertheless, geographic scale also matters: in the trade of birds within and into the European Union, the effect of attractiveness is less pronounced for live bird trade. This highlights how global data can help unveil general trends in wildlife trade, while underscoring the necessity of regional information to support a comprehensive understanding of species trade.

Evaluating evidence for dominant narratives around the use of wild species

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Tension between overexploitation as a major driver of biodiversity loss and humanity's reliance on wild species creates a flashpoint between those who do and do not support sustainable use as a tool to support livelihoods and incentivize conservation. The discourse is fraught, with dominant narratives around use often lacking evidence. We present the results of three separate studies, drawing on comprehensive analysis of the IUCN Red List, as an evidence-base for some narratives that currently dominate public and policy discourse. One posits that because overexploitation is a major threat to biodiversity, use can seldom be biologically sustainable; we show that ~34% of used species are Least Concern with stable or improving population trends on the Red List. Second, international trade is often presented as a major threat to wildlife; we demonstrate that the number of species threatened by local/national use is four times greater than for international trade. Finally, we evaluate the proposition that trophy hunting is a major threat to species, presenting results showing that legal hunting for trophies is not a major threat to any of 73 taxa imported to the UK. We place our results in the context of current policy formulation and decision making.

Uncovering the invisible: successes and challenges for wildlife crime prosecution in Europe

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Wildlife crime is devastating for endangered species and a growing risk to our societies' economic development and security, but most cases still go unpunished and undetected. For the first time, the European LIFE SWiPE project compiles information on cases and sentences of wildlife crimes committed in 11 European countries from 2015 to 2020. 13% of these crimes were related to wildlife trade, primarily involving parrots, tortoises, and skins/parts and products from big cats, brown bears, elephants and sturgeon. There is a lack of monitoring of this phenomenon, making crimes against nature invisible as only a small part of these cases is detected. Even if reported, many wildlife crime cases were not prosecuted (60% of wildlife crime complaints did not result in indictments that led to court proceedings). In order to improve its detection and prosecution, we recommend: (1) public awareness of wildlife crime; (2) increasing cooperation and coordination among the different bodies and institutions; (3) specialized and motivational training that raises the awareness of all the actors involved; (4) judge specialization; (5) dedicating more resources; and (6) allowing NGOs to appear for the prosecution in proceedings

168: Social and ecological values: Charting a course forward to 2030 for SCB Europe

Situating labour in conservation science and policy

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In the social sciences, labour has been theorised as a key mediator of material and affective relationships between society, technology and the natural environment. Because conservation and associated approaches to environmental management seek to shape these relationships, questions of labour (and values relatedly) bear on all aspects of conservation- design and management of projects, enrolment of rural livelihoods and care labour in 'community-based' projects, understanding how conflicts arise, and evolving roles that conservation activities play in processes of development and globalization. However, biodiversity conservation policies have still to embrace these, leading to a limited understanding of how people are put to work for conservation, under what conditions they work, and how conservation affects labour dynamics. Drawing on existing labour engagements in conservation social sciences and empirical material from a national park and a biodiversity hotspot region in India, this presentation argues for five areas of further inquiry toward a robust, transdisciplinary analysis of labor within conservation. These include- Forms of labour conservation enrols; Role of labour relations in conservation conflicts; How conservation affects labour dynamics in other sectors, such as forestry and tourism; How technology shapes changing opportunities for work, discipline of workers; and How labour and ecological conditions shape one another.

Narratives of connections to nature in protected landscapes

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Besides landscape fragmentation, social fragmentations in the form of contestation and conflicts are considered a challenge for biodiversity conservation in protected areas such as Natura 2000 sites in the EU. While ecological fragmentation and lack of acceptance of Natura 2000 have long been studied, measures to address these challenges tend to target shallow leverage points, e.g., with support mechanisms, management standards, or round tables. Deeper values, paradigms and worldviews underlying interactions in protected areas are much less understood. The concept of connection to nature offers the opportunity to understand these deeper leverage points towards sustainability. Applying this perspective to protected areas in a Northern-German case, we explore the diverse dimensions of human-nature connections and disconnections. We conducted 38 qualitative interviews with a broad array of local respondents that stand in relationship with selected Natura 2000 sites through their daily work or life. We developed narratives of human-nature connections based on a reflexive thematic analysis of the data. The narratives illustrate how protected areas can contribute to enable or constrain human-nature connections as well as social connections, and how the awareness of the diversity of connections can inform protected area governance and management and increase their social benefits and inclusivity.

Quantifying higher education student responses to conservation courses diversified with social and ecological justice content

Robert Alistair Montgomery
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Students enrolling in higher education courses today are highly motivated by environmental issues such as climate, biodiversity conservation, and sustainability. Importantly however, decisions to conserve the functioning of the natural world must also be considered in relation to social conditions. Thus, conservation decisions, such as the 30 by 30 commitments, must be considerate of both ecological and social values. The extent to which higher education students appreciate the complexity herein is in question. To evaluate complex decision-making within this context, a conservation course at a large (>50,000 students) US university was developed. This course was designed to enable students to unpack global problems in conservation and sustainability. Student perspectives were assessed via pre- and post-course surveys and reflection instruments. At the outset of the course, it was hypothesized that students would more highly value social justice. Following the 15-week course with immersive content provided in the social and ecological dilemmas of conservation, using subsistence poaching in the Global South as an exemplar topic, student perspectives modulated. This indicated an emerging understanding of how difficult it is to manage coupled human and natural systems. The presentation describes the structure of this course enabling it to be replicated at other universities globally.

Ecological and social justice should proceed hand-in-hand in conservation

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We highlight the need for ecological justice to go hand in hand with social justice in conservation science. We focus on the importance of ecocentric (non-anthropocentric) worldviews for advancing both social and ecological justice. While acknowledging the need to "decolonize" conservation, we question whether conservation as a whole may be justifiably termed "colonial"; noting that colonialism in the name of profit and political power has long been a main driver of both human rights abuses and biodiversity loss. Moreover, modern conservation science explicitly strives for social justice and equity while protecting biological diversity and thus ought not to be conflated with colonialism's long and unjust history. We suggest that efforts to portray modern conservation science as patriarchal, racist, and colonial are shortsighted, disregarding longstanding efforts by conservationists to reconcile social and ecological values.We conclude that the conservation community should shift focus toward targeting the main political actors and economic structures that oppress both humans and non-humans alike. A more nuanced appreciation of the shared history of colonialism and conservation may illuminate how social and ecological values converge in the mission of sustaining the ecological life support system on which every human and non-human being depends.

170: Conservation, Governance & Law: Net-Gain perspectives from the UN Post2020 Biodiversity Framework and the EU Biodiversity Strategy for EU conservation rules and policies

Net gain approaches of The Kunming-Montreal Global Biodiversity Framework (GBF) and EU Biodiversity Strategy: status and perspective for EU-laws

Volker Mauerhofer
Mid Sweden University, Sweden

The presentation aims to identify the nature-positive oriented interplay between the GBF, the EU Biodiversity Strategy and the EU's conservation laws, particularly the EU-Habitats Directive (HD) and the new EU Restoration Regulation. It will first comparatively show the timeline of the GBF-history and the EU Biodiversity Strategy to provide an indication for the progressive political nature of latter. Then it will outline already existing formulations of the HD and their implementation which allow for nature positive perspectives. Furthermore, it will also provide the results of an ongoing assessment whether the EU-Restoration law has the potential to contribute – beyond the existing restoration duties of the HD – to nature-positive outcomes of the current EU's nature conservation laws (particularly the HD but also the EU's Birds Directive). The presentation will finally summarize the main results of the assessment with an EU-outlook for the political 2030 and 2050 goals indicated in the GBF and the EU-Biodiversity Strategy. It will conclude with main perspectives and pitfalls as well as novel approaches for potential future nature-positive legal achievement based on the recent policies and laws (GBF, the EU-Biodiversity Strategy and the EU Restoration Regulation) as well as existing EU legal instruments (HD and Birds Directive).

The Role of Science in the Global Biodiversity Framework

Aysegul Sirakaya
Lund University, Sweden and Natural Historu Museum in London

In December 2022, Parties to the Convention on Biological Diversity adopted a new set of global goals that have been in the making since 2019. The objective of the long-time-coming Kunming-Montreal Global Biodiversity Framework is living in harmony with nature by 2050. The roadmap to do so is clustered into four sections: Protecting and restoring biodiversity, sustainably managing biodiversity resources, fair and equitable sharing of benefits and financing the implementation through capacity building, and technology transfer.

Science utilises biodiversity with the aim of generating data. Not only natural sciences but social sciences also make use of biodiversity-based research as well as knowledge over biological resources such as indigenous and traditional knowledge. This presentation will explore the forms science can contribute to the succession of the Global Biodiversity Framework by examining the pathways and obligations prescribed to Parties and relevant stakeholders such as collections and academia. The presentation will provide examples of work undertaken with the aim of conducting responsive and responsible research while contributing to the goals of the Global Biodiversity Framework.

Halting the Loss of Biodiversity in the European Union: The Effect of EU legislation

Valerie Fogleman
Cardiff University, United Kingdom

The EU is facing a biodiversity crisis. Only 15 per cent of natural habitats and approximately 27% of species in the EU a good conservation status compared with 63% of species and 81% of habitats having poor or bad conservation status. The Birds and Habitats Directives have greatly assisted in halting the loss of biodiversity in the EU, not least by establishing the Natura 2000 network of protected areas across the EU. Implementation of the directives by itself however is not sufficient to achieve the EU's objective of legally protecting at least 30% of the EU's land and sea area by 2030 or its vision of living in harmony with nature by 2050.

In June 2022, to assist in achieving the above objectives, the European Commission proposed a Regulation on nature restoration to restore degraded ecosystems, habitats and species across the EU. In November 2023, the European Parliament and the Council agreed a provisional text of the regulation, albeit watered down from the original proposal by the European Commission.

This presentation will examine measures taken by the EU to halt the loss of biodiversity in the EU.

Managing Extinction: Examining how the Global Biodiversity Framework's 'Considerations' can shape and inform conservation strategies.

Alison Hutchinson
Newcastle University, United Kingdom

Biodiversity is deteriorating at an unprecedented scale. It is well understood that species and ecosystems exist in a delicate balance, with losses producing rippling impacts towards species' population resilience, genetic diversity, and cultures. In recognition of the growing pressures facing biodiversity, the Kunming-Montreal Global Biodiversity Framework (KMGBF) was adopted in December 2022 at the fifteenth meeting of the Conference of Parties to the Convention on Biological Diversity (CBD). Underpinning this Framework are eighteen collective considerations that are intended to guide implementation. This presentation provides a platform to scrutinize the Consideration's contributions to biodiversity conservation planning and practice; and highlights the challenges arising from juxtaposing values and approaches surrounding human-nature dualisms and the value of biodiversity. Whilst the global community is becoming attentive to diverse worldviews, power and participatory inequalities continue to threaten biodiversity and stall meaningful progress. With so little time to meet the 2030 milestone of transforming conservation approaches and curbing environmental and biodiversity decline, I will discuss how a greater emphasis on the more progressive and holistic elements within the Considerations can help alleviate potential ambiguities within the Framework and encourage a shift in the way nature is valued within biodiversity governance and practice.

The Nature Positive Journey for Business: A research agenda to enable private sector contributions to the global biodiversity framework.

Thomas Bryce White[1,2], **Talitha Bromwich**[1,3], **Ashley Bang**[1,2], **Leon Bennun**[2,4], **Joseph Bull**[1,3], **Michael Clark**[1], **Graham Prescott**[2], **Malcolm Starkey**[2], **Sophus zu Ermgassen**[1], **E.J. Milner-Gulland**[1], **Hollie Booth**[1,2]

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Biodiversity is rising rapidly on the corporate agenda, prompting businesses to adopt the 'Nature Positive' framing, expressing a commitment to combatting biodiversity loss and actively contributing to global nature recovery goals. However, realising these ambitions requires transformative changes in business operations, with large uncertainties currently existing around possible strategies and pathways.

I will first introduce a conceptual model for 'Nature Positive' ambitions for organisations that extend beyond individual company actions, encompassing driving processes influencing private sector involvement, a spectrum of potential sectoral strategies, and the need for measurement of impact at various scales. We use this model to develop high-priority research questions where answers are urgently needed to guide effective, feasible and equitable action by businesses to protect and restore nature.

I will then outline some of our current work trying to address some of these research gaps. For example, what are the opportunities and limitations of different approaches for measuring the biodiversity impacts of businesses entire value chains, and understanding possible strategies that could mitigate impacts.

171: Protected area planning and management in Italy

“Gimme shelter”: insights into the role of artificial aquatic sites for amphibian conservation and future directions of management

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Almost 40% of amphibians are at risk of extinction. Anthropogenic habitat loss plays an important role with dramatic consequences on species persistence. Recently, artificial sites, associated with traditional farming, proved to represent an effective surrogate of natural sites.

Here, we deepened the ecological and genetic value of artificial sites for the conservation of Triturus carnifex and Lissotriton vulgaris within protected areas interested by traditional farming (e.g., Lazio, Abruzzo, and Molise National Park).

GLMs, based on a sample of 58 drinking troughs and 1279 individuals, highlight that mud occurrence, macrophyte cover and intermediate management positively affect L.vulgaris occurrence and abundance.

Morphometric, trophic, and environmental data from 8 sites and 189 individuals, show that drinking troughs represent suitable habitats sustaining healthy and specialized T.carnifex.

Microsatellite markers, performed on 470 samples from 7 natural sites and 14 drinking troughs, show that artificial sites, connected to natural waters, have a stepping-stone function favouring L.vulgaris dispersal and gene flow.

A deep understanding of habitat requirements, food strategy and genetic diversity is crucial to guide conservation actions and management of artificial sites in protected areas. The recognition of their conservation value is timely given the decreasing of traditional practices and the threatened status of amphibians.

Mediterranean islands and protected areas towards the 2030 Biodiversity Targets

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European Biodiversity Strategy states that >30% of terrestrial, inland water, coastal and marine areas, should be protected by 2030. European strategy also includes the ambitious goal of having 1/3 of the protected area under a strict protection regime. Islands are extremely vulnerable to biotic invasions, species extinctions, habitat degradation, and loss of ecosystem functionality. Therefore, protecting significant fractions of island areas, and possibly entire islands, is fundamental to guarantee the persistence of their biodiversity and ecological interactions. We analyzed the protection level (IUCN classification) of 2212 Mediterranean islands larger than 10.000 m2, by overlapping the new island geodatabase (MEDIS) with the Nationally designated areas. The percentage of protected island area is relatively low (<15%) and most of it is classified under the lowest conservation categories (IV, V and VI). The strictest conservation categories (Ia, Ib and II) cumulatively cover <2% of the total area of Mediterranean islands, indicating a substantial gap from the 10% target. Only a few islands are entirely (>90%) protected under strict conservation. While recognizing the limits of the data, we highlight the need for a conservation planning of Mediterranean islands designated to allow the long-term persistence of fundamental biogeographical processes, as well as rewilding processes.

Conservation gaps of Natura 2000 (N2k) network in preserving European Habitat: an accurate prioritization is needed.

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The Habitats Directive aims to protect over 200 Habitats (sensu Habitat Directive). Each Member State reports the presence of Habitat within 100 km2 cells. According to the latest report, only 15% of the Habitats are in good status. Nevertheless, an accurate prioritization at the continental scale is lacking. Here we present a new approach to identify the Habitats and areas that need more protection effort.

Given the coarse resolution of the available data, to assess which Habitats need more conservation effort we model the number of occurrences for each Habitat with the N2k cover within cells (in percentage). From the obtained fit, we calculate the integrals of the curve that it’s 1 if the Habitat falls in the highest number of cells fully protected or 0 in the opposite case. We use the Sum of the Inverse of the Integrals (SII) to assess the cells that need protection the most. Then, we model SII as a function of protection percentage. Using the model’s residuals, we identify which cells need more protection effort. The method proposed can be widely applied also for species and considering different grid resolutions, which will be useful for planning the future expansion of the N2k network.

Integrating marine connectivity in the maritime spatial planning of Italian seas

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Systematic conservation planning is a rigorous and repeatable approach to plan conservation actions such as the design of new protected areas that effectively meet conservation objectives (e.g. preserving biodiversity). In this study, we adopt a systematic conservation planning approach in three Mediterranean marine areas: the Northern Adriatic Sea, the Straits of Sicily and the Northern Tyrrhenian Sea. We formulate strategic objectives for maintaining marine functional connectivity between marine protected areas. We then apply the 'prioritizr' package to formulate and solve spatial conservation prioritization problems that integrate different objectives for marine connectivity. The resulting priority areas for conservation will be used to build and analyze three scenarios of the Italian maritime spatial planning (MSP): 1) Slow pace (following the current trends of economic development and environmental regulations); 2) Blue development (promotion of fast growth and innovations using a “build-with-nature” vision); and 3) Nature@Work (reducing negative effects by adopting strict measures for protecting valuable and vulnerable marine ecosystems). Identifying functionally connected network of protected areas within MSP will help safeguarding the environment from additional anthropogenic pressures while finding space for new uses across multiple scenarios.

High-resolution climatic projections for Italian tetrapods

Nina Luisa Santostasi, **Luigi Maiorano, Santini Luca, Rondinini Carlo**
Sapienza University of Rome, Italy

Italy is a highly biodiverse country and is dedicated to achieving ambitious conservation and restoration goals aligned with the European Union's biodiversity strategy for 2030. To effectively plan spatial conservation efforts, it is crucial to comprehend the current and future spatial distribution of biodiversity components.

We focused on amphibians, reptiles, and mammal species. We obtained occurrence data from open data infrastructures (i.e., GBIF, iNaturalist) and employed an ensemble forecasting approach to predict species distribution using climate and land-use drivers. Subsequently, we projected current and future (2050-2100) species distributions considering alternative greenhouse gas emissions scenarios.

A significant number of species is predicted to face range shift and/or contraction by 2100, causing alterations in patterns of species richness and composition. These results are fundamental for the identification of areas of current and future relevance for biodiversity conservation.

Contribution of Italian roadless areas to nature conservation targets

Riccardo Testolin, **Alessandro Chiarucci**
BIOME Lab, Alma Mater Studiorum University of Bologna, Italy

Italy is one of the most densely populated countries in the European Union and among the ones with the highest proportion of landscape fragmentation and sealed soil. Therefore, protecting the remaining roadless area is key to meeting international commitments for nature conservation and restoration. Within the frame of the activities carried out by the National Biodiversity Future Center for biodiversity conservation planning, we explored the potential contribution of Italian roadless areas to achieve biodiversity protection targets. First, we delimited roadless areas at high spatial resolution based on data from OpenStreetMap by buffering road and rail infrastructure. Then, we retrieved Italian terrestrial protected areas from the World Database of Protected Areas (WDPA), and assessed how much roadless area is currently protected. To assess the environmental representativeness of the abovementioned spatial datasets, we analysed their distribution across biogeographic regions and vegetation types. Furthermore, we characterised them based on their abiotic envelope and biodiversity patterns. Finally, we explored the potential contribution of currently unprotected roadless areas to complement the current network of protected areas in terms of additional extent and coverage of the environmental template. This research explores the opportunity of protecting the remaining infrastructure-free areas in Italy while identifying possible gaps.

172: Invasive species aware by 2030

The current and future spread of alien species

Hanno Seebens
University of Giessen, Germany

The number of alien species has steadily increased over past decades and centuries leading to now >37,000 recorded alien species worldwide. As shown in the recent IPBES assessment on invasive alien species, this can have negative consequences for nature and human well-being. The spread of species, and therefore also their current distribution, is highly uneven across the globe with marked hot spots in economically productive countries, and these hot spots remained rather stable over recent centuries. I will give an overview about the long-term trends of alien species numbers, their distributions and major drivers. I will also provide an overview of knowledge gaps and their influences on our understanding of the observed patterns. As the major drivers of biological invasions will accelerate in their intensities, the number of alien species and invasive alien species are expected to rise likewise in the future. I will give an overview of the projected distribution of alien species and will end the presentation with options to mitigate the spread of species.

Plants on 'the Union list' of EU regulation 1143/2014, how does is work in real life.

Johan van Valkenburg
NVWA / Netherlands Institute for Vectors Invasive plants and Plant Health

Having 40 plant species registered on a list of prohibited species based on a scientific risk assessment is all very nice, but how does this translate into action? How can we prevent the entry of these plants? How can we guarantee that they are no longer in trade and how can we prevent further spread of those species already established? How to identify them, as they do not always come with a name tag or are often, willingly or not, mislabelled. What tools do we have to identify them at the border, when they arrive as a commodity or contaminant, or at sale points, either via e-commerce or in a shop. How to tell them apart from congeners and look-alikes. Once listed we realize that there can be quite some taxonomical confusion, as has been seen with Gunnera, Myriophyllum, Salvinia and Pennisetum to name a few. In addition to the tools to prevent entry, we need an early warning system to report any sightings in natural areas. If despite all our efforts to keep these invasive plants out, they do arrive in natural areas, what options do we have to eradicate or control them.

Plant invasion risk: threats to protected areas

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University of Sassari, Italy

Invasive species are among the main global drivers of biodiversity loss, posing major challenges to nature conservation in the network of protected areas. Assessing the risk posed by invasive species through different frameworks, at different spatial scales and under different protection regimes represents an attempt to bridge the gap between theory and practice in conservation planning. This can help to identify site, management, monitoring, and control priorities specific to both established and newly arriving species. This synthesis discusses emerging insights on the identification of threats posed by invasive plants, and the most important drivers shaping invasive plants' occurrence inside protected areas, such as abiotic filters, key information to define appropriate strategies for prevention and monitoring of uninvaded areas. Local authorities and managers of protected areas should pay particular attention to the presence of communication infrastructures as well as to the local landscape and land use changes which may have crucial roles in promoting or preventing plant invasions. The staff of protected areas should conduct periodical field surveys on areas with high invasion risk to record the presence of non-native species and their invasion stage.

Invasive trees in temperate forests: how does invader quantity affect dispersal and impacts?

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Invasive trees are a major threat to biodiversity and functioning of forests. Most previous studies focused on comparing invaded and non-invaded sites, while few studies considered invader quantity as driver of impacts or dispersal ability. Here we present patterns of dispersal and impacts of model invasive trees: Prunus serotina, Quercus rubra, and Robinia pseudoacacia. We revealed strong dependence of the invader's natural regeneration density on quantity of parental trees. This relationship was the strongest for Q. rubra, producing large seeds, and the weakest for R. pseudoacacia, producing light, wind-dispersed seeds. Quantity of parental trees also negatively affected seedling survival at one year since germination. We also found that quantity of invaders affected natural regeneration of alien and native tree species, as well as understory species composition and biodiversity. In contrast, we did not confirm any impacts of invaders on aboveground biomass increments of native trees. We conclude that management of invasive trees should account for invader quantity, aiming to develop thresholds of negative impacts that can be mitigated and/or accepted in case-specific management scenarios. Such an approach would allow for prioritization of silvicultural treatments on sites with high conservation values and support optimization of conservation management in forests.

Soil steaming to combat invasive alien plants

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Transportation and reuse of soils can introduce invasive alien plants (IAPs) to new regions. Steam as an alternative to chemical fumigation, may allow contaminated soil to be disinfected. In 2021 and 2022, a dose-response experiment was performed. Seeds of selected IAPs incorporated in three different soils were exposed to steam treatment heating the soils to a maximum of 60-99°C before steaming stopped. Seeds were kept in the heated soil for three more minutes before being removed from the soil. Results showed that the soils were different in terms of reaching target temperatures, however, killing of the seeds was not affected by soil type. For each species, the response (seed germination percentage) to the maximum soil temperatures was described by a log-logistic dose-response model. The soil temperature required to reduce seed germination by 90% (ED90) was about 67°C for Heracleum mantegazzianum, 70°C for Impatiens glandulifera, 75°C for Avena fatua (both Polish and Norwegian population), 76°C for Echinochloa crus-galli (Polish population), 79°C for E. crus-galli (Norwegian population), 78°C for Solidago canadensis, and 105°C for Lupinus polyphyllus. Overall results showed promising control levels of IAP propagules in contaminated soils, except for L. polyphyllus. Steaming measures, therefore, should be adapted based on target species.

Abstracts of woskshops

107: Promoting CBD activities in Central and Eastern Europe: challenges and the way forward

Chair(s): **András Báldi** (Centre for Ecological Research, Hungary), **Kinga Öllerer** (Centre for Ecological Research, Hungary)

The Convention on Biological Diversity (CBD) has played a crucial role in Central and Eastern European (CEE) countries' efforts to preserve and sustainably manage their rich biodiversity. With this workshop we provide an overview of the activities and outcomes of CBD implementation in the CEE region, highlighting achievements, ongoing initiatives, and key challenges. Our aim is to promote the visibility and effective implementation of the CBD via boosting participation of biological conservation experts in European countries with less activity and capacity.

CEE countries have made notable strides in aligning their national policies and strategies with the objectives of the CBD. Biodiversity conservation has become a central component of environmental agendas, with governments enacting legislation and establishing protected areas to safeguard ecosystems and species. Collaborative efforts between CEE countries and international organizations have led to the development of action plans, capacity-building programs, and funding mechanisms that prioritize biodiversity conservation.

However, challenges persist and new challenges emerge. The CEE region faces severe biodiversity conservation issues associated with habitat loss and degradation, invasive species, illegal wildlife trade, potentially harmful agri-environmental subsidies and insufficient governmental, financial and academic resources for comprehensive biodiversity monitoring and management to mitigate these issues. The transition to more sustainable land-use practices and the incorporation of traditional knowledge into biodiversity conservation strategies are emerging goals that require further attention and sustained efforts.

International collaboration and knowledge exchange have been instrumental in advancing CBD objectives in the CEE region. Sharing best practices, scientific research, and technological innovations among countries have facilitated more effective conservation measures and policy implementation. At the same time, CEE countries are lagging behind in terms of the amount of biodiversity research and the visibility of the results for policy makers, while their biodiversity experts are much less represented in CBD processes.

Looking ahead, CEE countries must enhance their commitment to CBD principles, fostering cross-border cooperation, and leveraging available resources to address these challenges. Strengthened participation of national experts in CBD processes, partnerships between governments, non-governmental organizations, academia, and local communities will be essential in ensuring the long-term success of biodiversity conservation efforts in Central and Eastern Europe within the framework of the Convention on Biological Diversity.

With this workshop, organized in collaboration with the CO-OP4CBD project (Cooperation for the Convention on Biological Diversity, https://www.coop4cbd.eu/), we expect the strengthening of activities associated with the CBD and with the implementation of the Kunming-Montreal Global Biodiversity Framework in CEE countries, thus supporting biodiversity conservation and policy efforts.

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Presentations of the Workshop

The CBD and on the role of researchers in the process

Claire Brown
UNEP World Conservation Monitoring Centre

Why is it important for researchers to participate in the CBD and how to do that – inside experiences

Grégoire Dubois
EC Knowledge Centre for Biodiversity

Why are there so few CEE researchers involved in the CBD and how this could change?

Kinga Öllerer, András Báldi
Centre for Ecological Research, Hungary

117: One Health Networks to monitor wildlife populations and disease emergence: long-term sustainability of data collection and datasets

Chair(s): **Flavia Occhibove** (DSV, University of Turin, Italy), **Stefania Zanet** (DSV, University of Turin, Italy), **Rachele Vada** (DSV, University of Turin, Italy), **Amir Reza Varzandi** (DSV, University of Turin, Italy), **Ezio Ferroglio** (DSV, University of Turin, Italy)

In our era characterized by unprecedented environmental changes, largely driven by human activities, a multitude of threats and diseases which affect wildlife, livestock, and human health has risen. The interconnection between human health, animal health, and the environment has never been more evident, and the One Health approach represents a comprehensive strategy that seeks to address global health challenges recognizing these interdependencies (Zinsstag et al., 2018). Emergence and re-emergence of diseases, in humans, wildlife and domesticated animals, are driven by multiple factors, including increased human-wildlife interaction, alterations in land uses, modification of agricultural practices, and increased global connectivity (Brearley et al., 2013; Hassell et al., 2016). These emergent pathogens might represent conservation threats, and even cause extinction events (Smith et al., 2009). In addition, zoonotic risk management often requires challenging wildlife management actions to meet conservation and public health goals (and reduce the associated human-wildlife conflict that might undermine conservation efforts), which should be backed by robust evidence-based data.

To implement effective actions, we need solid data. Collecting, harmonising, storing, sharing and analysing these data, together with ensuring the long-term sustainability of these practices has been one of the key hurdles in developing appropriate and timely policy and practice in this field. For this reason, this workshop will present some examples of integrated wildlife disease monitoring. Within this broader view, monitoring of shared, multi-host infections expands within the One Health concept and becomes Integrated One Health monitoring (Cardoso et al., 2022). Also, we will discuss the main challenges and success stories in wildlife population data collection.

The goal of the workshop is twofold: highlight the importance of one health for conservation and resolution of human-wildlife negative interactions related to disease emergence risk (for humans or livestock, public health and economic issues); reflecting on the challenges of wildlife data population monitoring collection and long-term solutions for sustainable data collection, storage, and access.

Firstly, the session will include brief presentations of experiences from the Enetwild consortium, a European network of wildlife professionals funded by EFSA, its activities, and its impact on management of species of conservation interest:

1. Enetwild 2.0 - Wildlife and One Health

2. Transnational harmonised data collection: the observatory approach

Subsequently, a facilitated discussion on long-term sustainability of data collection schemes and dataset storage/accessibility will be held between organisers and invited Enetwild partners (academics and wildlife professionals) in charge of data collection from different European regions; the discussion will be open to the participants. For this reason, we will encourage participation of people interested in wildlife monitoring, or working in wildlife population collection schemes/projects, so that the discussion will also be a knowledge exchange to improve sustainable long-term data availability. Expected number of participants: 20-30 to allow satisfactorily interaction during discussion.

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Presentations of the Workshop

Enetwild 2.0 - Wildlife and One Health

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Transnational harmonised data collection: the observatory approach

Massimo Scandura
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118: European networks of protected areas: best practices for the conservation of biodiversity

Chair(s): **Gianluca Catullo** (WWF Italia, Italy)

Protected areas are crucial for the conservation of species and ecosystems and provide essential services for the life and health of the human population. They help address environmental emergencies, such as climate change, and social emergencies such as poverty. The Global Biodiversity Framework (GBF) adopted at CBD CoP15 in Montreal & the European Biodiversity Strategy set the target of achieving 30% ecologically representative, effectively protected and ecologically connected land, sea and inland waters. However, in Europe we are still far from the target, both in terms of surface area, connectivity, management effectiveness of our protected areas. To reach it, it is first of all essential to identify the areas of greatest value for biodiversity and connectivity that are still unprotected, based on the best available data, and to identify the most suitable forms of protection for each new area, also on the basis of its social context. But identifying and establishing new protected areas will not be enough without a significant improvement in their management, starting with adequate human and economic resources, planning at the individual area and system level, and improving the effectiveness of monitoring and surveillance activities. The challenge is complex, but it is crucial to overcome it in order to preserve Europe's natural capital, and with it the wellbeing and prosperity of present and future generations.

144: Assessing the dynamic demographic resilience of animal populations

Global change presents wildlife with an unprecedented number and variety of challenges, e.g., climate change, novel diseases, urbanization, and hunting. In this context it is important to assess how resilient populations, species, and ecosystems are to disturbances. Such assessments require strong quantitative skills. Resilience is a central concept in ecological theory, and diverse methods have been developed to quantify it using empirically-collected data. Studies of resilience have been limited mainly to higher levels of organization, such as communities or ecosystems. However, understanding the resilience of populations is at least as important because many management actions target this level of organization, and populations are best suited for common conservation actions such as restocking or translocation and reintroduction. Recently, Capdevilla and colleagues (2020) introduced the term "demographic resilience" to define population resilience and suggested quantifying it using methods developed for transient dynamics analysis that are applied to the matrix population model for the species in question. Over time, the nature and intensity of disturbances may change, affecting demographic rates. Because demographic rates are used to calculate demographic resilience, we expect that demographic resilience also changes over time. However, so far demographic resilience has been assumed to be static. The assumption that resilience is static means that only a single demographic resilience value is calculated, which does not allow pinpointing the points or periods in time when the population was affected by the disturbance and, in turn, impairs our ability to suggest effective mitigation and conservation measures. In this workshop, participants will learn about the theory of demographic resilience and the different metrics that are used to quantify it. We will introduce the commonly used 'bivariate approach' for quantifying resilience, which is based on measuring two resilience components: (i) the ability of a system to withstand disturbance (‘resistance’) and (ii) the ability of the system to recover from a disturbance, i.e., to return to its original state after the disturbance ('recovery'). The core of the workshop will focus on introducing the concept of dynamic demographic resilience (i.e. varying over time). We will present our newly developed R package for quantifying dynamic demographic resilience. We will demonstrate how our package can be used to measure dynamic demographic resilience and to compare it to the static demographic resilience.

Presentations of the Workshop

Resilience: history of use in community ecology

<u>Viktoriia Radchuk</u>, Julie Louvrier
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This lecture will focus on the historical development of the terms “stability” and “resilience” in community ecology. Although both terms are central concepts to the field of ecology, their definition, meaning and applications have generated multiple controversies over the past decades. Indeed, resilience is often used in its narrow meaning as the ability of the system to recover to its pre-disturbed state following a disturbance (“engineering resilience”), which is centered on the existence of a single stable equilibrium. However, when defined sensu Holling, resilience is not limited to a single stable equilibrium and is more broadly applicable to the systems with multiple stable states, which are much more likely to be found in nature. Much confusion around the terms stability and resilience and the fact they were defined in multiple ways demonstrate the multidimensional character of both stability and resilience. This lecture will highlight different dimensions that can be measured for both stability and resilience and clarify the relation between these two concepts.

Theory of demographic resilience

<u>Ella Worthington White</u>[1,2], Julie Louvrier[1]
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[2]Freie Universität, Germany

This lecture will introduce the framework of demographic resilience (DR) that was recently proposed (Capdevila et al. 2020) to quantify resilience of populations to disturbances, inspired by a similar concept from community ecology. As with resilience in community ecology, DR is a multidimensional concept that consists of several different metrics. These metrics can be broadly grouped under two main resilience components: resistance and recovery. In addition to resistance that is measured analogously as at the community level (as the extent of the decline in population size after disturbance), compensation can be measured as part of DR (measured as the extent of increase in population size after disturbance) as some populations may exhibit overcompensatory dynamics . Similarly to how community matrices can be used to quantify resilience of communities, population matrix models can be subjected to the analysis of transient dynamics to compute DR metrics. This lecture will explain how to compute a set of such DR metrics, including: damping ratio, reactivity, maximal attenuation and maximal amplification. Further, we will introduce the transient envelope, which encompasses the most extreme possible increases and decreases of the population size after disturbance, and can thus be especially useful in comparative studies.

Practical and package walk-through: Assessing Time-Varying Demographic Resilience

Julie Louvrier, <u>Viktoriia Radchuk</u>
Lebniz Institute for Zoo and Wildlife Research Berlin, Germany

After the previous lectures in which participants will learn about (i) the historical development of resilience and stability as concepts in the field of community ecology and (ii) the theory of demographic resilience (DR), a recently formally defined concept, the participants will learn the importance of accounting for temporal variation when assessing DR. Until now, DR has been assumed to be static, which prevents pinpointing the periods in time when disturbances occurred. Yet, DR can vary over time as a response to changes in demographic rates of a population.

In this third part of the workshop, we will present “demres”, the R package we have developed for applying the time-varying approach. This third part will follow the format of a practical, and participants will be guided through R scripts on how to apply both time-invariant and time-varying approaches using our package to quantify DR metrics. We will demonstrate the functionality of the available functions as well as the figures that are possible to plot, in order to visualize the different metrics values over time.

Abstracts of oral presentations

ID: 176

The future is not bright for Anatolian Brown Bears

Ercan Sıkdokur[1], Morteza Naderi[1], Emrah Çoban[2], İsmail Kudret Sağlam[1], Çağan Hakkı Şekercioğlu[1,2,3]

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The Brown bear is the largest carnivore living in Türkiye. In the current study, Ecological Niche Modeling was performed with an ensemble forecasting approach using the biomod2 package to evaluate brown bear habitat suitability for both current and future. Accordingly, the distribution of brown bears was highest in Euro-Siberian, Irano-Anatolian, and Mediterranean biogeographic regions, respectively. Forest cover and temperature-related variables were the biggest drivers in the model. Unfortunately, serious range contractions were projected in all future scenarios. The most susceptible regions were estimated as the Mediterranean, Irano-Turanian, and Euro-Siberian parts of the country, respectively. Our results showed that a northward shift would occur in bear distribution due to climate change. Potential distribution by altitude will be modulated because of anthropogenic and climate-change effects. Finally, our model showed that a conservation gap will occur in the near future for brown bears unless the status of established protected areas is reconsidered.

ID: 179

Identifying demographic routes for population recovery in migratory populations.

Catriona Morrison

University of East Anglia, United Kingdom

Across Europe, declines in the abundance of migratory landbirds have driven international calls for action, but actions that could feasibly contribute to population recovery have yet to be identified. Conservation actions ultimately aim to maintain and improve demographic rates. Understanding how rates vary in space and time can therefore greatly help identify suitable targets for intervention. Using long-term citizen science data, collected at constant effort bird ringing sites across Europe, we aim to identify a) demographic targets; weather to target productivity and/or survival rates, b) spatial-temporal targets; where and when targeting should take place, and c) the scale of targeting; weather targeting should take place locally or regionally. Using these findings, we present a framework for better targeting of conservation actions to help halt and reverse population declines in migratory species.

ID: 191

Towards an automated protocol for wildlife density estimation using camera-traps

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Camera-traps are valuable tools for estimating wildlife population density. Still, analysis of camera-trap data can be time-consuming: while algorithms for automated images classification are becoming more common they have mainly served as supporting tools, limiting their potential in being implemented in ecological analyses.

In this study, we applied REM and CT-DS models for density estimation with camera-traps of three target species. Images classification was carried out both by the user and a machine learning algorithm, and both outputs were used to estimate density. Finally, we assessed the algorithm effect on density under different classification scenarios through simulations.

While algorithm performance varied between species, density estimates between the user- and ML-classified dataset were consistent. Simulation results suggested that the CT-DS model could provide robust density estimates even at poor algorithm performances thanks to a compensation effect, while the REM model is more unpredictable and depends on multiple factors.

Our study showed that CT-DS and REM models are robust to images loss when a machine learning algorithm is used to classify species, with the CT-DS being an ideal candidate for unsupervised applications. These results are a further step towards a fully automated camera-trap protocol for density estimation in extensive multi-species monitoring programs.

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ID: 194

"Milking the lions": conservation performance payments in eastern and southern Africa

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Large carnivores often impose significant economic costs on the people they live amongst, and can be subject to pre-emptive and retaliatory killing as a result. Conservation performance payments (CPPs) are a tool which aim to reduce such persecution, by improving the cost-benefit ratio of living alongside large carnivores. They are results-based, with payments contingent on species presence or abundance. There is growing interest in CPPs, yet they have been the subject of little empirical research. Similarly, there is no literature on CPPs in Africa, despite the continent's global importance in carnivore conservation, and the recent implementation of multiple CPPs in the region.

This research reviews where and how these CPPs function, and identifies recurring challenges associated with their implementation. We conducted semi-structured interviews with representatives of nine CPPs, operating across five countries in southern and eastern Africa. We find that despite their theoretical simplicity, there is significant variation in how CPPs operate in practice. This includes differences in monitoring methods, governance, and all aspects of payments. Shared challenges include securing long-term funding, setting suitable payment levels, and ensuring equitable governance.

Practitioners view performance payments as a promising conservation approach, despite a lack of empirical evidence for causal behavioural change.

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ID: 197

Exploring the human-nature nexus towards effective nature-based solutions: the Aral Sea case

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The use of Nature-based Solutions (NbS) in drylands has received limited attention to date. To fill this research gap, we conducted a comprehensive analysis of NbS in Uzbekistan's Aral Sea region. Through a survey of 426 households in Muynak, a port town on the former Aral Sea, we explored the complex relationship between local communities and their natural environment by focusing on the use, perceptions, and values of natural resources, examining their potential role in NbS.

Our findings demonstrate varying impacts of environmental changes on community livelihoods and well-being. Many residents reported no significant change in income from alterations in natural resources. However, nearly half stated that wetland degradation adversely affected their livelihoods, with a smaller group benefiting economically from newly afforested areas.

The results also highlight a cultural prioritization over financial or historical valuation of natural resources among locals. The study underscores the potential of NbS to promote ecological restoration while enhancing human well-being in ecologically challenged areas like the Aral Sea region.

Our research supports the importance of NbS being context-specific and community-centered, considering local values, perceptions, and reliance on natural resources. It identifies key dryland NbS approaches each with unique advantages and challenges.

ID: 201

Traffic intensity and vegetation management affect flower-visiting insects and their response to resources in road verges

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To halt the loss of biodiversity, there is a need to manage also unconventional habitats for biodiversity conservation. Road verges can be managed to benefit plant diversity by adjusting mowing frequencies, but it is unclear how this affects flower-visiting insects, and if traffic moderates these effects. We manipulated mowing regimes of road verges to assess the combined effects of habitat quality, mowing frequency and traffic intensity on wild bees and butterflies.

We show that a management targeted to increase plant diversity in road verges can benefit flower-visiting insects, but that high traffic limits these positive effects. Specifically, road verges that were mown less often had higher flower densities, and there was a positive relationship between flower density and wild bee abundance and species richness. In road verges classified as valuable, butterfly abundance and species richness was higher if they were mown once instead of twice. However, traffic intensity had a substantial negative impact on wild bees and butterflies, and higher traffic intensities limited the positive relationship between plant and butterfly species richness. We conclude that targeted road verge management can benefit bees and butterflies, but such management should focus on roads with low traffic.

ID: 206

Flying from lowlands to summits: projected effects of climate change on butterflies in Central Italy

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Diurnal butterflies play a significant role as pollinators in natural ecosystems and are vital to the productivity of agro-ecosystems. Worryingly, a growing body of literature suggests that climate change could cause the extinction and decline of many butterfly species. Understanding which species and areas are most vulnerable to climate change is critical for butterfly conservation planning.

The LIFE project “BEEadapt” (LIFE21-CCA-IT-LIFE BEEadapt/101074591) aims to improve pollinator climate resilience in four areas of central Italy, including protected areas and a variety of ecosystems. We used species distribution models (Maxent algorithm) and two contrasting scenarios, one of sustainability and the other of fossil-fuel development, to assess the potential impacts of climate change on 114 butterflies found in these areas by the year 2050.

We discovered a clear vulnerability pattern among butterflies, with lowland and generalist species expected to expand their range under both scenarios, while mountain and specialist species are likely to see a decrease in suitability, particularly under the fossil-fuel development scenario.

Our findings provided key information for setting conservation priorities and informing BEEadapt mitigation strategies. Conservation measures such as habitat restoration and connectivity enhancement will be critical in ensuring the long-term survival of butterfly populations in the study areas.

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ID: 212

Kangaroo tales: how communities can help conserve common species in urban environments

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Common wildlife species are often overlooked in conservation, with little recognition of threats to populations and no protection of their habitat. Subsequently, there is often a lack of data and fewer incentives for conservation monitoring. The iconic eastern grey kangaroo (Macropus giganteus), a macropodid endemic to Australia, is often involved in human-wildlife conflict e.g. vehicle collisions(1).

Despite their common status, eastern grey kangaroos have undergone declines in some parts of their range, particularly in areas undergoing rapid urbanisation(2). This presentation provides an overview of collaborative research on eastern grey kangaroos, demonstrating the use of citizen science and community wisdom to overcome challenges in conservation of common species in urbanising landscapes.

In a mixed methods approach, this research used community sourced data and targeted field and laboratory work, to map and monitor changes in population abundance and genetic structure, assess risks, and identify priority habitats to inform conservation planning for eastern grey kangaroos. Kangaroo population declines were predicted by reduced remnant vegetation and high human population growth rates, with genetic structure influenced by buildings and roads(3). These findings highlight the importance of conservation planning for common species in areas undergoing urbanisation, providing insights into challenges of conservation of iconic common species.

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ID: 224

Where's the catch? Understanding spatio-temporal patterns of elasmobranch bycatch in the central-west coast of India

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India supports ~15% of all elasmobranchs, about one-fourth of which are threatened with extinction, but is simultaneously a leading shark fishing nation. Nearshore capture-fisheries, which are multi-gear and target multi-species, catch a diversity of sharks, rays, and skates, sometimes as bycatch (that are still sold). While information on catch rates for such species is available, a nuanced understanding of how fine-scale spatial, temporal and fishery factors affect (by)catch rates is required for their conservation and management. Here, we sampled fishing vessels at Malvan, an important fish-landing site on the west coast of India to record a) species caught, b) species-wise catch size and weights, c) fishing duration and gear, and d) fishing location and use this to extract spatial and temporal properties of fishing grounds using satellite imagery. We then use generalised linear models to understand how habitat, oceanographic, and fishery factors affect elasmobranch (by)catch. We found that species with similar ecological requirements (e.g., few Carcharhinus sp.) are impacted by similar factors, varying across seasons. Oceanographic processes (like productivity) interacted with habitat (like depth) and fishery properties (like fishing effort) to impact bycatch rates. We plan to use our results to initiate fisheries-management dialogues between local fishers and governmental departments.

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ID: 228

Sharks on the Menu: An assessment of the Consumption of Elasmobranchs in Sri Lanka

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Wildlife species serve as an affordable protein source for numerous communities, especially in developing nations. One taxonomic group which is facing continued threats through exploitation for food are the elasmobranchs (sharks and rays). Understanding the drivers of demand for elasmobranchs is pivotal to inform conservation strategies. This research aims to assess restaurant consumption patterns, trends, and drivers, while quantifying volumes and structure in the local value and supply chain in Negombo, Sri Lanka. The evaluation extends from landing site data at the primary fisheries harbour, intermediary vendors, and restaurant consumers. Elasmobranch landings data from 2017 to the present, combined with primary data collected from semi-structured interviews in 2023 are being utilised. Results suggest that domestic consumption through local markets drive the majority of elasmobranch demand for food. However, restaurant demand is minimal and targets international tourists. The leopard whipray (Himantura leoparda) and the milk shark (Rhizoprionodon acutus) are the most traded species (both are listed as Vulnerable on the IUCN Red List due to population decline and fisheries overexploitation). This research illustrates elasmobranch market dynamics, emphasising the impact of local consumption, providing insights for designing effective conservation strategies.

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ID: 229

Marsh frog invasions across Europe: multiple lineages, ecological opportunism, risk and conservation perspectives

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Whereas some biological invasions are well documented, others, more cryptic, are often underestimated despite multiple local warnings. This is the case of marsh frogs for which there is a lack of an integrative overview of its invasion patterns and risks to biodiversity. To fill this gap, we carried out an inter-disciplinary study in phylogenetics, spatial and trophic ecology. We found out that introductions involved dozens of localities and many lineages, originating from three continents, fitting well with the history of importations of live frogs in Europe. They gave rise to nation-wide invasions, facilitated by the wide ecological tolerance of the invaders and resulting in large niche overlaps with native amphibians. Marsh frogs showed also a high trophic opportunism, predating on most native amphibians but also on many invertebrate taxa and threatening some emblematic species. Altogether, these results rank the marsh frogs as one of the most complex invasive amphibian species in the world. They call for the conservation of structured and vegetated ponds to buffer the impact of invaders as well as a complete commercial ban on importation of live water frogs to prevent the opening of the pandora box which may result from new lineage combinations in invaded territories.

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ID: 242

Desert tourism pressure on wildlife around natural water sources

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Water scarcity in deserts is a common cause of human-wildlife conflicts. We studied the impacts of desert tourism on the behavior of wildlife around desert oases.

We placed camera traps during the spring and summer of 2021 at ten oases with high or low desert tourism levels. We found that human disturbance reduced activity and increased nocturnality in local species. Behavioral analyses unveiled heightened vigilance, reduced drinking, and reduced intra-species interactions in the high-tourism sites, even among nocturnal mammals.

In a follow-up experiment, in the summer of 2022, we placed camera traps at six low-disturbance oases and subjected these sites to increased human disturbance in the form of a one-day field party (presence of people with a loudspeaker for 8 hours) and studied the behavior of wildlife around the water sources for three days before, during, and for three days after the manipulation. While all species avoided the water sites during the disturbance, we found species-specific differences in the time it took individuals to revisit the site and return to pre-disturbance vigilance and other behaviors.

ID: 245

Data integration improves monitoring efficiency for threatened tropical mammals

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Conservation initiatives strive for reliable and cost-effective species monitoring. However, resource constraints mean management decisions are often based on data derived from single methodologies, bringing inherent taxonomic or geographic biases. We introduce a data integration framework to identify the most cost-effective approach to monitor threatened mammals, focusing on tigers and principal prey (sambar deer and wild pigs) in Sumatra's largest remaining tropical forest. We applied integrated community occupancy models to combine biodiversity data obtained from unstructured ranger patrols, systematic sign transects and camera trap surveys. Integration of multiple datasets improved the precision of species occupancy estimates, reducing uncertainty by up to 42%, while expanding spatial scope of inference to landscape-scales where interventions are typically staged. Moreover, utilizing multiple survey techniques reduced overall monitoring costs, demonstrating that a modest US$10,000 budget can achieve occupancy estimates of tigers and prey within acceptable levels of statistical precision. Our framework offers a practical solution to overcome resource constraints in species monitoring and address common biases occurring when survey methods are implemented in isolation. This is particularly relevant in the tropics, characterized by a greater number of threatened species and limited monitoring capacity, where timely biodiversity assessments are critical and budgets must be minimized.

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ID: 248

Navigating protected areas (PA) towards an uncertain future’

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In this paper, we are elucidating the effects of a more dynamic process-oriented conservation than the classic static ‘tin-can-conservation’ approach. Dynamic process-based management of protected areas should facilitate migration, biodiversity, and climate adaptation. Climate change in interaction with land use changes is expected to become an increasingly significant driver of biodiversity loss. Most international targets for biodiversity conservation have not adequately considered the impacts of climate change. However, the ‘post-2020 framework’ established by the Convention on Biological Diversity presents a crucial opportunity to address the complex interactions between land use and climate change and its consequences on biodiversity. We need to restructure of our conservation practices and change the underpinning aim of conservation from the static ‘tin-can approach’ that focuses on freezing certain landscape stages towards a more process-based dynamic conservation of biodiversity that facilitates species migration on a long spatial and temporal scale. Unfortunately, the current nature conservation practices are not sufficiently flexible and dynamic to captivate the impacts of climate change or land-use changes in the PA and its surroundings. We will argue that the dynamic approach to nature conservation will enable nature to better captivate the environmental and climatic challenges in the future.

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ID: 252

Pollinators enhance the production of a superior strawberry – A global review and meta-analysis

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This study focuses on the global significance of biotic pollination in strawberry (Fragaria x ananasa), the most economically important soft fruit worldwide. Despite the possibility of self- and wind-pollination, without biotic pollination the rate of strawberry flower pollination rarely exceeds 60%, impacting fruit production. As pollinator populations decline globally, understanding the ecosystem services they provide becomes crucial. Our systematic review, utilizing multilevel meta-analytic models, revealed a concentration of strawberry pollination research in Europe, with limited data for Asia, the largest strawberry producer. Disproportions in research topics were also noted, emphasizing the need for further exploration of pollinator preferences and the co-occurrence of managed and wild bee communities. On average, plants without biotic pollination experience a 25% reduction in fruit weight, irrespective of pollinator species, resulting in an annual global economic loss of $5.36 billion per year for producers. Furthermore, self- or wind-pollinated strawberry plants set 43% fewer seeds than biotically pollinated ones, impacting fruit quality. These findings underscore the vital role of biotic pollination in strawberry production and highlight the importance of sustaining healthy pollinator communities for optimal crop yield and quality. Growers are urged to take action to support pollinators and select optimal cultivars to ensure robust pollination services.

ID: 259

The Current Conservation Efforts and Future Prospects for the Endangered Nubian Ibex (Capra nubiana ibex) in Sudan

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To conserve the endangered Nubian ibex in Sudan, a comprehensive action plan is needed. Understanding the current status, conservation strategy, and relevant laws is crucial. A questionnaire was administered to stakeholders, revealing hunting as the primary threat. Mammals are most at risk, with research centers recognized as the main governing body. Habitat loss, mining, climate change, human activity, and agriculture also pose risks. However, there are no existing plans or initiatives to conserve the ibex, and awareness is lacking. Proposed conservation measures include implementing laws, conducting annual surveys, protecting habitats, establishing breeding programs, and launching awareness campaigns.

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ID: 262

Determining species vulnerability in a mountainous region

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The MontObEO research project implements a standard methodology to monitor biodiversity in the Natural Park of Montesinho (Northeast Portugal). The framework estimates species vulnerability by analysing trends (Mann-Kendall test) over time (2001-2022) of the habitat suitability index from a set of ecological niche models (Maxent) calculated with a time series of remote sensing variables (MODIS sensor). Positive trends are associated with increases in habitat quality; negative trends with decreases in habitat quality. All procedures (e.g.

gathering the satellite data, calculating the MaxEnt models, and analysing the habitat suitability trends) are performed in Google Earth Engine (GEE). We considered five taxonomic groups: vascular flora, amphibians, reptiles, birds, and mammals. We analysed habitat suitability trends over time for each species, taxonomic group, functional group, and potential species richness. We created an R package and a GEE App, where users can use our framework easily and efficiently, and built a spectral library for some vascular flora key species in Montesinho. Our framework is an effective monitoring methodology as it can be adapted to any study area at different spatial and temporal resolutions. This study is funded by national funds through FCT – Fundação para a Ciência e a Tecnologia under the MTS/BRB/0091/2020 project.

ID: 265

Birds and insects diversity in agroforestry systems of the Swiss Jura mountains

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Wooded pastures are a traditional type of agroforestry system consisting in assemblages of cattle grazed pastures and scattered trees. They have a high value of biodiversity because of their environmental heterogeneity due to irregular tree cover that promotes diversity of resources and habitats. Agricultural intensification and climate change threaten the fragile balance of this multifunctional systems. Thus, we aimed at finding what elements of trees and shurbs structural heterogeneity within wood pastures influence community composition and diversity of different groups of species.

We selected 48 wood pastures sites of 20 ha along a gradient of tree density. In each of them, we used remote sensing data, to characterize trees and shrubs structural composition and spatial distribution, and conducted survey of birds, syrphidae and carabidae. We modelled relationships between species composition and diversity and vegetations variables, also incorporating indicators of pastures ecological quality, elevation and exposition, to control for other environmental effects on animal communities.

An intermediate tree density, variation in trees' height and high ecological quality pastures were the main drivers of differences in community specific composition for the three groups of species. The same vegetation parameters influenced species diversity of birds, syrphidae and carabidae but with varying effects.

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ID: 274

How do restored riparian areas differ to remnant habitats in urban and peri-urban landscapes?

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Riparian areas are highly biodiverse landscape elements that provide critical habitats as well as ecosystem services for human populations. However, anthropogenic impacts such as land clearing and habitat fragmentation from agriculture and urban development have impacted riparian ecosystems globally. Restoration via revegetation is commonly implemented to recover biodiversity and ecosystem services in riparian areas, but the ecological outcomes are rarely assessed and may be lacking. Our study compared 10 to 14 year-old revegetation to remnant vegetation in riparian areas of south-eastern Australia to determine if species composition, vegetation structure and ecosystem function (plant recruitment) differed. We also assessed if the amount of surrounding native vegetation, browsers, or soil characteristics influenced native woody plant recruitment. Our results suggest that while revegetated areas may have similar species richness and tree cover as remnant areas, weeds are often dominant and important structural components such as shrubs and ferns, and ecological processes such as plant recruitment, are lacking, possibly as a result of introduced browsers such as deer. Better consideration of all vegetation strata and control of browsers and weeds are likely to be necessary to achieve better revegetation outcomes.

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Sacha Jellinek is a senior researcher at the University of Melbourne, Australia. He has experience restoring agricultural and urban landscapes and monitoring the impacts of climate change and anthropogenic impacts on native floral and faunal communities. He has worked extensively in Australia and Southeast Asia in terrestrial, riparian and marine systems.

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ID: 276

Decision-support tools to consider biodiversity in spatial planning

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Human actions are deeply entangled with all ecosystems, species and associated services. There is huge pressure of land to fulfil multiple interests, such as produce food, provide space for living, work and leisure, or maintain biodiversity and ecosystem services (BES). Often interests are mutually exclusive, leading to conflicts. To stop biodiversity loss, BES need to be considered in every planning process, and fair and transparently weighted against conflicting interests. Scientific decision-support tools can help, but they often lack implementation into practice. Following a literature review on decision-support tools for BES, we evaluated and ranked their characteristics (type, cost, data, resources, etc.). Additionally, we interviewed different practitioners concerning their utilization of tools in four Swiss case studies (urbanization, agriculture, tourism, water). The results illustrate, which tools have the highest potential for practice to account for BES in spatial planning. They also show the uptake of scientific tools by practitioners, as well as their needs and wishes to future decision-support tools. It is essential to improve spatial planning processes and make scientific knowledge better applicable to practice, assuring a better inclusion of biodiversity and natural resources. Our study contributes by ranking current decision-support tools and studying needs and future expectations of practitioners.

ID: 281

A multitaxonomic assessment of Natura 2000 effectiveness across European biogeographic regions

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The Natura 2000 (N2K) protected area (PA) network, spanning 18% of the EU's land area, is a critical tool for mitigating biodiversity loss in Europe. However, uncertainties persist regarding its effectiveness across diverse taxa and regions. To assess this, we employed propensity score matching accounting for confounding variables associated with the non-random placement of PAs in the landscape. The analysis focused on 1,769 priority species, encompassing mammals, birds, amphibians, reptiles, arthropods, fishes, molluscs, vascular, and non-vascular plants, specified in the EU's Birds and Habitats Directives. Results indicate that N2K PAs host significantly more priority species than non-protected areas, but this varies across regions and taxa. Alpha diversity and diversity within specific groups were higher within PAs, except in the Boreal region. Beta diversity was generally higher within N2K PAs, and gamma diversity exhibited the highest values inside these areas, with exceptions in the Boreal and Atlantic regions. Consequently, the planned expansion of the N2K network, aligned with the European Biodiversity Strategy for 2030, should prioritize areas in the southern part of the Boreal region, emphasizing regions with high species diversity among amphibians, arthropods, birds, mammals, and vascular plants, currently underrepresented in the N2K network.

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ID: 282

Conservation priorities for functionally unique and specialized terrestrial vertebrates endangered by biological invasions

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Invasive alien species (IAS) are a major threat to biodiversity worldwide, causing declines in native populations and species extinctions, which can ultimately lead to the disruption of ecosystem processes. Implementing conservation actions to mitigate this threat requires identifying the most vulnerable species and areas. However, to date, prioritization methods rely mostly on taxonomic diversity and fail to consider the functional role of threatened species. We thus developed the FUSE-IAS score, combining species' functional uniqueness and specialization with extinction risk and IAS impact to identify functionally critical species vulnerable to IAS. Applying this method to global terrestrial vertebrates, we identified more than 1,300 species that were of high functional value but at high risk of extinction, possibly because of IAS. Those priority species were spread all around the world with hotspots varying according to the taxonomic group: birds were mostly insular and coastal species, whereas amphibians originated mostly from Central America and Madagascar. This approach responds to global conservation initiatives that highlight the need to prioritize species and sites to mitigate IAS impacts, emphasizing the importance of considering functional value in conservation strategies.

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ID: 283

Predation by the European bee-eater (Merops apiaster) has species-specific effects on the ecology and evolution of bumblebees

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Predation is a major ecological force, but its effects on pollinators such as bees have rarely been studied. In Germany the European bee-eater (Merops apiaster) is a main predator of bumblebees and might impact their abundance and traits related to predation risk, e.g. body size. Here we investigated if the presence of bee-eaters decreases the abundance and body size of Bombus lapidarius, Bombus terrestris and Bombus pascuorum compared to nearby predator-free sites. Our results showed that bee-eater sites harboured significantly less and smaller bumblebees compared to predator-free sites, although the effect of the bird appeared to be species-specific. Furthermore, we tested if a reduction in the abundance of B. lapidarius and B. pascuorum at bee-eater sites is also reflected in a lower effective population size (Ne) and genetic diversity (expected heterozygosity, He) using genome-wide SNP markers. Indeed, B. pascuorum but not B. lapidarius possessed a significantly lower Ne and He at bee-eater sites. Overall, the presence of bee-eaters seems to influence the ecology and evolution of bumblebees, albeit not uniformly. Counteracting the effects of a high predation pressure by appropriate management of bee habitats will be especially relevant in the future as bee-eaters are among the winners of global warming.

ID: 285

Inclusion of fossil data into ecological niche models to assess the effect of changing climate on biodiversity

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Ecological Niche Models (ENMs) may suffer from niche truncation when occurrence data describe environmental gradients that represent only a small subset of the fundamental niche [1-3]. This study evaluates the effect of adding fossil data to modern occurrences to reduce niche truncation in 38 IUCN threatened terrestrial mammals. We built two sets of ENMs: one with modern data and another combining modern and fossil data. Models were projected over current and 2080 climate change scenarios, calculating range net change (RNC) values for both model groups, as well as their difference (ΔRNC). We also calculated the percentage increase in niche width granted by adding fossil data (%IGFD). We assessed the relationship between these two metrics through a linear mixed model with ΔRNC as the response variable and %IGFD as the explanatory variable. Finally, two Random Forests models were used to examine how the climates added by fossil niche influence species outcomes under different climate change scenarios. The results highlighted that fossil data consistently broaden species climatic niches. In addition, pooled ENMs for species where fossil data provide niche with colder and wetter climates predict worse future outcomes than species where fossil data add warmer and drier climates.

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ID: 286

A framework to quantify the vulnerability of insular biota to global change

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Islands represent ecosystems with unique biogeographical features, so understanding and quantifying the vulnerability of insular biota to global change demand comprehensive understanding and specific approaches specifically design for insular biota. In this study, we demonstrate the challenges associated with the uniqueness of insular biota, worsening their vulnerability to threats, and we underscore the lack of attention paid to insular biota in the global science-policy interface. To overcome those issues, we introduce a new framework for quantifying the vulnerability of terrestrial insular biota in terms of their exposure, sensitivity, and adaptive capacity to multiple threats. This framework uses markers that reflect the characteristics of island systems, from the population to the community level. Our framework involves four steps, from identifying the scope of the vulnerability assessment to transferring vulnerability measures into conservation actions by selecting the most appropriate markers to compute vulnerability. We demonstrate the need and urgency to deploy this framework to guide evidence-based decisions for conserving the unique and fragile biodiversity associated with insular ecosystems.

ID: 293

From experience to action: nature-relatedness mediates between nature exposure and pro-conservation behaviour intentions in adolescents and adults

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Addressing the global biodiversity crisis requires engagement from current and future generations, but the phenomena of generational amnesia and extinction of experience pose threats to conservation. Understanding how knowledge and nature exposure influence conservation behavior is crucial, with a notable gap in intergenerational empirical research. In two German online surveys, we explored differences between adolescents (15-18 years) and adults (>18 years) in nature exposure (frequency of greenspace visits), knowledge (familiarity with species and identification skills), nature-relatedness, and pro-conservation intentions. Both generations reported similar species familiarity and nature exposure. Yet adults exhibited higher identification skills, nature-relatedness, and pro-conservation intentions. Generally, the identification skills decreased from plants to birds to butterflies. Visit frequency significantly influenced nature-relatedness and subsequently, pro-conservation intentions in both groups, while knowledge was not significantly related to pro-conservation behavior intentions. These findings highlight the importance of counteracting generational amnesia by improving species knowledge among adolescents. Moreover, our results underscore the significance of nature exposure for fostering a strong connection with nature, irrespective of age. Urban areas can play a crucial role in engaging people in pro-conservation actions through integrated approaches that provide access to natural areas, opportunities to connect with nature and environmental education.

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ID: 298

Is eDNA metabarcoding an effective new approach for the monitoring of mine site restoration? Tips and tricks from 6+ years of research

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Monitoring is critical to mine site restoration as it enables tracking of restoration trajectories, adaptive management, and assessment of whether goals are reached. However, traditional monitoring approaches are time-consuming and expensive, and so are rarely undertaken effectively. Application of molecular tools has made important contributions to understanding restoration success, and eDNA metabarcoding is a relatively recent tool used to monitor ecosystem recovery. Here, I will discuss our application of eDNA metabarcoding to monitoring the recovery of everything from soil microbes to mammals across mine sites in Western Australia. Findings from numerous studies suggest that DNA metabarcoding of diverse substrates can increase the scope of biomonitoring but requires careful consideration of survey design.

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ID: 305

The functional role of rare species

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Biodiversity provides services and functions that humanity and many living beings rely on. These include nutrient cycling, carbon storage, microclimate regulation, food production… If the positive role of biodiversity for ecosystem functioning (BEF) is now well established, a tension remains between two important corpus of ecological research. On one hand, BEF literature gives a central importance to the raw number of species, eg. the more plant species seeded, the higher the biomass production, and even more so over time. On the other hand, functional ecology, focusing on functional traits and biomass weighted community means, tends to demonstrate the major role played by a few dominant (plant) species, while struggling to quantify the functional role of rare ones. In the current ecological crisis, it is crucial to reconcile the two perspectives, so as to give clear, concrete, and operational ideas about species functional contributions and better manage, restore, and protect the eroding services that nature provides. Using a dynamic community model, we highlight the importance of time scales considered. BEF makes broad statements about the outcome of ecological assembly, whereas functional ecology characterizes the end point of assembly, partitioning the current environmental impacts of species.

ID: 308

The role of individual predator traits in wolf feeding behavior

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Among the physical, behavioral, and environmental drivers of carnivore feeding patterns, those associated to predator individual traits are among the most difficult to study. The growing field of faecal DNA-based diet analysis combined with genotyping has the potential to increase the feasibility of large-scale diet analyses related to individual predator traits.

We investigated the use of moose and roe deer with prey DNA data from 1478 wolf scat samples and examined the proportion of time spent scavenging with carcass data from 39 GPS-collared wolves in Scandinavia. Results supported predictions of more scavenging and higher use of roe deer while lower use of moose for wolves that were expectedly less skilled hunters. We observed prey use variability at the landscape level, indicating dietary responses to changes in wild ungulate abundance. Wolves showed a low extent of scavenging (6-15%), which was related to season, social affiliation, inbreeding, and co-occurring species densities.

The observed patterns underline the opportunistic nature of wolves' behavior and show support for variation at the individual level in relation to intrinsic traits. Adding to a small body of literature, our study advocates a line of research looking into environmental and behavioral traits related to the individual condition and experience.

ID: 320

How conservationists may positively affect mass and social media framing of biodiversity

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In our vastly digitized world, the media has gained the capacity to deliver information to a global audience within a very short time. Media framing can either promote or discourage tolerance toward wildlife. We investigated how potentially harmful species were framed by online newspapers and social media. The information delivered by the media was highly biased toward a sensationalistic view of those species. However, we highlight how communication interventions by conservationists allowed positive and more balanced messages to enter the media dialogue and resonate globally. Our results suggests that a rapid and massive communication strategy may amplify pro-conservation messages in the global media, ultimately supporting wildlife conservation. We have devised guidelines for journalists and conservationists to enhance communication on human-wildlife conflicts. We recommend that conservationists increase their presence on successful channels for public engagement, such as social media, podcasts, or visual art. Utilizing visual communication along with plain and simple language is essential to make scientific content accessible to journalists and the public. There is a need for a greater focus on positive messages; conservationists should inform the media about successful conservation stories and positive interactions with problematic species.

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ID: 321

Between Nature, Biodiversity, and ecosystem services – what is the focus of our conservation efforts – a philosophical approach

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'Nature' is an opaque term. Consequently, the term 'biodiversity conservation' has replaced 'nature conservation' in most conservation contexts. Yet 'biodiversity' is also ambiguous and is often preceded by the qualifier 'natural' to attain meaning. Here we aim to analyze the terms 'nature', 'natural', and 'biodiversity' within the scope of applied moral thinking within the frameworks of both intrinsic and anthropocentric schools. We explore valuation in both of theses schools in a three-level scheme - ultimate value, mid-level principles, and the lower-level case specifics. The ultimate value of the intrinsic school is naturalness, guided by three mid-level principles – autonomy, integrity, and resilience, that reflect structural and functional diversity. In this scheme, biodiversity is only a lower-level case-specific metric for assessing naturalness and holds value only if qualified by 'natural'. The ultimate value of the anthropocentric school is ecosystem services and its mid-level principles are productivity, utility, sustainability, and cultural products – all weakly linked to biodiversity. Moreover, in both schools biodiversity can only be quantified through many case-specific proxies and cannot be projected onto a unified scale. Consequently, biodiversity can only be an umbrella term for the lower-level case specific measures and is analogous to homeostasis proxies in medicine (e.g., blood attributes).

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ID: 323

Long-standing deadwood – the impact of substrate origin on wood-inhabiting fungal communities.

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Long-standing deadwood is the rarest wood substrate in Central Europe (roughly less than 4% of trees stay standing dead compared to windthrows and breaks); nevertheless, it is commonly logged for safety reasons, even in protected areas. Wood-inhabiting fungal communities were monitored on 60 spruce logs in different decay stages divided into two classes – (a) uprooted and (b) fallen snags, trees that had remained standing dead (several years to a few decades) before falling. Fieldwork was carried out in 2021 in the Boubín primeval forest (Šumava Mts., Czechia). On each studied log, we conducted both traditional fruitbody-based and eDNA-sequencing sampling. Our results show that the fungal assemblages differ between both classes of the studied trees. The species composition differs on fallen snags even after decades of decay. The fallen snags served as the preferred substrate for a significantly higher number of threatened species, such as the extremely rare Phellinidium ferrugineofuscum, rediscovered in Czechia after 25 years. Our findings suggest the need for a targeted selection of objects when managing deadwood in forest stands. Not only the total amount of deadwood but also its diverse structure and origins represent critical factors for the biodiversity of many dead-wood-dependent groups of organisms.

ID: 325

Modelling the occupancy of forest grouse at multiple spatial scales to improve habitat management in the boreal landscape

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The characteristic spatial scale at which species respond to their environment is unclear. Limitations in understanding the species use of the landscape arise from analyzing pre-defined spatial scales when constructing species distribution models. This study focuses on determining the spatial scale of habitat selection for forest grouse in the boreal landscape and evaluates the benefits of multi-scale modeling for guiding habitat management. To assess how grouse occupancy is affected by forest characteristics at multiple spatial scales, we fitted Generalized Additive Mixed Models linking stand-level grouse presence/absence from Finnish wildlife triangle census data with forest composition and structure from Airborne Laser Scanning and satellite data. We estimated the effects of predictor variables aggregated at three spatial scales reflecting the species use of the landscape at local (stand), home range (1-km) and regional (5-km) scale. We found that the spatial scale affected the predictive capacity of the occupancy models, and the characteristic scale of habitat selection was species-

specific, with forest structure outweighing compositional diversity in predicting grouse occupancy irrespective of the scale. Our findings suggest that modeling grouse occupancy at multiple spatial scales can guide forest managers towards effective habitat management, emphasizing the need for an integrated multiscale approach in conservation actions.

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ID: 332

The response of insects to anthropogenic threats: a global assessment of experts

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The last few years have seen an increasing interest in insect conservation, with concern over severe declines for some taxa and regions, but variable trends elsewhere. Key to understanding population trends is identifying how insect populations respond to changes in the intensity of anthropogenic threats. The Global Insect Threat-Response Synthesis (GLiTRS) project is integrating available evidence for insect population trends and their drivers into a holistic picture. However, for many regions and taxa, existing field data are sparse or non-existent, making it difficult to predict – let alone measure – changes. To fill these data gaps, we developed an ambitious expert elicitation survey, based on the Delphi-technique, to gather expert opinion on the response of different insect taxa to 18 major global threats. The survey was sent to over 300 entomologists, in six different languages, with expertise covering 25 insect Orders. I will present the results of this survey and how the GLiTRS project will use them to inform a broader synthesis of evidence for insect population trends – and the threats that are driving them – globally.

ID: 333

Perceptions on climate and biodiversity during an energy crisis on social media

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Global environmental crises, such as biodiversity loss and climate change are intertwined with other social and political dimensions underpinning sustainability. Europe is experiencing an energy crisis, sparking debates over the role of climate and biodiversity policies. Exploring discussions on social media may contribute to understand saliency of events and related narratives forming public opinions. We explored users' perceptions towards climate and biodiversity issues in the context of Europe's energy crisis on X (former Twitter) in 2021-2023. Temporal spikes corresponded to geopolitical events (e.g., war) and socio-economic issues (e.g., living costs). Attention towards climate and biodiversity issues was marginal, and mostly related to implications of environmental policies in the context of the energy crisis (e.g., transition towards renewable energy). Different phases discussed different events to construct support for or against environmental policies. Geopolitical events were used to elicit positive hopes for an accelerated energy transition. However, events on socio-economic issues sparked negative sentiment towards environmental policies (deemed responsible for the crisis) and on the crisis consequences on environmental agendas. Discourses on social media may be reinforcing the conception of dimensions underpinning energy crisis to be isolated, constructing and further exacerbating tensions between solutions which may favor one dimension but compromise another.

ID: 336

Vocal characterisation and mapping of the naturally hybridised gibbon in central Borneo, Indonesia

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Acoustic research is a rapidly growing field with high conservation potential. Arboreal and inconspicuous primates like gibbons (Hylobatidae), make ideal candidates for auditory sampling. Gibbon songs are species-specific, where mated pairs produce a coordinated duet song, the most genetically conserved vocal phrase of their repertoire. The remote rainforest of Central Borneo harbors the only Bornean hybrid gibbon population (Hylobates albibarbis x Hylobates muelleri). Three acoustic methods, triangulation, passive, and active bioacoustics, were used to sample 18-listening posts across a 10,000-ha stretch of primary dipterocarp rainforest. Three co-occurring species, H. muelleri, H. albibarbis, and the hybrid were found from vocal analysis. Great calls show temporal variation at an inter-species level, with two temporal parameters able to distinguish species and hybrid sub-types from each other. Five variations of hybrid great calls were found, with structural variations found across small-scale geographical gradients. Hybrid gibbons showed selection for dipterocarp and plantations habitat types and showed avoidance to all three-heath habitat sub-types. With increasing anthropogenic pressure for resource extraction in the research area, this research is vital to build a robust acoustic database for the monitoring of the only hybrid gibbon population in Central Borneo, with this study the first conducted in over 20 years.

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ID: 338

Pl@ntBERT: leveraging large language models to enhance vegetation classification through species composition analysis

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Biodiversity is under pressure, as many disturbance events threaten natural areas. Therefore, habitat distribution mapping is increasingly relevant for monitoring their statuses. It aims to quantify the mathematical relationships between predictors and occurrences of categorized locations. Thus, advanced numerical technologies are more required than ever. They help summarizing our knowledge of species assemblages. Herein, we present Pl@ntBERT, a framework that encodes vegetation patterns and enhances their classifications. This tool leverages computer science and linguistic processes based on transformers. In particular, the pipeline implements two artificial intelligence tasks: fill-mask and text classification. Firstly, masked language modeling gets a statistical understanding of vascular plant compositions. Then, subsequent training assigns a label to sentences describing phytosociological relevés. The fine-tuning of a pretrained foundation model on in-domain words shows significant upgrade and clearly outperforms previous state-of-the-art methods. The software pushes the accuracy score on a database containing millions of European surveys to 92.48%. Finally, our results showcase that flora is a strong marker of ecosystems and doesn't need to be coupled with environmental data to train neural networks. The proposed application has a vocabulary covering over ten thousand organisms. This approach offers a methodology for advancing our comprehension in community ecology and conservation biology.

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ID: 341

Population trends of terrestrial mammals in community forests of Indonesian Borneo

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Anthropogenic activities threaten tropical biodiversity, particularly in the Rungan-Kahayan landscape of Central Kalimantan, Indonesian Borneo. This region comprises largely-unprotected forest habitats, and has experienced mounting anthropogenic pressures from logging, oil palm and gold mining. Over the past decade, social forestry has emerged as a way to conserve Indonesia's forests, while bringing tangible benefits to people. Yet, studies assessing wildlife population trends and the underlying stressors in these socioecological systems are scarce. We studied the occurrence of terrestrial mammals and identifying drivers of population variation at a landscape level in Rungan-Kahayan via intensive camera-trapping inside and outside social forestry areas. We combined this information with mapped environmental and social covariates using Multi-Species Occupancy modelling to examine their influence on wildlife at a community and species level. Social forests supported substantial mammalian diversity and species occupancy tended to be greater with increasing distances from gold mining sites, limited rural infrastructure, reduced human population pressures, closer to forest edges and high aboveground forest biomass. Environmental factors had an overall higher impact on species throughout the landscape. Understanding how these socioecological predictors influence biodiversity in social forestry systems will help us evaluate whether these interventions bring co-benefits to wildlife and people in the region.

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ID: 345

Contribution of agricultural fields for conservation of arthropod populations

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The intensification of agriculture has been identified as one of the main causes of arthropod declines. To reverse this, changes in farming practices and management of surrounding habitats should occur, but a key challenge is identifying which changes in management approaches are effective in restoring biodiversity. Therefore, this study examines arthropod abundance and diversity in different agricultural habitats and management types. Arthropods were sampled three times in spring and summer of 2022 with pyramid traps in 120 sites in Buijtenland van Rhoon (Netherlands). These sites included a variety of crops as well as semi-natural habitats. Our study showed that on average the abundance and diversity of arthropods of several taxa was lower in crop fields compared to semi-natural habitats. Interestingly, in crop fields most variables related to field management, such as herbicide applications, amount of fertilizer usage and days after ploughing did not show any significant relationship with arthropod abundance or diversity. Within semi-natural habitats, number of days after mowing was positively related to arthropod abundance of several taxa and Hemiptera family diversity. Overall, our findings show that some crop species can strongly contribute to arthropod abundance and diversity, while management was only related to arthropod communities within semi-natural habitats.

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ID: 346

How many wolf ecotypes? The urgency of conserving biodiversity within species

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The ecological effects of within-species differentiation (i.e. biodiversity within species) may be as consequential for whole ecosystems as those of biodiversity of species, despite the latter having been a foremost concern of conservation biologists. Concepts used to define biodiversity within species include subspecies, ecotypes and Evolutionarily Significant Units (ESUs), conservation units and management units. Ecotypes may be defined based upon concordant distributions of genetic, morphological, behavioural and ecological characteristics of organisms. We focus on all such characteristics for North American and Eurasian wolves, which originated from Beringia following the end of glacial maximums (likely in multiple events) and expanded into their contemporary wide range. Our results demonstrate that wolves are not panmictic and that spatial variation in prey specialization influences wolf gene flow, morphology, behaviours, and determines ecotypes. The apparent paradox of differentiation in a species with immense potential for gene flow is therefore explained by understanding the trophic ecology of wolves. Hence, we envision a future for wolf conservation, involving the study of genetic and ecological diversity, and the determination of ecotypes requiring safeguarding. Finally, we suggest that our wolf results might be transferrable to other terrestrial species whose differentiation and ecological role should also be of conservation concern.

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ID: 349

Surveying lichens with airborne eDNA

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Biodiversity declines rapidly across the globe. Accurate information about the state of biodiversity is fundamental for understanding the mechanisms behind the decline and for planning conservation. Environmental DNA (eDNA) is an efficient way to obtain such information.

We develop methods for the use of airborne eDNA to map the diversity of lichens, an important and species-rich group. We utilize a unique archive of air filters collected by the Swedish Defence Research Agency. We have sequenced DNA from weekly air filter samples collected in 1974-2022 in Kiruna, northern Sweden. This represents one of the world's most extensive time series of biodiversity data.

We found airborne eDNA to be a promising method for surveying lichens. We compared the eDNA data to results from a traditional field survey, and found that most lichen taxa observed in the field were present in the eDNA. Moreover, the data archive provides a unique chance to examine temporal trends in lichen diversity and abundance: we found that both annual and long-term trends are present in the data. Next, we aim to examine the long-term trends (1974-2022) in more detail, link them to changes in climate, and identify which lichen functional traits mediate their response to climate change.

ID: 351

Dealing with uncertainty and conflicting objectives in the control of invasive species

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Invasive alien species (IAS) are a major cause of biodiversity loss, impacting endemic species via predation, competition for resources, and more. There are numerous approaches to control IAS, but their success varies depending on the target species and management context. A formal evaluation of different methods is needed when dealing with limited resources and ethical implications of lethal and non-lethal control methods.

This study focused on control methods for Trachemys scripta, one of the 100 most invasive species according to the IUCN. The presence of T. scripta can have negative ecological impacts to native European pond habitats, particularly through competition with the European pond turtle (Emys orbicularis).

Our project assessed methods for T. scripta control, in terms of biological effectiveness and costs. For effectiveness, we projected T. scripta population dynamics under different control methods, using both data from previous projects and novel data. Using the modelling results, we estimated the total management costs. I will present these results (finding fyke traps to be the most cost-effective) and propose further questions such as animal welfare and dispersal.

Through this assessment, we facilitate rational planning, balancing successful control actions and financial constraints against biological evidence, allowing optimal protection of native species.

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ID: 353

The role of protected and conserved areas in preserving bicultural diversity

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Biocultural diversity represents the variety of integrated relations between the natural and cultural systems. Even though Protected and Conserved Areas (PCAs) are paramount for conserving biodiversity, little is known about their importance for safeguarding biocultural diversity. The success of PCAs is contingent upon their ability to preserve both biological and cultural elements, and thus rigorous evaluation methodologies that can address both aspects are necessary. To address the knowledge gap of PCAs' effectiveness in preserving biocultural diversity, this study evaluates the role of PCAs in conserving medicinal plants in one of the most biocultural diverse countries in the world - Brazil. Based on a literature review, we assessed 1,500 plant species with recorded medicinal use and evaluated the effectiveness of different types of PCAs, including Protected Areas, Indigenous Territories, and Local Communities in conserving those species. This work raises the need for an integrated conservation paradigm that acknowledges and prioritizes the inseparable connection between biological and cultural diversity within the PCA framework, thereby advancing the broader goals of global conservation initiatives.

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ID: 359

Skylark abundance in two different agricultural landscapes: exploring the interplay of habitat composition, crop diversity, and in-field factors

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European farmland serves as a crucial habitat for many organisms, but the transition from extensive to intensive agriculture has led to habitat homogenisation impacting biodiversity, including farmland birds. This study focuses on a farmland specialist ground-nesting insectivorous bird, the European Skylark (Alauda arvensis), in Slovakia and Austria, unravelling its abundance in different landscape structures provided by these countries. In this "natural experiment", bird censuses, food supply assessments, and vegetation structure analyses were carried out. Austria showed significantly higher Skylark local abundance compared to Slovakia, persisting throughout the season. Skylark numbers positively correlated with increasing crop number, highlighting the significance of the habitat composition. Food availability surged with more crops, emphasizing diverse crop compositions' role in fostering a stable food supply for farmland birds. Interestingly, Austria showcased increase of Skylark abundance with food supply due to suitable vegetation, while in Slovakia, single-crop dominance obviously challenged possibilities of foraging and nesting. The results underscore habitat composition, crop diversity, and in-field factors' pivotal roles in shaping Skylark populations. Slovakia-Austria differences highlight the need for context-specific conservation, reducing field sizes and reintroducing non-productive areas on one side and supporting sustainability of high-quality non-productive areas and diversity of cultivated crops on the other.

ID: 371

Assessing sampling methods for monitoring wild bees (Hymenoptera: Apoidea: Anthophila) in sown flower strips

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In the past decade, the global declining trend in pollinator populations has stimulated an increase in field studies of pollinating insects. Wild bees are the most studied and sampled group both because they are very effective pollinators and because they are considered an excellent indicator group in different ecosystem settings. Widely used sampling methods for wild bees are hand netting along transects (HN), observation plots, and as passive methods, pan-traps (PT), trap-nests (TN), Malaise-traps, and vane-traps. In our two-year experimental study, the wild bees were monitored using HN, PT and TN in non-productive peri-urban areas recently converted to retention basins along river belts, where flowering plants were sown for the benefit of pollinators. We evaluated how different methodologies can complement each other to describe the wild bee community, and how they favour the representation of certain traits, such as body size, floral preferences, nesting habits, and solitary, social or parasitic life. We highlighted that while observations on the visited flowers during HN give general information on trophic preferences, TNs provide specific information about pollen preferences. Therefore, the two methods allow for elaborate more detailed pollination networks useful to evaluate the effectiveness of environmental ameliorations to enhance local bee biodiversity.

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ID: 383

Restoring beyond species diversity - restoration effects on taxonomic, phylogenetic and functional diversity

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Maintaining and restoring biologically diverse and functional ecosystems are highly prioritised in the face of climate change. The relationship between biodiversity and ecosystem functioning is gaining more recognition. Addressing biodiversity beyond merely taxonomic diversity, including functional and phylogenetic diversity facilitates connection to ecosystem functioning. Here, we evaluate the decadal effects of restoration aimed at an umbrella species, the white-backed woodpecker, on taxonomic, functional and phylogenetic diversity patterns of saproxylic beetles. We compare stands that were restored ten to twenty years ago to non-restored stands and historical white-backed woodpecker habitats acting as restoration target stands. We found that restored stands show similar levels of taxonomic, functional and phylogenetic diversity to that of non-restored stands while not reaching the same levels as the restoration target stands. This means that restored stands support a lesser functional trait space and phylogenetic lineages compared to target stands. We stress that restoration should provide a diversity of structures over time to support more functionally and phylogenetically diverse species assemblages. Our results stress the importance of identifying a target level when assessing restoration outcome.

ID: 387

Predicting the range-shifts of woody plant species: consequences of gray squirrel personality for the dispersal of novel seeds

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To adapt to climate change, plants may shift their ranges to meet optimal climate conditions, relying on animals such as rodents for seed dispersal. As plants migrate, the first dispersing seeds face individual dispersers that may not have previously encountered that seed (i.e., novel seeds). Therefore, plants' ability to track changes in climate depends on the responses of seed-dispersing animals to novel seeds. Since recent work has shown that small mammal personality affects seed dispersal, we ask whether some individuals are more likely to disperse novel seeds. We conducted a citizen science field experiment in northeastern USA spanning the northern range limit of several hickory (Carya) and oak (Quercus) species and focused on the gray squirrel (Sciurus carolinensis), a major seed disperser in this system. With help from over 100 high school and undergraduate students we trapped, marked, and tested the personality of squirrels and offered six species of tagged hickory and oak seeds with cameras recording squirrel seed selection. Comparing interactions with novel versus familiar seeds, we tested the effects of personality and seed novelty on squirrels' dispersal behavior. Squirrel personality and seed novelty mediated dispersal patterns, highlighting the importance of seed disperser personality for predicting plant range expansions.

ID: 391

Can olive groves support bat conservation during winter? A case study from Tuscany, Italy

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Bats contribute to important ecosystem services such as the suppression of pest insects, but are highly threatened by agricultural intensification and climate change. This study examines the impact of rising winter temperatures on bat activity in olive agroforestry systems in Tuscany, Italy. Across 12 organic olive groves and 4 related semi-natural habitat sites in our study area, we used passive acoustic monitoring to investigate their role as activity and food reservoirs for bats during December 2023. Within three consecutive nights per site, we recorded 159 bat passes from 8 species, suggesting hibernation arousal for 7 of them. The average nightly recording temperature was 13.5°C, with the lowest recordings measured at 7°C. Species-specific temperature thresholds were identified, and comparatively reduced activity in common urban species was observed. Further, our results indicate higher winter bat activity in olive agroforestry systems with low surrounding semi-natural habitat (SNH < 10%) compared to those with high semi-natural habitat (SNH < 50%). Our results highlight the disturbance effects of increased winter temperatures for hibernating bats at local and landscape scales, with implications for their conservation and pest control services, as well as the potential of organic olive groves as winter reservoirs under future climatic conditions.

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ID: 392

Biodiversity conservation priority-setting: Tanzania's Key Biodiversity Area system and its potential for strengthening vertebrate conservation

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Identifying and protecting the most important places for nature is crucial if the Kunming-Montreal Global Biodiversity Framework (GBF) goals are to be met. The Key Biodiversity Area (KBA) Programme supports identification, mapping, monitoring and conservation of 'sites that contribute significantly to the global persistence of biodiversity', based on quantitative thresholds collectively known as the KBA Standard. KBAs are indicators of Targets 1, 2 and 3 in the GBF.

Tanzania and Zanzibar's KBA network currently comprises 148 sites, yet most of these are legacy sites such as Important Bird Areas that must be assessed against KBA Standard criteria to

be confirmed. The nation is home to 1,424 endemics and the highest number of threatened species on mainland Africa.

We explore to what extent Tanzania's threatened and endemic biodiversity is covered by the current KBA and Protected Area (PA) systems, and what biases and gaps exist. We identify numerous terrestrial vertebrates likely to qualify as KBA Standard trigger species based on the proportion of their range within 117 mapped sites, and find 123 Tanzanian endemics with 95% or more of their range outside these sites. Endemic freshwater fish are notably unprotected, and Pemba Island identified as in urgent need of KBA delineation.

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ID: 394

The conservation value of disproportionately consequential individuals: results from an 8-year field experiment on small mammal seed dispersers

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As conservation biologists, we rarely consider the role of individuals in affecting ecosystem functioning, and thus their importance for conservation is often overlooked. Our goal here is to show how some individuals with certain behavioral traits are disproportionately consequential in affecting ecosystem services, such as the key service of seed dispersal provided by small scatter-hoarding rodents. We will report the results of an 8-year field experiment conducted in Maine (USA) focused on the effect of individual personality on seed dispersal, wherein we trapped and behaviorally phenotyped 3764 individuals of 10 different small mammal species and tracked more than 10,000 seeds predated or dispersed by these individuals. Through the results of four key experiments focused on all phases of the seed dispersal process, from seed choice to the final fate of the seeds, we show how some individuals bear disproportionate consequences for ecosystems by dispersing more seeds further distances and to more optimal sites for germination. We will conclude by highlighting the conservation implications of these findings, underscoring some conservation measures that can maximize the preservation of behavioral diversity of wild small mammal populations and thus the associated ecosystem services.

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ID: 397

Bottleneck legacies at the whole-genome level: reduced genetic diversity, inbreeding and genetic load in the Italian wolf population

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Preserving genetic diversity and adaptive potential, while avoiding inbreeding depression, is crucial for maintaining thriving natural populations. Even if a population is currently undergoing a demographic increase, the consequences of past bottleneck events at the genomic level must be addressed. The Italian wolf is a paradigmatic case. After being on the verge of extinction at the mid of the 1970's, it naturally recolonized most of the Italian peninsula aided by legal and habitat protection. Whereas demography suggests a positive trend, a comprehensive understanding of the genomic consequences of its historical bottleneck is lacking. To fill this gap, we sequenced the whole genomes of 13 individuals from Central Italy and conducted comprehensive population genomics analyses, comparing them with those from the highly-inbred Scandinavian and Isle Royale populations. According to our findings, the Italian wolf population exhibits comparatively low levels of genetic diversity, underwent a significant reduction in Ne, reports not-so-recent signatures of inbreeding, and carries a non-negligible genetic load. These findings underscore that the wolf in Italy, despite its recent population increase, is still potentially susceptible to population reduction and environmental changes, emphasizing the importance of considering key genetic parameters in addition to demographic data to inform conservation and management.

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ID: 401

The importance of education about pollinating insects for their conservation

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Development and introduction of pollinator conservation strategies requires education of society. The Apiculture Division is the largest Polish facility devoted to research on pollinators of both managed and wild bee species. The highly qualified staff of the Division constantly conducts popularization activities in order to emphasize the importance of pollinators' conservation. To increase the effectiveness of these activities, it was necessary to enrich them with courseware and an educational infrastructure. The project of "Centre for information and improvement of knowledge about pollinating insects" includes the preparation of new, educational nesting structures, beehives, an area with nectariferous plants, and a playground for children, along with media campaign for the entire project. The recipients of the activities represent various social groups, e.g. children, students, allotment holders, farmers, beekeepers, as well as members of local governments responsible for managing urban greeneries. The effects of the project, such as the number of held classes, the number of trained people along with an analysis of the age structure, gender distribution, education level, data on evaluation of the classes are analyzed and will be disseminated i.a. as reports.

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Ecological networks in an Alpine glacier ecosystem

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Glaciers host a still underexplored biodiversity of cold-adapted organisms. Even less is known on the ecological interactions among them. However, their understanding is crucial for unravelling the functionality and stability of glacier ecosystems. This study qualitatively assesses the biodiversity and trophic interactions of the Forni Glacier (Central Alps), one of the most extensively studied alpine glaciers. By reviewing the existing literature and incorporating novel data, we show the importance of allochthonous organic matter inputs and primary production mainly by Cyanobacteria. Springtails (Collembola) play a key role in the trophic network, connecting the microbial food web with ice-dwelling predators: ground beetles (Nebria castanea) and spiders (Linyphiidae, and Pardosa saturatior). Tardigrades (Cryobiotus klebelsbergii) dominate cryoconite holes communities. This simple ecological web highlights the fragility of supraglacial ecosystems, which are undergoing rapid transformations due to climate change.

Despite the extensive research on Forni, our current understanding allows only for a qualitative description of the interactions. Future studies should prioritize quantifying the energy and matter flow in glacier ecosystems, while extending this approach to other glaciers to assess the consistency and geographical variations of ecological networks. Such work is essential for assessing future losses of biodiversity and ecosystem services due to glacier retreat.

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ID: 408

A gap in media communication of human-bear conflicts management

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Wildlife conservation, especially in the era of digital media, hinges on communication. In the context of human-wildlife conflicts involving large carnivores, it can strongly influence public perception and tolerance towards the species involved. In this study, we evaluated media coverage of the case of M49 (a.k.a. 'Papillon'), a brown bear from Trentino, Italy. M49 elicited great public attention between 2019 and 2021 after escaping twice from the Casteller Wildlife Center, where it was held captive for displaying problematic behavior. We collected media reports (n=311) from Google News and carried out a content analysis, identifying significant gaps in communicating choices regarding problematic individuals. Only 1.7% of reports provided science-based motivations for management actions (i.e. capture, sterilization, captivity), potentially triggering the spread of misinformation and mistrust towards institutions and professionals involved in wildlife management. Pro-conservation messages were infrequent (19.9%), and stakeholder representation was skewed, with politicians largely being the most portrayed category in the media. Ultimately, this is a missed opportunity: media-attractive cases like M49 could be exploited to deliver constructive, science-based messages, supporting human-wildlife coexistence. To fill this gap, we propose recommendations for effective communication of human-bear conflicts, including increased collaboration between conservationists and journalists.

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ID: 410

Reconciling mining and conservation in biodiversity hotspots: time for a new perspective?

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Mining makes important economic contributions in many low-income countries but can result in negative impacts for biodiversity. There is a popular perception that mining is inherently ‘worse' than alternative land uses. We take a critical look at this assumption using two case studies from Madagascar and counterfactual impact evaluation approaches. 1st we explore the impacts of a high-profile mining rush where tens of thousands of artisanal miners descended on a protected forest. Media coverage claimed the rush caused hundreds of hectares of deforestation and threatened lemur populations. Using the synthetic control method, lemur surveys and household surveys, we suggest the mining rush had limited impacts relative to other threats. 2nd we evaluate the effectiveness of biodiversity offsets associated with an industrial mine at delivering no net loss of forest. Using statistical matching and difference in differences, we show that the offsets averted as much deforestation as was caused by the mine (though with important caveats). Mining in biodiversity hotspots is here to stay and will likely expand to meet the mineral requirements for the energy transition and development aspirations. While we do not seek to minimize negative impacts from mining, we make suggestions for more constructive engagement with the sector.

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ID: 411

A unique refugium from global warming in the eastern Mediterranean Sea

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The Mediterranean Sea is warming at a higher rate than the global ocean. The Levantine Basin – the easternmost Mediterranean Sea – is the hottest and has warmed ca 3 °C in the last three decades. Consequently, summer temperatures now exceed the thermal tolerance of most native species, causing their massive collapses, documented so far from the Israeli shallow shelf. Cyprus island (north-eastern Levantine Basin), experiences summer seawater temperatures similar to Israel, except at the south-western shores, which are 3–4 °C cooler due to coastal upwelling. This area may thus serve as a refugium for the persistence of native biodiversity notwithstanding anthropogenic climate change. To test this hypothesis, we sampled the molluscs associated to Posidonia oceanica meadows and rocky substrates – the most diverse Mediterranean benthic assemblages – from 5 to 30 m depth, and compared them against a historical baseline reconstructed from shelly death assemblages. As expected, the cooler area had a more diverse native assemblage while diversity loss was more pronounced in the warmer area. Importantly, deeper stations are cooler and thus showed high native diversity and low diversity loss irrespective of geographic location, suggesting depth as a third important dimension when identifying refugia.

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ID: 412

Mapping of citizen science approaches for monitoring farmland biodiversity

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Biodiversity monitoring in agricultural landscapes is important for assessing the effects of both land use change and activities aimed at promoting farmland biodiversity. Despite a considerable increase in citizen science approaches to biodiversity monitoring in recent decades, their potential in farmland-specific contexts has not been systematically examined. Therefore, we conducted a comprehensive review of existing citizen science approaches for biodiversity monitoring on farmland. Using three complementary methods, we identified a range of programmes at least partially covering farmland. From these, we developed a typology of eight programme types, reflecting distinctions in the degree of standardization in site selection, the types of data collected and nature of volunteer involvement. We identified the respective strengths and limitations of the eight types of programmes, depending on the purpose of the monitoring. While all eight types can make substantial contributions to farmland biodiversity monitoring, there is considerable scope for their further development—particularly through increased engagement of farmers, for whom receiving feedback on the effects of their own practices could help facilitate adaptive management.

ID: 414

Does supplementary feeding change the home range size in terrestrial mammals?

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Supplementary feeding of wildlife is a widespread practice, carried out professionally by wildlife managers, habitually by the general public and unintentionally by improper food waste disposal. Optimal foraging theory predicts that home range size should be inversely related to resource density and renewal. However, a comprehensive meta-analytical study to define the impact of supplementary feeding on ranging behaviour of terrestrial mammals are lacking. Here, we present a quantitative analysis of the impact of supplementary feeding on the home range size in terrestrial mammals. We extracted 28 studies from global citation databases, which provided 64 effect sizes. Using the Hedges` g estimator, we measured the change in home range size under supplementary feeding. We fitted ten meta-analytical mixed-effects models to examine the main effect and influence of nine moderators related to species biology, feeding regimen, and methodology. We found no overall effect of supplementary feeding on changes in home range size and none of the moderators did affect this relationship. We conclude that that multitude of drivers and complex mechanisms affecting home range behaviour can make it insensitive to manipulation with supplementary feeding. Small number of available studies are in contrast with the ubiquity and magnitude of supplementary feeding worldwide.

ID: 420

The Women Contribution Index to publishing reveals a new gender bias in Ecology

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Academia imposes challenges on researchers to publish. Biographic features toughen these challenges which are especially burdensome for women and minorities due to social and economic status, ethnicity, sexuality, care tasks, and gender. In the Ecology field, this bias is reinforced by the challenges of accommodating fieldwork with scientific research. We analyzed authorship patterns in the top journal "Ecology" to assess gender bias in publications from 1999 to 2021. We developed a "Women's Contribution Index" (WCI) which measures individual contributions within papers, considering gender, author order, and team size. Despite comprising only 30% of authors, women publishing in the Ecology Journal significantly over-contribute compared to men, according to the WCI. While this suggests progress in addressing gender bias through increasing female participation, the observed over-contribution raises concerns about "over-compensation," where women may need to outperform men for equal recognition. We hypothesize that "over-compensation" may lead to burn-out and thus, to the leaky pipeline, with women leaving academia. Yet, authorship by women and mixed-gender teams increased over time, suggesting progress toward gender parity in scientific publishing. The WCI offers a valuable tool to quantify and understand these nuanced gender dynamics, offering a more equitable and inclusive evaluation of ecological research and publishing

ID: 423

Mapping global biodiversity hotspots for terrestrial vertebrates

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Biodiversity is declining at an alarming rate. This decline is caused by humans and have intensified over the last decades if not centuries. A key step to safeguard biodiversity is identifying areas of importance to biodiversity and ensure their persistence through protection and other conservation actions. One influential approach to identify priority-areas has been the identification of global 'biodiversity hotspots'; focused on areas with high value for biodiversity which are under significant threat. However, the original hotspots have also been critiqued for being taxonomically biased, using a simplistic approach to threats, and not integrating the rights of people. To address this, we bring together two unique datasets on biodiversity importance (based on weighted endemism and extinction risk) and threats (based habitat loss, pollution, overexploitation, invasive species, and climate change). We do this for 33,604 species of amphibians, birds, mammals, and reptiles. Our results show ca. 13% of the world is meets our definition of a biodiversity hotspot, and that these are primarily located in the tropics and align reasonably well with the original hotspots. We also show that 1/3 of the human population live inside our hotspots, which will have significant implications for any priority setting based on them.

ID: 424

Beyond the screen: Investigating viewers' interactions with nature through a yearly Swedish moose migration TV broadcast

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Nature TV shows and live broadcasts provide a unique blend of entertainment and education, offering vicarious contact with nature that is often inaccessible in daily life. As we move further into the digital age, these shows may play a crucial role in

shaping perceptions of and interactions with the natural world, contributing to individuals' connection or reconnection with nature. 'Den stora älgvandringen' (The Great Moose Migration) is an award-winning Swedish nature programme with millions of online viewers annually. It offers a symbolic encounter with nature, showcasing moose crossing a river as winter ends, marking the revival of the natural world after the long winter months.

Our objective was to investigate the impact of this programme on viewers' connection to nature, their motivations for watching, and their immersion in a technology-mediated nature experience. The study used a mixed-methods online survey and received responses from over 1000 viewers, providing comprehensive insight into the audience's engagement with 'Den stora älgvandringen.' By elucidating the role of televised nature shows in people's relationship with nature, this study could significantly contribute to conservation efforts, enhancing public engagement and offering valuable direction for educational content development, utilizing digital platforms to foster environmental literacy and engagement among diverse audiences.

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ID: 436

Maërl beds in the Arctic: Distribution analysis in Icelandic waters

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Little is known about the distribution or ecology of maërl beds in Iceland. Maërl beds are habitats that host high biodiversity. They create habitats for various flora and fauna, some of which are rare or economically important, and play an important role in carbon sequestration. Individuals grow very slowly and can become hundreds of years old. Maërl beds are vulnerable habitats that are under threat from many anthropogenic influences, such as dredging, extraction, bottom trawling, pollution, and climate change. In order to manage effectively and conserve the habitat, it is necessary to map their distribution. When the distribution is known it is possible to identify threats and effects from human activities and create a conservation plan accordingly. This project aims to develop species distribution models for maërl in Icelandic waters and identify important factors influencing their distribution using machine learning algorithms. Data on maërl presence and absence were collected from literature, interviews and surveys. Variables that are considered include bathymetry, topography, temperature, salinity, light availability, turbidity, and concentration of nutrients. We aim to create a model predicting the absence or presence of maërl for the entire Icelandic coastline with a spatial resolution of approximately 50 meters.

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ID: 438

Expert-based recommendations for implementing workflows for essential biodiversity variables at a European scale

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The EuropaBON project aims to co-design a comprehensive European Biodiversity Observation Network that addresses both current and future demands of biodiversity policies in the EU. Central to the project is the concept of Essential Biodiversity Variables (EBVs), which form the foundation for the monitoring design. The successful generation of EBVs relies on the design of workflows which describe the sequence of tasks that is needed to process the raw observations into harmonized and integrated EBV data products. The content of EBV workflows can strongly vary depending on the EBV class, taxonomic scope, and monitoring techniques employed to collect the data. We present examples of EBV workflows for the marine, freshwater, and terrestrial realms, together with an assessment of the potential use of advanced monitoring techniques (citizen science, genetic monitoring, digital sensors, satellite remote sensing and aerial remote sensing) for data collection at the European scale. Moreover, we identify specific needs and requirements to implement and operationalize EBV workflows. To describe these workflows, we have consulted a broad range of experts and biodiversity monitoring stakeholders across Europe. This collaborative approach will pave the way for establishing a European Biodiversity Observation Network that is rooted in the EBV concept.

ID: 444

Population Genomics of oil-collecting bees in a threatened tropical biodiversity hotspot

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Worldwide multiple studies suggest a decline of bee species, with habitat loss and fragmentation being among the main drivers. The Brazilian Cerrado savanna is not only a global biodiversity hotspot but simultaneously experiences among the world's highest rates of agricultural intensification, rendering it the most threatened tropical savanna worldwide. Here we generated whole-genome sequencing data to investigate the population genomics of two common oil-collecting bee species, Centris aenea and C. fuscata, in this highly fragmented and disturbed habitat. Overall, we found that both species exhibit a surprisingly high nucleotide diversity, π (C. fuscata: 0.315, C. aenea: 0.275), which was also reflected in the demographic analyses that suggested a recent increase in the effective population size (Ne) of C. aenea and a rather stable, albeit lower, Ne for the populations of C. fuscata. Genomic differentiation between C. fuscata (FST = 0.047± 0.046) populations was significantly higher than for populations of C. aenea (FST = 0.004± 0.004), although overall very low and none of the species showed isolation-bydistance. Our results suggest that although habitat loss and fragmentation are certainly threatening biodiversity some species might be well able to cope with those anthropogenic changes.

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ID: 458

Managing different personalities: effects of forestry practices on American red squirrel personality distributions and activity patterns

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Managed forests make up over half of forests globally, with the majority used for timber harvest. In order to ensure efficient forest regeneration, it is vital to understand how different management regimes affect seed-dispersing and seed-predating animals. Personality, or consistent behavioral tendencies, has been found to be a key factor driving all stages of the seed selection and seed dispersal processes, including consumption versus caching decisions. Therefore, it is critical to understand how differing anthropogenic forest manipulations may shift the personality distribution of a population. Within the context of a long-term capture-mark-recapture study in Maine, USA, we measured the unique personality of 354 individual American red squirrels (Tamiasciurus hudsonicus) over 8 years across three silvicultural treatments. We also deployed collar-mounted light-level geolocators on individuals to measure daily activity patterns since these can affect seed caching patterns. Our analyses show that anthropogenic forest modification shifts the distribution of personalities and that intraspecific differences in daily activity patterns are driven by both personality and silviculture. Overall, our research demonstrates that differing forest management regimes result in differing behavioral compositions of rodent populations, having important implications for seed dispersal and the maintenance of ecosystem services associated with behavioral diversity.

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ID: 460

Forest management has contrasting effects on the functional diversity of bird and mammal communities

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More than half of the world's forests are managed, which underscores the fact that forest management is an important component of global change. Although the effects of forest management on taxonomic diversity are well-studied, we do not fully understand its impact on functional diversity. Understanding this is important to predict how ecosystem processes will respond to global change scenarios and to implement efficient conservation actions. We conducted a large-scale (~81,800 km2), natural experiment over four years in temperate forests of the northeast USA to investigate how forest management influences the functional structure of bird and mammal communities. We surveyed 85 bird species distributed in 115 sites using point counts, and 14 mammal species across 197 sites using camera trapping. For each species, we selected functional traits that summarize key aspects of biology such as body mass and diet, and we collected data on forest disturbance intensity at each site. We found that functional richness increased with forest disturbance for mammals, whereas it decreased for birds. Our results also show that body mass is a highly influential trait, indicating that forest management can act as a filter selecting species with certain sizes potentially leading to a long-term decrease in functional diversity.

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ID: 469

Wolf inter-territorial variation in prey use and selection in a multi-ungulate system

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Understanding feeding behaviour of large predators is crucial for conservation and management purposes. The grey wolf population in Scandinavia has recently been expanding from prey systems dominated by moose and roe deer in central Scandinavia to multi-ungulate areas in southern Sweden. This study investigated 1564 wolf scat samples using a new DNA-method for prey detection. Based on the frequency of occurrence of prey species, the diet of wolves was mainly dominated by large ungulates with moose as the main prey in

central Sweden, and roe deer followed by moose in southern Sweden. The diet of wolves expanded included a higher proportion of alternative ungulate species where their abundance increased towards the south. Comparing prey selection across territories showed that moose was overall selected, roe deer was consumed proportional to its abundance, while red deer, fallow deer and wild boar were generally avoided but with a large variation between wolf territories. Wolves' selection for moose was negatively influenced by high abundances of fallow deer, suggesting dietary shifts due to the presence of alternative prey species. These findings have management implications as they highlight the dietary response of wolves to changes in ungulate communities across the predator expansion range.

ID: 470

Impacts of future forest use on biodiversity, ecosystem services and climate

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Our objective is to identify sustainable pathways for future forest management that enhance multifunctional forests, and address climate change by providing non-woody ecosystem services and preserving biodiversity. This involves analyzing synergies and trade-offs among various forest biomass' uses in Sweden over the next 30 to 80 years. Our methodological approach includes simulating multiple forest management alternatives and employing multi-objective optimization to identify future pathways aligned with specified objectives for the Swedish forest. The optimization process will encompass harvest levels, ecosystem services, biodiversity, and climate change mitigation. In our work, we will leverage models for diverse non-woody ecosystem services and species representing different organism groups. We will present our initial efforts in jointly optimizing objectives to address the varied responses associated with forest biomass use. The presentation will delve into key questions: How can we manage and harvest the Swedish forest to achieve a 50% increase in red-listed species, maintain current levels of non-woody ecosystem services, and maximize climate change mitigation? Additionally, we will investigate the feasibility of reaching a 50% increase in red-listed species and assess the impact on climate by comparing business-as-usual (BAU) forestry with current conservation protection measures versus implementing forestry practices aligned with the EU Biodiversity Strategy.

ID: 473

Mow it or grow it: heterogeneous biodiversity-yield tradeoffs in grasslands

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Grasslands are key for food security and provide important ecosystem services. Intensive management such as frequent mowing increases productivity but decreases other ecosystem services including plant species richness. We here provide a new approach to estimate large scale, causal, spatially explicit effects of mowing frequency on plant species richness using large, satellite-sourced data and provide spatial assessments of yield-species richness trade-offs. More specifically, we use a unique, multisource remote sensing based dataset covering all grassland plots across Germany (N=1,313,073) over four years to estimate the causal impact of mowing frequency, as a proxy of grassland use intensity, on plant species richness. We identify spatially explicit, heterogeneous treatment effects using generalized random forests. We find that higher use frequency significantly reduces plant species richness, but these effects differ by environmental and socioeconomic context. We quantify species richness-yield trade-offs as implied by changes in mowing frequency and show how these heterogeneous effects contribute to the design of better, i.e. more cost-effective policies by using spatially explicit targeting of conservation policies. Motivated by the 30 by 30 goal, we estimate opportunity cost of marginally extensifying 30 percent of German grasslands.

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ID: 474

Supporting wolf dispersal flow in heavily-anthropized areas: an example of successful collaboration between scientific research and governance

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Despite an extensive recovery, the Italian wolf (Canis lupus italicus) is still threatened by genetic isolation from other European populations. In 2017 the species was detected in the Ticino Natural Park, a lowland ecological corridor that could significantly boost gene flow between the Italian and Dinaric-Balkan populations supporting dispersal from Northern Apennines to Central/Eastern Alps. In seven years of monitoring and distribution/movement data analyses we found that corridor's permeability significantly drops at its northern extremity and identified areas where roads defragmentation actions should be implemented to enhance connectivity[1,2]. We also found that wolves use the corridor by resting for long periods in core areas characterized by prey abundance and low human disturbance[2,3]. This strategy reduces wolves/humans encounter rates, a key condition for a coexistence conservation strategy. Based on this finding, after the detection of a wolf pair in the most recently established core areas in December 2023, the managers of the protected area have limited the wild boar hunting activities in the pair territory to minimize human disturbance. These important scientific and practical results were achieved through a close collaboration among universities, protected areas' managers, and territorial entities setting a valuable example of cooperation between scientific research and policy.

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ID: 476

Evaluating different approaches to integrate genome-wide genetic diversity in spatial conservation prioritization

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Locations for new protected areas should be identified with consideration of intraspecific genetic diversity because genetic variation enhances the adaptability of species to novel environmental conditions. Spatial conservation prioritization is a mathematical, computer-aided approach to siting new protected areas. Integrating multidimensional continuous metrics of genome-wide genetic diversity in spatial conservation prioritization involves significant challenges in terms of computation speed and memory requirements. In this study, we tested several approaches to approximate the multidimensional continuous metrics of genetic diversity using multidimensional discrete genetic clusters or unidimensional discrete conservation features. To this end, we apply two popular tools for spatial conservation prioritization, RAPTR and PRIORITIZR, to genomic datasets of two fish species (the white seabream Diplodus sargus and the red mullet Mullus surmuletus) sampled throughout most of their distribution range in the Mediterranean Sea. We found that most of the approximations tested either did not achieve all genetic conservation targets or resulted in excessively high conservation costs. Nonetheless, approaches based on multidimensional genetic clusters allowed generating prioritizations with relatively small gaps in genetic objectives at very high computation speed. This might be an interesting option for exploratory, interactive analyses such as those performed in workshops with stakeholders.

ID: 477

Short-term effects of mowing and mulching on snail communities

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Condition of wet meadows depends mainly on human activity. While mowing and grazing are traditional management practices, mulching is a newer and increasingly common technique. The ecological impacts of traditional management are still incompletely known, and we know almost nothing about the effects of newer methods. We therefore carried out an experimental investigation of the effects of mowing and mulching on the characteristics of snail communities in wet meadows. Our results showed that one year after management, mowing had a detectable negative effect on the communities. However, mulching did not alter their characteristics. We also analysed the response of the most common species, with mixed results. The population of Carychium minimum and Vallonia pulchella was not affected by the treatment. In the case of Vertigo angustior, the population increased in the mulched areas compared to the mowed areas. In conclusion, mulching appears to be beneficial for snail communities in short-term interventions such as habitat restoration. However, further research is needed to determine long-term effects of these methods.

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ID: 480

Starting-year effects of annual and perennial urban flower sowings on pollinators and floral resources

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Floral availability for pollinators can be boosted by sowing seed mixtures in public spaces. We sampled pollinators and floral resources in paired treatment (sown) and control (intensively mown) sites April-September in 2022 and 2023, in Budapest, Hungary. The treatments were sown with non-native annual seed mixtures in 2022 and a perennial native seed mixture in 2023. The sown sites have a negative impact in the first half of the season due to the early spring sowing, and a positive in the second half of the season by the late summer flowering peak. This positive effect was lower in 2023 than in 2022 due to the slower flower supply of the perennials. The seasonal and long-term effects of consecutive years of extreme drought and rainfall draw attention to the need for long-term monitoring in cities. Perennial seed mixtures provide resources for pollinators over several years and require less management, becoming more sustainable. Native flowers may not be as eye-catching as non-natives, but natives should be better for the local pollinators. This topic is understudied in Eastern Europe, comparisons of seed mixtures are needed regarding their flower supply, climate change resistance, and long-term costs.

ID: 483

Assessing the effectiveness of biodiversity offsetting for pollinator conservation: A Dutch case study

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Biodiversity offsetting, a strategy aimed at achieving "No Net Loss" by conserving nature while accommodating development, has been extensively implemented. However, its effectiveness in supporting pollinators remains an under-explored area of research. We assessed the benefits and risks of biodiversity offsetting of pollinator-friendly grassland habitat in 40 paired control (existing long-term grasslands) and offset (newly developed grasslands compensating for infrastructure development) sites across the Netherlands. Wild bees, hoverflies, transect flower cover, and site vegetation communities were surveyed between May and August 2022.

Our preliminary analyses indicate that grassland offsets had comparable hoverfly abundance and species richness, as well as wild bee species richness, to control sites. Wild bee abundance was significantly higher in offsets, but this could not be attributed to differences in percent flower cover or flower species richness, which were similar between treatments. We also show that the floral and vegetation communities differed between offsets and controls, but that pollinator communities were similar.

While there are local habitat differences between control and offset grasslands, this does not appear to significantly impact differences between pollinator communities. Our study contributes to the empirical knowledge base of the effectiveness of biodiversity offsetting as a conservation intervention for pollinators.

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ID: 490

Complementary hotspots of endangered species and habitats in Austria: a baseline for PA expansions and restoration

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Systematic Conservation Planning (SCP) can aid the expansion of existing protected area (PA) networks demanded by national and international biodiversity strategies, ensuring efficiency, comprehensiveness and representativity. This study is an extensive Austrian SCP analysis, compiling existing distribution data of 2668 endangered conservation targets and covering species and habitats of EU Community interest, threatened species according to national Red Lists, and (sub-)endemic species. We identified and compared hotspot areas (with highest numbers of local conservation targets) and SCP priority areas (with maximised coverage of conservation targets in the network, identified with Zonation 5) and considered the impact of existing strict PAs. The hotspots cluster in Eastern Austria, particularly in the Pannonian region, the Danube and March floodplains, and the Alpine foothills in Lower Austria, Styria and Burgenland. Additional hotspots are particular Alpine regions, e.g. Rheintal and Karawanken. In comparison, SCP uncovered priority areas that gained importance through their complementarity, e.g. particular mountain ranges like Koralpe and Rax/Schneeberg. The study provides important insights for potential expansions of Austria’s (strict) PA network, although it remains necessary to consider appropriate local conservation measures on a case-by-case basis. The identified areas are also relevant for the restoration of conservation targets under the EU Restoration Law.

ID: 494

The ecological footprint of outdoor activities: Factors affecting human-vectored seed dispersal on clothing

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People can transport numerous diaspores on clothing (epianthropochory) worldwide, which can have various conservation implications, both positive effects, such as establishing connections between natural habitats and negative ones, such as spreading weeds and invasive alien species. In our study, we investigated the role of human-vectored seed dispersal (HVD) on clothing in Central-Europe. In a multi-site field experiment, we collected 2008 subsamples of diaspores from shoes and socks from 88 volunteer participants from 39 different sites. We used variables related to the movement of people, their clothing type, and the visited habitats in the analyses. We detected 229 species in the samples, from which 110 were weeds. We found that HVD on clothing provides opportunities for not only species with adaptations for epizoochory, but also for species with other forms of dispersal (e.g., endozoochory, anemochory). Individual factors (e.g., clothing type, human behaviour, activity type) and site characteristics played an important role in the spread of diaspores from one habitat to another. Our results showed that it is very important to minimize the chances of weeds spreading in the nature reserves. Furthermore, it is essential to keep the wide audience properly informed about the epianthropochory and the possible prevention measures.

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ID: 496

The density of meso and macro mammals in a Marsican bear corridor of the Central Apennines

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Ecological corridors are crucial for the conservation of large mammals because they connect suitable habitat patches of various protected areas. Five corridors have been identified in the Central Apennines for the conservation of the endangered Marsican bear (Ursus arctos marsicanus), a relict subspecies only surviving in central Italy. In our study, we focused on the corridor connecting Sirente-Velino Regional Park with Abruzzo, Lazio and Molise National Park (ALMNP), to evaluate its effectiveness to support other (non-target) mammal species. Data were collected through 14 camera traps, placed according to a random stratified sampling. Using Random Encounter Models (REM), we estimated the densities of 8 mammal species: roe deer (Capreolus capreolus), red deer (Cervus elaphus), red fox (Vulpes vulpes), wild boar (Sus scrofa), Apennine wolf (Canis lupus italicus), European badger (Meles meles), European hare (Lepus europaeus) and porcupine (Hystrix cristata). Our results showed that several species (including ungulates and the wolf) have densities equal or higher in the bear corridor than in the nearby protected areas. This work demonstrates how corridors defined to support connectivity for the Marsican bear population can represent an important habitat that maintains high density of several co-occurring species.

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ID: 501

Primary productivity modulates apparent competition at a macroecological scale: logging, predator-prey dynamics, and caribou conservation in Canada

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Understanding apparent competition has been critical to controlling biological invasions and conservation planning. In the boreal forests of North America, landscape disturbance (wildfire, logging) is suspected of promoting populations of deciduous-browsing ungulates like deer and moose and hence ungulate predators like wolves and bears, heightening predation risk to Threatened boreal caribou. Such "disturbance-mediated" apparent competition, or DMAC, is well documented in southern, productive forests; however, little is known of how it may be modulated by system energetics, e.g., at higher latitudes. We hypothesize that in the context of caribou, DMAC is fundamentally driven by available energy to consumers. Using data on net primary productivity (NPP) and fire and anthropogenic disturbance; moose density; and alternate prey and predator richness; we assessed how NPP related to caribou recruitment and survival for 40 and 34 study areas across Canada, respectively. Multivariate and structural-equation models show that NPP is a chief causal factor for higher predator richness and anthropogenic disturbance leading to lower caribou recruitment, and higher moose density influencing lower adult survival (from predation). The strength of apparent competition to limit species distribution should vary at macroecological scales as food webs and human appropriation of NPP changes in response to available energy.

ID: 502

The socioeconomic predictors of biodiversity threats at the global scale

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The accelerating biodiversity crisis, marked by the potential extinction of thousands of species, poses a critical threat to global ecosystems and the essential services they provide. Despite considerable financial investments and advancements in mapping global threats, there is still a significant gap in understanding the underlying socioeconomic and ecological drivers of biodiversity loss. In this study, we investigate this gap using data on seven taxa-specific major threats – logging, agriculture, hunting, pollution, invasive species, climate change, and urbanization – and model their global distribution in relation to socioeconomic drivers that are both potential causes and solutions to the biodiversity crisis. We do this separately for each tetrapod group: amphibians, mammals, birds, and reptiles and then use a combination of socioeconomic and biophysical predictors at a 50 x 50km resolution. Ultimately, this study generates actionable insights and tools for policymakers and conservationists that brings together information on socioeconomic context and the most important threats to biodiversity. By contributing significantly to the understanding of biodiversity loss, it seeks to aid in the preservation of the world's rapidly declining natural environments, offering novel perspectives and practical solutions for effective conservation efforts.

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ID: 504

Slugs hide in the dark: Impact of Artificial Light at Night (ALAN) on herbivory

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Artificial light at night (ALAN) is increasing and has deleterious effect on biodiversity. While disruptive effects of ALAN on predators are relatively well understood, we still know very little on how it affects other functional groups and the ecosystem functions they provided, like pollinators and herbivores. Here we hypothesized that ALAN impacts fitness and feeding activity of one of the most destructive herbivores from the Swiss agricultural landscape. To test the effect of ALAN on the amount of herbivory, we setup a field experiment in the Swiss lowlands, in which we experimentally illuminated eight independent wildflower strips and kept eight as dark controls, and we measured the amount of herbivory on three common plant species. In addition, experiments with captive individual feeding on plants with and without nocturnal lighting were conducted to investigate how ALAN impacted development and behaviour of slugs. We found less herbivory on illuminated sites compared to control sites, and the captive slugs bred with nocturnal lighting fed less on plants compared to the ones kept in natural conditions, had lower weights, respectively. It seems that ALAN negatively impacts the fitness and lowers the activity of the slugs, with consequences for herbivory damage caused in the field.

ID: 506

Enhancing conservation strategies with a hierarchical revisit of Hanski's incidence function from single to multi-species

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Understanding population dynamics is crucial in the context of current environmental changes and human-induced disturbances. This comprehension is essential to develop effective conservation strategies, ensuring ecosystem sustainability. Hanski incidence function model stands out among approaches addressing the consequences of habitat fragmentation on population dynamics. This model assesses how landscape structure influences species dynamics and persistence, based on factors such as patch size and inter-patch connectivity. It is widely used in conservation biology for its practicality because it can be parameterized using presence-absence data. However, this approach has limitations, notably its monospecific nature leading to a restricted understanding of biological diversity effects on population viability.

We propose to revisit the incidence function model to integrate several species using a hierarchical model. Besides analyzing several species simultaneously, our model also assesses inter-species variability, identifying general trends for a comprehensive understanding of metapopulation dynamics.

Our approach broadens perspectives on Hanski's incidence function model, making it more realistic in the context of complex, fragmented ecosystems. While retaining the practicality of the original model, configurable with presence-absence data, it enables a more robust anticipation of habitat fragmentation consequences on biodiversity, providing a solid foundation for developing holistic conservation strategies.

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ID: 508

Exploring bird diversity in olive agroforestry systems at local, landscape and seasonal scales

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Large-scale expansion and intensification of agriculture pose significant threats to avian populations, particularly insectivorous species in Mediterranean landscapes. While prior studies have demonstrated the potential of olive agroforestry systems to support bird diversity and associated ecosystem services, variations across local, landscape and seasonal scales remain poorly understood. During spring and autumn 2022 and 2023, we assessed bird diversity patterns in olive groves with varying proportions of adjacent semi-natural habitat in the Monte Pisano region of Tuscany, Italy. Through systematic point counts, we examined species richness and abundance responses to seasonality and high or low proportion of semi-natural habitat in 12 organic, smallholder olive groves. Our findings reveal seasonal variations in both richness and abundance, with higher species richness in spring and increased bird abundance in autumn. Notably, peri-urban sites exhibited higher bird abundance and species richness compared to those surrounded by a high proportion of semi-natural habitats, especially during seasons of resource scarcity in adjacent forests. Our results underscore the importance of olive groves as alternative habitats for numerous bird species in Mediterranean agricultural landscapes. Promoting wildlife-friendly olive agroforestry management, alongside comprehensive conservation initiatives, contributes to preserving Mediterranean bird communities and associated ecosystem services for olive smallholders.

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ID: 509

Conservation genetic strategies for the Hula painted frogs (Latonia nigriventer) by assessing habitat preferences

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Hula painted frogs (Latonia nigriventer), a critically endangered amphibian species residing in the Hula Valley of Israel, are in dire need of conservation due to habitat degradation exacerbated by human activities. To address this urgency, our research integrates genetic methods and habitat analysis. Environmental DNA (eDNA) techniques are employed for habitat mapping, offering insights into the distribution of Latonia and co-inhabiting species. Real-time PCR results revealed a strong signal at the reference site, with traces of the Hula painted frog's eDNA detected in nine different locations in the Agamon area of the Hula valley, while an absence was noted in six sites. Simultaneously, we explore the invertebrate communities in both Latonia eDNA-positive and -negative sites, which will enhance our insight into the habitat preferences of the Hula painted frogs. Our integrated approach, which combines genetic analysis and habitat characterization, will guide conservation efforts for Latonia nigriventer and other endangered amphibians, while also identifying potential sites for successful reintroduction.

ID: 517

The edible sea urchin in Western Sardinia (Italy): do effective conservation measures matter?

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Sea urchins are herbivore keystone-species of marine ecosystems able to regulate structure and biodiversity of macrophytes. The edible sea urchin Paracentrotus lividus (Lamarck 1816) is intensively harvested in Sardinia, one of the most historically exploited area in the Mediterranean Sea. Although P. lividus is included among the species whose exploitation is regulated under the Protocol concerning Specially Protected Areas and BIOlogical diversity in the Mediterranean (SPA-BIO) and the Bern Convention on the Conservation of European Wildlife and Natural Habitats, sea urchin populations are overexploited in many areas of Sardinia with potential dramatic ecological and socio-economic consequences. Therefore, over the last 5 years, a monitoring program was funded by Sardinia Region to evaluate the spatial and temporal dynamics of populations and compare abundances between permitted and banned fishing zones, performed by collecting data on abundance and size of individuals.

Along the western coast, monitoring revealed a sharp decline of ~50% after 5 years. In the last year, only 12% of individuals were of commercial size (test diameter ≥ 50 mm) and larger sizes (>60 mm) dropped away as well as recruits (>20 mm).

These results provide crucial elements for setting up effective management interventions needed to halt the collapse of populations.

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ID: 519

A multispecies trait-based landscape connectivity assessment suggests establishing priorities for connectivity restoration in Europe

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Restoring and maintaining ecological connectivity to support the species' gene flow between changing landscapes, especially among protected areas (PAs), is nowadays of crucial importance. However, the 'where' of connectivity restoration is more urgent remains unknown, especially in the highly fragmented European landscape. In our study, we first aim to assess ecological connectivity with a multi-species approach, through varying resistance values on both species' sensitivity to human modification, dispersal capabilities, and species traits. Then, we identify more functional corridors (≥ 0.90 quantile) for each combination of contributing variables and quantify the portion of these corridors protected by PAs, nationally. Greater connectivity values and corridors' abundance were found across Northern and Eastern Europe, even if most of the areas important for connectivity resulted as unprotected. Maps of connectivity importance vary among scenarios, with different effects of both dispersal traits and resistance surfaces. Species more sensitive to human impact typically score the lowest connectivity, mainly across Central Europe. Our findings emphasize the importance of supporting ecological connectivity in large areas, but concurrently it is also essential to identify and preserve small, isolated parcels of relatively uncontaminated territories. Conservation and restoration of critical connectivity areas could support biodiversity conservation by ensuring safe dispersal corridors.

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ID: 525

Using social media records to inform conservation planning

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Citizen science plays a crucial role in helping monitor biodiversity and inform conservation. With the widespread use of smartphones, many people share biodiversity information on social media, but this information is still not widely used in conservation. Focusing on Bangladesh, a tropical megadiverse and mega-populated country, we examined the importance of social media records in conservation decision-making. We collated species distribution records for birds and butterflies from Facebook and Global Biodiversity Information Facility (GBIF), grouped them into GBIF-only and combined GBIF and Facebook data, and investigated the differences in identifying critical conservation areas. In my presentation, I will discuss how Facebook data can reduce the global biodiversity data shortfall and improve conservation assessments.

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I am a Postdoctoral Research Associate with Professor Aletta Bonn at the German Centre for Integrative Biodiversity Research (iDiv) in Leipzig, Germany. Here, I am combining and analyzing the German biodiversity data to identify the changes in the state of biodiversity in Germany.

ID: 530

Sensemaking and abductive reasoning for transformative biodiversity conservation

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In order to identify novel solutions to halt biodiversity loss, conservation science needs to broaden the ways knowledge is produced in highly complex, open, and dynamic social-ecological systems. Designing just conservation actions requires not only optimising existing solutions, but also generating innovative action-oriented accounts that recognise and incorporate value plurality and different knowledge systems. However, the ways to enact the diversity of effective approaches to achieve these goals are yet to be explored. In line with recent calls for transformative conservation, we investigate the underexplored potential of sensemaking and experimentation through abductive reasoning to broaden knowledge production in biodiversity conservation. We start by highlighting the meanings of the abductive logic of "what might be" and how it allows to recognise and critically engage with plausible accounts of complex problems in conservation. We then explore how integrative and generative processes of sensemaking may foster critical and relational knowledge co-production between scientists and other actors, towards the identification of novel and adequate conservation actions. We conclude by discussing opportunities and challenges to foster integration and critical reflection on plural knowledge systems by ensuring that processes are epistemically adequate, scientifically rigorous, and ethically responsible.

ID: 544

Crow control by trapping and its impacts on the urban crow population and bird community

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Urban biodiversity is often characterized by the dominance of few generalist species and a depauperate fauna. We implemented a population control programme on Hooded Crows, a generalist urban corvid bird that has recently colonized many European cities, in Debrecen, Hungary and monitored the impacts on the crow population and the urban bird community in 2019-2022. We trapped and removed 621 crows, of which most (82%) were juveniles of the year. While the urban breeding population (150 pairs) did not increase further and nest density slightly decreased in the most frequented area, the outside-breeding season population increased, suggesting an ongoing influx of crows from rural areas. Monthly bird community surveys showed that species richness and diversity decreased in the four years. Counts increased for six cavity-nesting species and two open nesters (blackbird, wood pigeon). Our results show that the removal of juveniles-of-the-year may temporarily halt urban population increase but also that an influx of individuals will still increase the total year-round urban crow population. Our study shows that even a large control effort can have limited efficiency in reducing the population of nuisance species in urban environments, and suggests that local solutions may not be enough to address regional-scale processes.

ID: 545

Restoring plant diversity in lowland grasslands through different seed addition methods

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Grassland biodiversity has significantly declined over the past century, largely due to the intensification of management practices. This study tested the efficacy of different active restoration methods in promoting plant biodiversity in degraded Swiss lowland meadows. Four treatments and a control were set up in 2019: 1) sowing of a previously harrowed meadow with hay transfer from a donor meadow; 2) sowing of a previously ploughed meadow with hay transfer from a donor meadow; 3) direct sowing with a commercial seed mixture; 4) direct sowing with natural seeds collected from a donor meadow; 5) control, with no soil management and no reseeding. The experiments, spatially replicated, were carried out at field scale. Vegetation surveys were performed before and after the restoration. After a pronounced biodiversity rise in 2021, plant species richness stabilized in 2023 with on average 16% more species in restored compared to control meadows, and 90% of the restored meadows qualified for the result-based payment scheme. Harrowing before seeding was found to be as effective as ploughing. This study provides evidence-based recommendations for the restoration of grasslands using different methods that are financially and practically feasible for farmers.

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ID: 547

Influence of the physical and acoustic landscape on insect song

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Sensory ecology theory proposes that modalities like vision, audition and olfaction determine habitat selection and behavioral adaptation by organisms. This research project has a two-fold objective: i) to establish experimental areas with modifiable landscape structures that alter sound propagation and ii) to evaluate the response of singing orthopterans (Ensifera suborder) to modifications of landscape structures and acoustic properties. In Québec, Canada, four subfamilies of the Ensifera suborder (Nemobiinae, Phaneropterinae, Conocephalinae and Oecanthinae) exhibit unique sensory adaptations in terms of visual acuity and sound propagation. We constructed hardwood structures in herbaceous fields that successfully altered the acoustic properties of whole landscapes. We replicated a Before-After-Control-Impact design with three treatments: control, wall structures, floor structures. We assessed species' incidence within each landscape using recordings over the mating season. Our results show that the probability of detecting mating calls increased for the Nemobiinae subfamily when wall and floor structures were present, but decreased for the Conocephalinae under the wall structure treatment. Some of these effects persisted even after removing the structures. This one-of-a-kind experiment allowed us to manipulate both the physical and acoustic properties of whole landscapes to evaluate the consequences of land use changes on wildlife and help implementing better conservation plans.

ID: 552

Phenology mediates population responses of animals to temperature globally

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Consideration of phenotypic traits in population ecology is timely given that traits such as phenology and morphology were shown to respond to climate change. However, we still have a limited understanding of the extent to which traits mediate climate effects on population growth across species. Here, we assembled hundreds of time series on animal traits and population sizes into a global dataset and matched it spatially with temperature and precipitation data. Corroborating previous research, we found a significant advancement of phenology with warming temperatures across studies. Further, the phenology-mediated effect of temperature on population growth rate was positively associated with population trends over the study periods, meaning that phenological responses to global warming likely allowed the studied populations to not decline historically on shorter timescales. Though we could partly explain the heterogeneity in phenological responses to temperature by species generation time and latitude, the heterogeneity in phenology-mediated population responses to temperature could not be explained by either these predictors or other tested species characteristics (migratory mode and thermoregulatory type). Thus, single species characteristics may have low predictive ability of trait-mediated population responses to climate, despite such property is very desirable for more effective conservation.

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ID: 554

The endangered Calabrian Alpine newt: integrating ecological modelling and connectivity planning for effective conservation actions

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The survival of the endemic Calabrian Alpine newt Ichthyosaura alpestris inexpectata is threatened due to the recent introduction of fish into three of the lakes where this amphibian occurs. This newt also shares breeding habitats with two other species of urodeles, namely Triturus carnifex and Lissotriton italicus.

To face this conservation challenge, we have developed an Action Plan. One of its key actions is to create a network of small semi-natural or artificial ponds connected to historical sites, providing temporary habitats for the Calabrian Alpine newts during habitat restoration.

We initially produced fine-scale habitat suitability models coupling climatic, topographic, hydrologic, and habitat-related predictors through post-modelling GIS techniques, identifying current and future suitable areas. Subsequently, we assessed the landscape corridors among these areas using different connectivity approaches.

The obtained results supported each other, defining a coherent network. In-situ validation will refine the highest-consensus connections and the most suitable patches.

This approach allowed us to strategically identify the optimal location for artificial ponds for medium and long-term planning, both for permanent habitats and stepping stones, helping the persistence of enduring aquatic habitats in the context of the ongoing climate crisis.

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ID: 555

Chronicles of spectral diversity: unraveling plant alpha and beta diversity in grasslands through a multitemporal lens

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Grasslands stand out as biodiversity hotspots, encompassing habitats that foster a remarkable range of biodiversity. Improving our ability to monitor grassland biodiversity is essential to mitigate plant species loss caused by global changes. Using drone-borne multispectral sensors has a far-reaching potential to provide cost-effective monitoring of grassland biodiversity. Such high-resolution data can theoretically capture the direct link between the diversity in species-specific optical characteristics (spectral diversity, SD) and ground diversity. However, the reliability of SD for plant diversity monitoring is controversial due to potential confounding factors. Besides, the potential of SD to infer multiple facets of diversity at the community scale and monitor them across years has scarcely been studied. This study investigates whether SD can reflect alpha- and beta-diversity in alpine grasslands, considering taxonomic, functional, and phylogenetic plant diversity and three types of spectral diversity metrics. Spectral and plant diversity were calculated based on data collected at the growing season's peak over four years in thirty 5 × 5 m plots. For both alpha- and beta-diversity, our results reveal that spectral species-based SD metrics better reflect all the facets of plant diversity considered, with consistency over the years, confirming that SD holds promise for biodiversity monitoring in grasslands.

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ID: 571

Behavior of brown bears under fluctuating resource availability

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Mast seeding, the variable and intermittent production of seeds, have cascading effects on ecosystem functioning. This study explores its influence on the brown bear populations in the Italian Alps, focusing on beech nuts, the primary food source for bears in the region. Using the MASTREE+ historical data database, field sampling, and contributions from the 'Centro Nazionale Carabinieri per la Biodiversità di Peri,' we estimated and mapped the annual seed biomass from 2007 to 2021 in a GIS.

The energy content of beech nuts was assessed through high heating values (HHV), providing the caloric resources available.

Concurrently, we integrate GPS collar data from 18 bears, showing diverse patterns of space utilization. We found a correlation between mast seeding and decreased damages to agriculture and livestock, suggesting that bears met their trophic needs through natural food sources.

This work provides insights on the ecological dynamics and conservation implications of brown bear in the study area by mapping the spatial and energetic aspects of mast seeding.

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ID: 580

Breeding biology of Yellow Wagtails in a restored grassland and marsh system

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Grassland restoration is known to increase the species richness and diversity of farmland birds, but much less is known whether or how restoration influences their breeding success and population growth. We studied the breeding biology of Yellow Wagtails as a function of landscape structure in a complex of natural and restored grasslands, meadows, marshes and croplands in Hortobágy National Park (Hungary) in 2022-2023. We tested relationships between breeding parameters and the proportion and diversity of habitat types around the nests. Data from 52 nests in two years showed that clutch size was negatively related to the proportion of mowed grasslands, whereas fledging success was positively related to the Shannon diversity of habitat types and negatively related to the proportion of marshes. These patterns were robust to the size of circular buffer (range 50 to 500 m radius) used around the nest. Our results showed that landscape structure significantly influenced the breeding parameters of Yellow Wagtails. Most importantly, fledging success increased with the diversity of habitats around the nest. While restoration did not influence breeding success parameters per se, it had an indirect role by increasing habitat diversity in the landscape.

ID: 581

Flower-bee vs pollen-bee metanetworks in fragmented landscapes

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Understanding the organization of mutualistic networks at multiple spatial scales is key to ensure biological conservation and functionality in human-modified ecosystems. Yet, how changing habitat and landscape features affect pollen-bee interaction networks is still poorly understood. Here we analyzed how bee-flower visitation and bee-pollen transport interactions respond to habitat fragmentation at the local network and regional metanetwork scale, combining data from 29 fragments of calcareous grasslands, an endangered biodiversity hotspot in central Europe. We found that only 37% of the total unique pairwise species interactions occurred in both pollen transport and flower visitation networks, whereas 28% and 35% were exclusive to pollen transport and flower visitation networks, respectively. At local level, network specialization was higher in pollen transport networks, and was negatively related to the diversity of land cover types in both network types. At metanetwork level, pollen transport data revealed that the proportion of single-fragment interactions increased with landscape diversity. Our results show that the specialization of calcareous grasslands' plant-pollinator networks decreases with landscape diversity, but network specialization is underestimated when only based on flower visitation information. Pollen transport data, more than flower visitation, and multi-scale analyses of metanetworks are fundamental for understanding plant-pollinator interactions in human dominated landscapes.

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ID: 582

Habitat loss, extinction debt and climate change threaten terricolous lichens in lowland open dry habitats

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Habitat loss is the main driver of biodiversity decline worldwide, and its detrimental effects can be exacerbated by climate change. Consequent species extinctions, however, may occur many years after habitat loss events (extinction debt). We tested such extinction debt in terricolous lichens in 45 patches of lowland open dry habitats (grasslands and heathlands) in the western Po Plain (N Italy) by using complete species inventories. We considered all, red-listed, rare, and common species. Using GLMs, we found that oldest (1954) patch extent positively correlated with all, red-listed, and rare species, while

current (2020) extent only with common species. Additionally, distance from the nearest dry habitat patch and annual rainfall was related to all, red-listed, rare, and common species, and extent difference (1954-2020) to all, and red-listed species. Our results thus reveal an extinction debt not yet paid. Furthermore, climate appears to drive observed lichen richness. The interaction between habitat loss and climate change is therefore likely to threaten terricolous lichens in lowland open dry habitats. Fastly carried out management actions aimed at preserving open dry habitats may counteract the occurring decline. Restoration and conservation of the species-richest patches, regardless of their current extent, should be prioritized.

ID: 583

The strengths and weaknesses of the new biodiversity offsetting law in Finland

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In biodiversity offsetting, biodiversity losses are compensated by producing commensurate gains elsewhere. Offsetting is guided by internationally set criteria, yet offset planning, execution and monitoring face well-known challenges that can prevent them from achieving the goal of no net loss of biodiversity. Here, we assess the strengths and weaknesses of the new Finnish biodiversity offsetting policy, introduced in June 2023, against these challenges.

The new policy is in many ways advanced, outlining an exact way to calculate biodiversity losses and gains and setting clear rules for what actions can be called biodiversity offsetting. The policy includes several central criteria, such as the additionality and in-perpetuity of offsets and accounting for time-lags and uncertainty in future gains. All implemented offsets will also be listed in an open biodiversity offset register.

The policies' weaknesses include the illogical definition of avoided loss offsetting, which diverts from the international definition and likely prevents its use. Adherence to mitigation hierarchy or confirming offsets deliver biodiversity gains are not required, reducing the scheme's incentive towards avoidance. Offsetting is also entirely voluntary, hampering its uptake. These weaknesses illustrate the challenges of creating credible biodiversity offset policies that can set biodiversity on a net positive trajectory.

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ID: 586

Availability and usability of airborne laser scanning data in conservation biology

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Ecosystem structure, especially vertical and horizontal distribution of vegetation, is one of the six Essential Biodiversity Variable classes and is an important aspect of habitat heterogeneity, affecting species distributions and diversity. Vegetation structure can be derived from airborne laser scanning (ALS) point clouds, the availability of which has steadily increased due to direct investments in data acquisition by national agencies. Many European countries make their national ALS data publicly available. The growing availability of ALS data has the potential to improve ecological research and conservation biology. However, this potential is currently not fully exploited as deriving vertical structure variables from ALS point clouds requires extensive data processing and remote sensing skills that most ecologists do not have. Furthermore, the data are fragmented across national agencies and are virtually impossible to use for studies covering several countries or an entire continent. This leads to the curious fact that although the datasets as such are often available, access to ecologically meaningful information is practically denied to many. Here, we will (i) concentrate on ALS data availability in Europe, (ii) provide several examples of their use in ecology and conservation biology, and (iii) focus on the urgent need for their harmonisation across Europe.

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ID: 587

Assessing landscape connectivity to enhance conservation efforts of an endangered large predator (Cuon alpinus) in Southeast Asia

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Large predators play a critical role in maintaining the functionality and dynamics of ecosystems by regulating prey populations and preventing the spread of plagues and diseases. In Southeast Asia, a region known for its high biodiversity, large predators face severe threats due mainly to extensive habitat loss and prey depletion. Thus, to effectively conserve these species, it is essential to prioritize key areas capable of supporting viable populations over the long term. In this study, we modeled the habitat suitability for dholes (Cuon alpinus), an endangered species, and identified and ranked crucial core areas and corridors for maintaining connectivity among dhole populations in Southeast Asia. Our analysis indicates that only a limited portion of the species' original distribution is currently suitable. Within these areas, populations are fragmented, with limited and weak connectivity

among populations. Additionally, some core areas may struggle to uphold viable populations in the current landscape scenario, posing a risk of potential local extinctions. The remaining populations are anticipated to become more isolated and diminish in size, underscoring the urgent need for adopting more effective management actions to conserve this species.

ID: 592

Atlas based JSDMs to evaluate French protected areas and green corridors performance for insect conservation: the case of Occitanian Butterflies

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The Occitanie region (France), characterized by numerous and heterogeneous landscapes and bioregions, hosts a great diversity of species, including a rich entomofauna that it must legally preserve through a landscape approach. Here, using atlas data and as part of a collaboration between researchers and conservation practitioners, we have developed niche models for butterfly communities (Joint Species Distribution Models). The first objective of this work was to better understand the variables influencing species assemblages (taxonomically, phylogenetically, and functionally) and to establish distribution maps for all species through the HMSC modelling framework. The second, at the core of our project, was to assess the coverage rate of protected areas (PAs) and green networks (GN) in relation to butterfly communities in Occitanie. Thus, our ultimate goal is to assess how spatial biodiversity protection tools cover different entomological sets and issues as, beyond percentage coverage, each PA and GN was characterized by its degree of naturalness and frequency of pesticide use. Our gap analysis shows where conservation schemes should be improved in order to be effective to butterfly preservation. Finally, the results will be discussed in light of recent publications addressing the evaluation of spatial protection tools concerning entomofauna on an international scale.

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ID: 594

Deintensification of anthropogenic impact and proactive conservation measures in Europe to address a long history of trophic degradation

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The status of wildlife in Europe has been negatively impacted for millennia by human niche construction, leading to increasing pressure on animal and plant communities, particularly through overhunting and intensification of land use. Trophic cascades, for example, have been greatly simplified since the late Pleistocene, homogenizing landscapes at the macroecological spatial scale. The loss of trophic connectivity has led to many effects, including the emergence of evolutionary anachronisms with organisms characterized by functional traits that are no longer useful in the current environment (maladaptation), as reported in other parts of the world.

However, a de-intensification of land use (mainly due to globalization, which has led to the offshoring of food production outside the continent) and strict policies focusing on the conservation of remaining wildlife have resulted in significant benefits for many species, which have recovered large parts of their former range. Yet, in this century when environmental changes are increasingly becoming a tangible threat, Europe, like all other continents, needs to develop conservation policies that consider future perspectives of impact on species fitness. These policies should notably aim to counteract potentially irreversible damage to ecosystems by proactively creating sufficiently extensive and interconnected ecological networks in which human impact is minimized.

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Re-evaluating the importance of threatened species in maintaining global phytoregions

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Anthropogenic introductions are known to be changing the structure of global phytogeographical regions (phytoregions), but previous studies have been limited by incomplete or biased data and are thus likely to underestimate the importance of threatened species. We analysed a comprehensive dataset of all known vascular plant species and their occurrences (at botanical country resolution) to quantify the impact of potential future extinction scenarios. We used Infomap, a network-based community detection algorithm, to generate phytoregional delineations for six species-distribution scenarios (native, introduced and extinctions of species that are either documented as threatened or likely to be threatened, as well as combinations thereof). We compared the numbers and sizes of phytoregions to characterise the amount and spatial distribution of changes in global phytoregions under each scenario. We show that extinctions of species that are predicted to be threatened had a greater homogenising effect on phytoregions than introductions, and there was some evidence that introductions may even mitigate the homogenisation caused by extinctions, though this interaction is complex. This research provides the first evidence that the loss of threatened species would have significant ramifications for global phytoregions and demonstrates the need to consider extinction processes in studies of anthropogenic effects on biodiversity patterns.

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ID: 602

The role of ecological and life-history traits in mediating spatial responses to global change in mammal species

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Species' ecological and life history traits are often used as predictors in the assessment of range shifting, but the complexity of species' spatial responses tends to increase the more traits interplay with different facets of environmental change also driving distribution changes. Here we estimate the effects of ecological and life-history traits in mediating spatial responses for 28 mammal species of Great Britain. We use species occurrence records to extrapolate changes in occupancy between 1960 and 2017, and use occupancy changes as response variable in a random intercept mixed effect model with traits as predictors. We found that species with large body mass and size are more likely to face declines in occupancy, while species with large home ranges and dispersal distance are more likely to experience occupancy increases. Generalist life strategies were also associated with positive occupancy responses compared to specialist species, which were usually declining instead. For the same species, different traits have the potential to mediate opposite patterns of spatial responses. As such, we argue that assessment of species range shifting under global change scenarios need to account for all the ecological attributes that characterize a species, producing different degrees of spatial responses.

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ID: 603

Interactions between renewable energies and other human-induced threats to biodiversity

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Renewable energy (RE) developments are critical for combatting climate change but also have the potential to negatively affect biodiversity. Moreover, the potential negative impacts on biodiversity from expanding RE infrastructures will interact with other human pressures that are threatening wildlife. Thus, recognizing and explicitly accounting for the co-occurrence of threats and how they could interact is essential and can help us better understand their dynamics and impacts on ecosystems. Here we aim to assess the interactions between RE and other human-induced threats affecting biodiversity in Europe and South America. Through a co-occurrence analysis between the locations of RE (ongoing and future developments separately) and the threats from agriculture, hunting and trapping, logging, pollution, and invasive species, we identify hotspots areas of threats. We also map the overlaps between RE and other threats, and evaluate the level of protection of these areas, as well as how these interactions are projected to change over time. Understating the interaction between threats could foster a more accurate view of the extinction risks species are facing.

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ID: 613

Altitudinal distributions and shifts of European mountain birds differ between slopes

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Climate change is driving species towards higher elevations. While local shifts in altitude are well-documented, patterns across entire mountain ranges are less understood. Abiotic factors, such as topography and solar radiation can affect the speed of these shifts on mountain slopes. Solar radiation's impact on biodiversity is evident, but studies have mostly focused on plants, invertebrates, and amphibians, and only at a very fine scale. In our study, we adopted a cross-scale community approach to quantify the impact of solar radiation on the mean altitude and altitudinal shifts of bird species across European mountain ranges of the Alps, Pyrenees, Scandinavia and UK over an 18-year period. We found that bird communities tend to inhabit higher altitudes on slopes receiving more solar radiation. Specifically, the mean altitude of birds was, on average, 43meters lower on slopes with low solar radiation and 68meters lower on slopes with medium solar radiation. Over time, altitudinal shifts were faster on medium solar radiation slopes, which was particularly evident in the continental analysis, the UK uplands, and the Alps. Our findings underscore the significant influence of abiotic factors on the bird altitudinal shifts. Identifying areas with accelerated shifts is crucial for tailoring local conservation strategies effectively.

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ID: 614

Wetland management: how do management type and intensity influence amphibian communities of alkali marshes

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Amphibian populations are declining globally and proper management of their habitats is essential to mitigate the process. We evaluated the effects of different management types (cattle-grazing, reed-cutting, wildfires), management intensities and water levels on populations of seven amphibian species in a Before-After-Control-Impact design in alkali wetlands of Hortobágy National Park (Hungary) in 2015-2022. We found that the total abundance of amphibians increased from before management to during management and that it declined back to pre-management levels after management ceased. Cattle-grazing of moderate intensity (~1 livestock unit/ha) had long-lasting benefits to amphibians, particularly for Fire-bellied Toads (Bombina bombina), whereas wildfires had short-term, one-year benefits only and reed-cutting decreased the availability of amphibian habitats. Total abundance and toad abundance was highest in shallow edge zones in each habitat type studied. Our results demonstrate that management is essential in maintaining amphibian populations in alkali marshes because abundance declines in the absence of management. Cattle-grazing of low to moderate intensity in each season, possibly in combination with prescribed burning repeated in every five years, appears to provide the greatest benefits to the declining amphibian community of alkali wetlands.

ID: 615

Risky business: revealing the selective advantages for bold and aggressive small mammals in managed forest landscapes

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Predicting population responses to novel selective pressures is a pressing challenge and animal behavior plays a crucial role in shaping such responses. Mounting research shows that individuals behave consistently differently from one another, and that environmental change resulting from forestry practices, predator introductions, or urbanization can reduce the behavioral diversity of populations. Whether these changes stem from selective advantages of certain behaviors is poorly understood but given the impact of behavioral diversity on critical ecosystem processes (e.g., predation rates and seed dispersal), comprehending how behavior effects survival under varying selective pressures is paramount. In a long-term field experiment, we quantified behavior and population dynamics within the small mammal community of Maine, USA. Working across forest stands with different management histories, we examined effects of behavioral type on survival and assessed whether relationships differed depending on forest structure. In the most abundant species, Peromyscus maniculatus and Myodes gapperi, risky individuals experienced higher survival. However, this advantage depended upon refuge quantity (i.e., coarse woody debris and understory vegetation density). We suggest that spatial heterogeneity in perceived risk caused by forestry and other forms of land-use change alter the selective advantage of some behavioral traits and may have subsequent consequences for ecosystem function.

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ID: 622

How boring are humans in comparison to Mother Nature?

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Fundamental characteristics of our world are the color and dimension of visual structures, the frequency and amplitude of sounds, as well as the chemical composition of smells. Sensory diversity encompasses the variation in all structures, sounds and smells that are detectable by organisms. In this work I explore the tenet that human activities homogenize the sensorial environment. More specifically, I evaluate whether structures and sounds of geologic or biological origin are more diverse than those of human origin. I analyzed the greenness and texture of >20,000 visual scenes from the SUN-MIT database, as well as the dominant frequency and soundscape index of >10,000 sound clips from the BBC database. I also compiled the visual acuity and sound production traits of over 500 animal species. Results of the exercise reveal a splash of points with no marked difference between visual scenes and sound clips of geologic, biological or human origin. Humans are rather gifted organisms in terms of visual acuity and sound production/detection traits in comparison to other species. I found no indication that humans are boring in comparison to Mother Nature, at least in their sensorial creativity.

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ID: 633

Representativeness of Natura 2000 protected areas with respect to the diversity of groundwater Crustacea Copepoda in Europe

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The Natura 2000 (N2k) network of protected areas (PAs) still represents the key conservation tool of the European Union (EU) for species and habitats. However, the degree to which the biodiversity of groundwater ecosystems is represented within N2k PAs has not been thoroughly assessed yet. Such an evaluation faces two main challenges. First, most subterranean species were not listed in the Directives shaping the N2k network, so that member states are not legally obliged to monitor them for N2k reporting, leading to data deficiency. Secondly, N2k PAs are not randomly located across the landscape, so that many confounding factors may bias the outcomes of analyses evaluating their representativeness for the target taxa.

Starting from a novel dataset comprising some thousands occurrence records of European groundwater harpacticoid species, we used propensity score matching techniques to compare their species richness and beta diversity between matched selections of N2k PAs and non-protected areas. Harpacticoid diversity emerged to be differently represented within and outside PAs, with the ratio changing across biogeographic regions and groundwater habitat types. Our results may assist in updating the N2k network to encompass subterranean biodiversity − and the related ecosystem services − more comprehensively in EU conservation planning.

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ID: 637

The impacts of integrated farming systems on biodiversity : a focus on bats and their insect prey.

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In the UK, agriculture comprises almost 70% of total land use. Intensive farming practices have driven rapid declines in insect populations [1], with potential knock-on effects for taxa at higher trophic levels. To reverse biodiversity decline, whilst feeding an ever-growing human population, we must find ways of farming that are less harmful for farmland wildlife. 'Mixed' farming, where livestock are integrated into the crop rotation, may provide benefits to biodiversity by reducing synthetic inputs and by increasing habitat diversity [2] and may also reduce input costs for farmers. However, at commercial stocking levels, livestock can have a detrimental impact on insects [3]. This study investigates whether mixed farming benefits biodiversity in comparison to agricultural systems where livestock are absent. Between June and August 2022, twenty-six farms in Scotland were surveyed for nocturnal insects using light-trapping and for bats using acoustic recorders. Structural equation modelling was used to investigate links between farming systems, agricultural landscapes, insects and their nocturnal predators: bats. Preliminary results show that integrating livestock can have both positive and negative effects on nocturnal insects. However, this did not have a cascading effect on bats.

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ID: 644

Lichens on standing deadwood: the role of deadwood age and challenges for conservation

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Deadwood has an important role in forest ecosystems by providing habitat for a myriad of species. Lichens growing on the surface of deadwood are a distinctive part of the biotic communities associated with deadwood, especially on standing dead trees. We studied lichen communities on standing dead pines (Pinus sylvestris) in Fennoscandian old-growth pine forests, which are characterized by a high abundance and slow turnover (up to several centuries) of snags. Our main focus was to assess how time since tree death, determined with dendrochronological methods, drives lichen community structure. We found high lichen diversity, including high occurrence of threatened species, and distinct composition of lichen communities on old, high-longevity snags compared to fresh snags. With the special importance of high-longevity snags, our results underline the importance of not only deadwood quantity, but also its quality. Despite ongoing efforts to increase deadwood amounts in managed forests, current evidence indicates that high-longevity snags are dependent on old-growth dynamics and are not generated in managed forests at all. Instead, they are becoming increasingly rare. Thus, the conservation of lichens on deadwood entails significant challenges. Conserving the remaining high-longevity snags with their unique lichen assemblages is critically important for reaching conservation goals.

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ID: 648

Demographic resilience: does time matter?

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In a world that is rapidly changing, it is imperative to be able to accurately predict population persistence to assist conservation efforts. In recent years, a consolidated framework has emerged for quantifying demographic resilience, borrowing transferrable concepts from ecological resilience theory. The concept of demographic resilience has allowed better understanding of population responses to disturbances, but does not yet allow integration of temporal variability into its analyses. Using 36 and 27 years of longitudinal datasets on two populations of spotted hyena (Crocuta crocuta) in Tanzania exposed to different disturbances, we explored the concept of time-varying demographic resilience. Multistate Mark-Recapture Models were first used to extract annual vital rates from individual-based data, which were essential to constructing Stage-Based Matrix Population Models. We then performed analyses of transient dynamics on these models to estimate the metrics of demographic resilience for each year. We compared these time-explicit results with typical static measures of resilience, which provide a single estimate per resilience metric for the entire study period. We discuss the advantages of time-varying versus static demographic resilience for use in conservation-motivated studies of population dynamics. Our work opens new avenues, concepts and questions in the emerging field of demographic resilience.

ID: 654

Quantifying variability: expanding the knowledge on reproductive traits in functional ecology

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The functional traits of flowers and fruits (reproductive traits) have received limited attention in ecology. The inherent stability of these traits has the potential to mitigate methodological challenges linked to relying solely on mean trait values from databases, neglecting intraspecific variability of traits. In this context, reproductive traits may hold untapped potential in functional ecology, yet their applicability requires rigorous quantitative validation. We aimed to determine the variability of these traits at both inter-specific and intra-canopy levels, shedding light on their potential contributions to functional ecology. Our study involved the collection of flowers, fruits, and leaves from 79 species of trees and shrubs, with measurements of 16 distinct traits. At the inter-specific level, traits linked to the dry mass of flowers and fruits showed the most significant variability, contrasting with the conservatism observed in traits associated with carbon content in flowers and leaves. On an intra-canopy level, specific leaf area exhibited substantial variability, while traits related to carbon content remained notably stable. Furthermore, we compared the effectiveness of our proposed traits to the traits contributing to the Plant Economic Spectrum. We revealed meaningful relationships between the traits we proposed and those commonly used in ecological studies.

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ID: 656

Data-driven counterfactual evaluation of management outcomes to improve emergency conservation decisions

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Monitoring is needed to assess conservation success and improve management, but simplistic interpretation of monitoring data can lead to poor decisions. We illustrate how to counter this risk by combining decision-support tools and quantitative counterfactual analysis. We analysed 20 years of egg rescue for tara iti (Sternula nereis davisae) in Aotearoa New Zealand. Survival is lower for rescued eggs: however, only eggs perceived as imminently threatened by predators or weather are rescued, so concluding that rescue is ineffective would be biased. Equally, simply assuming all rescued eggs would have died if left in situ is likely to be simplistic. Instead, we used the monitoring data itself to estimate statistical support for a wide space of uncertain counterfactuals about decisions and fate of rescued eggs. Results suggest under past management, rescuing and leaving eggs would have led to approximately the same overall fledging rate, because of likely imperfect threat assessment and low survival of rescued eggs to fledging. Managers are currently working to improve both parameters. Our approach avoids both naïve interpretation of observed outcomes and simplistic assumptions that management is always justified, using the same data to obtain unbiased quantitative estimates of counterfactual support.

ID: 661

Hitchhiking seeds: the role of off-road vehicles in seed dispersal in protected areas

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Nature conservationists can have a crucial role in seed dispersal by transportation in protected areas. We examined the seed dispersing role of off-road vehicles moving in various types of habitats. We aimed to determine the qualitative and quantitative characteristics of seed dispersal, as well as the traits of the dispersed species. We collected external and internal samples from off-road vehicles in the Hortobágy region, Hungary over the course of one year. In less than a year, over 6,000 individuals of more than 100 plant species germinated from the samples. Most of the species were characteristic of disturbed habitats, but specialists and invasive species germinated, too. To have a deeper insight into the process, we distributed a questionnaire among Hungarian nature conservationists. We aimed to get information about the potential spatial scale of the process and daily habits that can influence the fate of the seeds potentially dispersed by drivers. As the number of off-road vehicles is on the rise, it is important to reveal their role in seed dispersal to reduce the spread of harmful species in protected areas. For this, it is crucial to inform drivers about their potential role in seed dispersal and about the preventive actions.

ID: 662

Quantifying gains from restoration actions for biodiversity offsetting when using habitat hectares

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Biodiversity offsetting (ecological compensation) is a widespread attempt to compensate for biodiversity losses from development projects by restoring and/or protecting nature elsewhere. The aim of biodiversity offsetting is often No Net Loss (NNL), where gains from offset actions are equivalent to the losses. Habitat hectares, calculated as area*condition, are a common approach for offsetting calculations that enable comparing biodiversity losses and offset gains. This approach requires ecologically justified metrics to assess the condition of a site (e.g., its level of pristineness). Furthermore, the effectiveness and time-lags of restoration and protection actions should influence offset calculations: less effectively the action improves the target ecosystem's condition, larger the area needed for achieving NNL. This however is rarely required in national offset schemes. Here we present a project for defining ecosystem-specific condition metrics and estimates for how different restoration actions improve the condition of ecosystems in Finland. In total, 201 response estimates for ecosystem type/restoration action pairs were defined in a large-scale expert collaboration. The work sets a basis for official biodiversity offsets in Finland, where offsetting has been recently introduced in national legislation. Condition metrics and response estimates benefit restoration planning also outside the biodiversity offsetting context.

ID: 665

Assessing habitat degradation using partitioned beta diversity - a case study using boreal forest lichens, polypores and bryophytes.

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Recognising habitat degradation is essential for planning and undertaking conservation initiatives. One way to do this is to partition beta diversity into turnover (species replacement) and nestedness (differences in species richness) because high nestedness is theoretically an indicator of differences in habitat quality.

We tested this assumption using boreal bryophyte, lichen, and polypore, assemblages in managed forests. We asked whether nestedness is greater when comparing assemblages in forests of different habitat degradation levels, and whether this result varied between local and regional scales.

We detected higher nestedness when comparing assemblages between habitat degradation levels, and the result was consistent between spatial scales. However, nestedness was less sensitive to differences in habitat degradation when comparing assemblages in relatively less degraded habitats. Our results support the use of nestedness for detecting habitat quality differences using assemblage data, but caution that it is better for detecting significant degradation.

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ID: 681

The impact of invasive tree species on temperate forest natural regeneration

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Regeneration ability is a crucial element of a forest resilience. As invasive tree species can transform ecosystems, we expect its manifestation in their impact on forest natural regeneration. We assessed the influence of Robinia pseudoacacia L. and Prunus serotina Ehrh. on forest natural regeneration. We established 160 plots with varying abundances of studied invasive species, in nutrient-rich oak and nutrient-poor Scots pine sites of different stand ages (medium or mature). We expect differences between R. pseudoacacia and P. serotina in impact intensity due to the differences in ecology between those two neophytes. Both of the studied invasive species should facilitate the spread of the other alien tree species. Furthermore, we will notice a difference in the reaction of particular native tree species to the presence of the tested neophytes. Shade-tolerant species should be more resistant to neophytes competition. Finally, native species regeneration will be more limited by studied neophytes in poor habitats. According to the multifunctional, sustainable forest management, natural regeneration should play a prior role. Additionally, natural regeneration is an ecologically and economically reasonable choice in contrast to artificial forest regeneration. Therefore, our research should support the management of invasive species in managed and protected forests.

ID: 687

Experimentally broadcasted wind-turbine noise alters songbirds' habitat selection and vocal communication in a natural environment

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The sound of wind turbines is a potential threat to songbirds, who use vocal communication to transfer information and rely on acoustic cues from the environment. Previous studies have shown decreased bird density around wind-farms, but the exact causes for this decline have not yet been fully recognized. We investigated the effects of wind-turbine noise on songbird populations by deploying a "Phantom Turbine": broadcasting wind-turbine noise at a site without actual turbines. We conducted the experiment in cycles of three stages: 'before', 'noise-treatment', and 'after'. We monitored birds' abundance using mist-netting and recorded freely-flying birds' communication and background noise levels. Wind turbine noise caused a significant decrease of ca. 45% in mean number of Sardinian Warblers (Corruca melanocephala momus) and a significant reduction in the number of detected calls compared to the control stages. Vocalization reduction was stronger with increased noise level. The broadcasted sound overlapped birds' known hearing range and vocalization frequency range, providing possible explanations for birds' response. These findings provide evidence of a strong negative impact of wind-turbine sound on habitat selection and vocal communication in a songbird population, emphasizing the need to consider noise impacts when planning wind farms or other noisy infrastructures in natural environments.

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ID: 702

Environmental and management factors drive biological communities and ecosystem services in agroecosystems along an urban-natural gradient

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The socio-ecological systems at the interface between urban and natural/semi-natural environments are crucial for agricultural production, biodiversity and ecosystem services. We addressed environmental and management drivers of avian communities, pollinating insects and nature-based recreation along the urban-natural gradient around Trento, northern Italy. Flower-visiting insects were mostly promoted by flower occurrence on field margins and within inter-rows in vineyards and orchards; mixed flowers, high grassland sward and cover are recommendable to support pollinators, while the cover of vineyards and apple orchards decreased their abundance. Bird communities mostly responded to land-use variables, with positive effects of heterogeneity and hedgerows. Apple orchards and vineyards negatively affected bird richness and/or abundance. The intensity of nature-based recreation increased with low or intermediate cover of vineyards and urban areas. Both intensive grasslands and apple orchards were negatively associated with recreation, while waterways had a positive effect. Agricultural landscapes around towns could support biodiversity and cultural and regulating ecosystem services, but some types of cultivations decrease the environmental potential of such areas. The maintenance of heterogeneous landscapes, and the implementation of biodiversity-friendly practices such as dedicated inter-row management, can improve conditions for biodiversity and visitors/locals, and synergic strategies could be easily developed in that sense.

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ID: 704

Phenological response of Batesian mimicry complex (Bumblebee - hoverflies)

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Beyond the evolution of Batesian mimicry is the assumption that Batesian mimics should co-occur spatiotemporally with models to gain protection from predators. Regardless of phenological order (whether models emerge first or mimic emerge first), studies on how climate change may disrupt the synchrony of phenology within the Batesian complex still lack enough attention. We analyzed the phenological response of the model bumblebee and its mimic hoverflies to warming climate within the Scandinavian Peninsula using citizen science data from Artsdatabanken and Artportalen. Means and standard deviations for each flight season were estimated with latitude and elevation as covariates.Then data were brought into the regression, for which precision is set on a year-by-year basis to be proportional to the inverse of the sample size for the year. A scan of probability of direction (pd) values reveals strong evidence that six of the nine model Bombus species have shifted flight seasons earlier, but there is no or at best weak evidence that the flight seasons of any of the mimic hoverflies have shifted. Understanding the climate change response of this Batesian-mimicry complex is essential to averting climate-driven mismatches within the complex.

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Blessing Umeh is currently a Ph.D. candidate at Nord University. She had her first degree from Nnamdi Azikiwe University in Nigeria. Thereafter, she obtained her masters degree from the University of Ghana, conducting research on pollinator diversity in different cocoa agroecosystems and the impact of the CODAPEC mass spraying insecticide program on insect diversity within this agroecosystem. After she took part in the Global Challenge Lab on Climate Action in 2022, her interest in how climate change is affecting insect pollinators emerged. This inspired the beginning of the PhD program, where she studies the impact of climate change on Batesian mimicry complex (model bumblebees and mimic hoverflies)

ID: 707

Feliplex: a high throughput sequencing (HTS) microsatellite panel for genetic monitoring of felids

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Molecular tools are increasingly becoming robust for understanding threatened species. Next-Generation Sequencing (NGS) has paved the way for genomic studies that are statistically powerful, replicable, and accompanied by an objective bioinformatic pipeline. Most of these targeted molecular tools are species-specific, limiting applicability for understanding communities or rare species. Recent approaches allowing genotyping-by-sequencing based on microsatellite markers have demonstrated its potential for assisting field studies. These hypervariable markers have the untapped potential of targeting multiple species simultaneously.

In a novel attempt, we have designed a multiplex nuclear marker panel that allows species and individual identification of multiple species, parallelly. Optimized for the NGS platform, the panel consists of over 50 tetranucleotide microsatellite primers with cross-amplification across Felidae species. The multispecies panel was validated with known samples from seven felid species across genus Panthera, Prionailurus, and Felis. Further, the panel was tested on unknown samples of the fishing cat to understand population structure. Aimed at wide applicability across Felidae, our approach allows the generation of objective and robust genotype data using genomic tools from poor-quality non-invasive samples. Allowing robust individual identification from non-invasive samples, this tool would enable population genetic studies to understand and conserve lesser-studied small cat species.

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ID: 709

The gender dynamics of wild meat: Mapping women's roles and their influence in tropical wild meat systems

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Wild meat is a key natural resource worldwide. Therefore, it must be managed sustainably to avoid livelihood insecurity, species population decline, and biodiversity loss. An often-overlooked aspect of wild meat management is the pivotal role that women play in its harvesting, processing, and distribution. Understanding women's contributions to wild meat systems is not only important for gender equality but for effective resource management; growing evidence suggests that actively involving women in conservation, including natural resource management, enhances outcomes.

Identifying where women exist within wild meat systems is the first step towards improving women's inclusion in wild meat management and conservation. However, these gender perspectives are poorly understood and understudied. To address this gap, we conducted a systematic literature review and present a map of women's roles in tropical wild meat systems according to the published literature, detailing the frequencies, location, geographic and operative coverage, as well as an assessment of women's participation in wild meat decision-making from price negotiation to policymaking.

The presentation is important for wild meat researchers, particularly those designing conservation policy and practice who wish to incorporate a gender perspective, and is relevant to those interested in conservation equity, particularly women's empowerment.

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ID: 715

Interactive effects of landscape diversity and flower fields on the natural control of insect pests

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The decline in biodiversity and ecosystem services due to agricultural intensification requires an enhanced approach to balance agricultural production and biodiversity conservation. While agri-environmental measures (AEM) play a crucial role to maintain local biodiversity in agricultural landscapes, critics point to the need for landscape-level improvements and tailored approaches based on regional conditions.

Within the KOOPERATIV-project, we tested the implementation of perennial flower fields along a gradient of landscape diversity in Lower Saxony (central Germany). The objective was to discern the combined influence of landscape diversity and flower fields on natural pest control and natural enemies.

In 37 landscapes perennial flower fields were sown in autumn 2022 and spring 2023, representing a gradient ranging from 0 to 13.5% flower field coverage in the landscape. Within each landscape we conducted baseline sampling in 2022 and repeated the sampling in 2023. We utilized aphid cards, visuals and pitfall traps to monitor natural pest control and the abundance of pests and their predators in cereal fields.

Results from the 2023 measurements provide insights into the effectiveness of flower fields across the landscape diversity gradient. Our study will contribute to designing landscape-scale AEM that promote pest control services depending on the previous landscape heterogeneity.

ID: 718

Location, location, location: how we represent species ranges is highly important for conservation

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Most area based conservation is based on knowledge of species' distributions. However, our knowledge of species distributions is lacking. Moreover, the concept of a species distribution is vague and dependent on people's perceptions, and available knowledge. Consequently, a lot of our conservation actions can be based on partial knowledge and unformulated conceptualizations of distributions. In this work we analysed the global distributions of land-vertebrates (altogether 33,000 species) based on knowledge from point-localities, expert drawn polygonal-ranges, and species distribution models based on both data types. We further explored polygonal and point data for global reptiles from different sources. Using these different data types and sources we first explored global broad diversity patterns. We further evaluated species' overlap with protected areas. Overall, we found that distributional data type greatly affects the broad distributional patterns of the groups we examined. Polygonal data sources for reptiles showed similarity in broad patterns, while the two sources for point data showed different patterns. Overlap with protected areas differed greatly across distributional data type, with greatest differences found for species with the smallest ranges – that are mostly of conservation concern. Our results highlights the importance of acknowledging distributional data type and source when making conservation priorities.

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ID: 725

A review of 'flatshark' ecology and conservation: Identifying knowledge gaps and research priorities for some of the world's most threatened fishes

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Amid drastic species declines and intensifying anthropogenic pressures in marine environments, awareness of extinction risk in the world's Chondrichthyans (sharks, skates, rays and chimaeras) has increased in recent years. However, the global scientific and conservation response has been stronger for certain taxa, with well-known charismatic species, such as the white shark, whale shark and manta ray, continuing to gain the most public and research interest. Despite consistently being highlighted as an urgent global conservation priority, sawfishes (Pristidae), wedgefishes (Rhinidae), guitarfishes (Rhinobatidae), giant guitarfishes (Glaucostegidae), angel sharks (Squatinidae) and to a lesser extent banjo rays (Trygonorrhinidae), remain amongst the most threatened fishes in the world. Here, we synthesise existing knowledge on these six families (hereafter referred to as 'flatsharks') based on a semi-systematic literature review of publications on ecology and conservation. We identified major taxonomic and geographical knowledge gaps, reflecting research and publication bias towards sawfishes, and towards the Western Central Atlantic. Given that these highly threatened elasmobranchs share many morphological and ecological traits, a collective and collaborative approach to research and conservation delivery may be useful in addressing biases within the group, and in raising the public and scientific profile of flatsharks within marine conservation more widely.

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ID: 726

Relationships between plant communities and soil in restored alkaline wetlands

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Wetland conservation requires effective restoration to combat the loss of endemic and rare species occurring in these globally threatened ecosystems. An emblematic case is the Friuli Venezia Giulia lowland fens, where several restoration actions aiming at re-establishing alkaline wetlands were undertaken. This research aims to assess the effectiveness of the restoration actions of lowland wetland focusing on the plant-soil relationships over time in three plant community distributed along a soil flooding gradient.

Plant communities and soil were surveyed in 4 m2 (2x2m) plots in three different habitats: dry meadow, low alkaline fen and Cladium-dominated fen. In addition, in a selection of sub-plots (50 cm radius) we counted the target species Primula farinosa.

Soil total nitrogen, phosphorus, organic carbon and microbial biomass C content increased over time since restoration, but this was also affected by the soil flooding gradient (i.e. habitat type). The relationships between plant diversity, functional traits and soil showed to significantly change in the habitat considered also affecting the Primula farinosa micro-community.

These findings underline the crucial role of plant-soil feedback in the restoration of threatened wetland habitats, opening some important perspectives for site conservation and management.

ID: 728

Time travel in landscape ecology: Archive aerial images and texture-based indices reveal past urban landscapes and their effects on plants and birds

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This study assesses the potential of historical orthophotographs (Strasbourg, France) to measure the effects of urban landscape dynamics on current plant and bird communities. A textural-based approach using Gray Level Co-occurrence Matrix (GLCM) was used to characterize past landscapes from historical orthophotographs in 1966, 1976, 1986, and 2000. Those historical metrics were combined with biodiversity data to determine the time lag of community responses to urban landscape evolution.

Selected texture-based models (Linear and Non-Linear Mixed Models) for urban landscapes, respectively, include GLCM homogeneity and contrast for built areas and brightness mean and diversity for high vegetation. After being successfully validated on historical orthophotographs, these models reveal dependencies on landscape composition up to 50 years ago for plant urbanity score and up to 30 years ago for bird functional richness. Time lag and influences of built areas and high vegetation vary regarding selected biodiversity indices.

Results demonstrate the potential of aerial black-and-white archives for describing urban landscapes over the past five decades. Landscape textural indices, easier accessible than categorical data, greatly facilitate investigations of time lags in landscape ecology, which further improves our understanding of resilience and functions of biological organisms and contributes to creating sustainable urban planning policies.

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ID: 732

Can we predict the predation pressure of owned domestic cats on all birds in the united states?

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Domestic cats (Felis catus) have coexisted with humans for over 10,000 years, emerging as one of the most widespread predators globally. This study evaluates the ecological impact of owned domestic cats on bird species in the United States, focusing on predation. Utilizing a novel framework that integrates machine learning with citizen science data, the study developed a Random Forest model to predict annual predation pressure on birds. The model, trained using data from Mori et al. (2019), considers traits, phylogeny, and geographical distribution of native continental bird species.

The findings highlight that predation pressure is significantly influenced by geographical distribution, phylogeny, and specific traits, including the hand wing index. Alarmingly, 35% of bird species predicted are at 'high' or 'very high' risk of predation from owned domestic cats, particularly those in shrubland, forest, and artificial habitats. These insights align with prior evidence of domestic cats' predatory impact and underline the urgent need for targeted conservation strategies.

Although further refinement is necessary, this framework is pivotal for advancing species extinction risk models. Enhanced by broader citizen science data, it promises to guide more accurate and specific conservation strategies to mitigate domestic cats' impact on native bird populations.

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ID: 733

Where to restore – an approach to spatial prioritization of connectivity forests for forest landscape restoration

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With two centuries of forestry, natural forests in boreal Sweden are rare and strongly fragmented. Hence, restoration aiming to improve conditions for forest biodiversity is needed. However, to ensure landscape connectivity – where to restore is a critical concern.

Our study objective was to identify connectivity forest that through restoration support connectivity and biodiversity. The study area covers the 1.3 million ha Vindelälven river mountain to coast watershed and represent gradients of forest types and conservation status. We 1) quantified the distribution of connectivity forests, 2) identified where these are situated relative to known high conservation value forests (HCVF), 3) determined sub-regional and 4) forest-type differences along the watershed. We used a model that predicts the relative likelihood of single hectares being HCVF. We assessed the potential to enhance connectivity by inserting forest areas with different probabilities of being HCVF and identified suitable areas for restoration.

Existing HCVF in the mountain region has high functional connectivity while for the inland and coastal regions, increasing connectivity require that substantial areas become restored. Only pine forests demonstrate a potential for functional connectivity across the watershed. For other forest types, the low abundance of connectivity forests strongly limits the potential for functional connectivity.

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ID: 734

Fine-scale spatial genetic structure and dispersal among Italian smooth newt populations in a rural landscape

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Amphibians are particularly sensitive to habitat loss and fragmentation caused by the intensification and modernization of farming occurring in the Mediterranean basin. However, artificial water bodies, associated with traditional husbandry, proved to be important surrogate for amphibian persistence.

Microsatellite genotyping was used to investigate the genetic structure of 21 Lissotriton vulgaris meridionalis populations (470 individuals) and the role of drinking troughs in supporting viable populations within a rural landscape interested by traditional farming (Tolfa Mountains, Italy). Our analysis highlighted the conservation value and the stepping-stone function of artificial sites in the species dispersal and in the gene flow maintenance.

Drinking trough populations show allelic richness and heterozygosity levels comparable to those from natural ones. A complex system of artificial sites and few natural wetlands was identified sustaining a well-structured network of demes highly interconnected with each other. The conservation of the identified genetic clusters may be useful to prevent further population declines and future loss of genetic diversity within an area characterized by scarce natural wetlands that frequently dried because of agricultural practices and strong seasonality.

Site-specific protection measures are needed to contrast the progressive disappearance of drinking troughs because of the abandonment of traditional farming in the last years.

ID: 737

Influence of climate databases on ecological niche models of forest species at different spatial scales

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The proliferation of climate datasets is stimulating the use of climate-based ecological niche models (C-ENMs) in conservation planning and management. Still, the effect of choosing a specific dataset has not been deeply assessed across spatial scales. We addressed the effect of bioclimatic data from different open access platforms on the predictive capacity of SDMs of more abundant conifer and broadleaved species at regional (Andalusia~1km2), sub-continental (Iberian Peninsula~10km2), continental (Europe~50km2) and global (~100km2) scales. We selected five broadly used climate datasets (CHELSA, WorldClim, ENVIREM, MERRAclim and TerraClimate). For each species and climate dataset, we calculated SDMs using an ensemble forecasting approach. Overall, the models performed very well based on the AUC and TSS scores across spatial scales. The predictive capacity of ENMs based on the climate datasets was significantly different between datasets and types of species (conifers vs. broadleaved). The contribution of each bioclimatic predictor also differed between species and datasets. There was significant variability when overlapping the spatial projections of the different C-ENMs. In conclusion, choosing the correct bioclimatic input data is key to avoiding erroneous conclusions when performing modelling approaches at different spatial scales, which is essential for developing successful decision-making.

ID: 740

Understanding the contributions of grazing to biodiversity conservation and fire hazard mitigation areas designated for nature conservation

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When managed under specific low-input farming systems (FS), some agricultural landscapes, known as High Nature Value farmlands (HNVf), support biodiversity, while delivering multiple ecosystem services to society beyond food production (provisioning), such as regulation (eg climate regulation, fire risk prevention) or cultural (eg eco-tourism). The role of specific FS, such as extensive livestock grazing, to maintain the extent and favourable conservation status of many species and habitats under the Habitats and Birds Directives, within the European Union (EU) Natura 2000 network of designated areas has been widely acknowledged.

Extensive livestock grazing has been advocated as a promising tool to maintain and restore open landscapes, by preventing ecological succession, thus fostering biodiversity while preventing the risk of wildfires in agricultural landscapes. Using data reflecting grazing patterns and densities, we analysed how grazing patterns relate to the occurrence of habitats whose persistence depends on active management, and with fire patterns through the last decade. We then pinpointed areas designated for nature conservation within the Natura 2000 network in which the promotion of grazing would have the highest impact on biodiversity and natural hazard reduction.

Implications are discussed in the context of EU biodiversity and agricultural-related policies.

ID: 747

SAFE Project: developing a conceptual framework to roadkill surveys in order to estimate vertebrate mortality with citizen science at a country scale

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Roads are globally increasing, with negative effects on biodiversity. Their most studied impact is roadkill, but little is known about the consequences on populations' persistence. The first step should be estimating the magnitude of roadkill mortality for all involved species. This is the objective of SAFE Project, focusing on vertebrates in Spain. We developed a conceptual framework for roadkill surveys, which are affected by three biases: carcass-location, carcass-persistence, and observation bias. Carcass-location bias regards the fate of roadkilled animals, which could not be on the road, so making them not detectable by roadkill surveys. Carcass-persistence bias can depend on species traits and environmental/road variables. Observation bias can depend on observer experience and survey method, but also on species traits and environmental/road variables. In order to estimate these three biases, we performed literature reviews, questionnaires to biologists, field surveys, meta-analyses, and macroecological modelling. We will finally apply the estimated biases to the results of a citizen-science survey we organized at a national scale, under an agreement with the Spanish Ministry of Ecological Transition and the three main scientific societies focusing on vertebrates.

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ID: 748

Are protected areas effectively tracking threats to terrestrial biodiversity?

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Protected Areas (PAs) are vital for nature preservation, yet evidence shows that pressure to biodiversity is increasing despite their global expansion. Our goal is to evaluate if PAs at the global level are effectively tracking threats to terrestrial vertebrates. Using threat maps based on IUCN Red List and the World Database of Protected Areas data, we assessed the cover of PAs on the most important threats: agriculture, hunting, logging, pollution, invasive species, and urbanization to all amphibians, birds, mammals, and reptiles. In total, our study draws on data from 33,379 species. We identify patterns between PA coverage and threats that highlights that many areas with a high probability of threats are not sufficiently protected. Thus, our results reveal a potential disconnect between global PAs and threat tracking, often leaving high-threat areas insufficiently covered. Notably, our mapped threats combined impact over half of the land surface, primarily in unprotected regions. Amphibians were the most threatened group, primarily driven by agriculture, logging, and urbanization. Likewise, agriculture poses a significant challenge for mammals and reptiles, along with hunting to mammals. Our research provides crucial insights into PA effectiveness, spotlighting areas requiring immediate attention and guiding strategic conservation planning.

ID: 763

Using digital yellow water traps for continuous pollen beetle monitoring in diversified agricultural landscapes with pesticide reduction strategies

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The European Farm to Fork strategy strives to reduce pesticide use and risk by 50% by 2030, preserving agricultural productivity, biodiversity, and human health. Research on crop diversification and novel field arrangements, supported by digital technologies, offers sustainable innovations for pest control.

This study evaluates digital yellow water traps, equipped with a camera and associated artificial intelligence model, for continuous pollen beetle monitoring. Data were collected in oilseed rape from three harvest years (2021–2023) at patchCROP, a landscape experiment established to study the effects of spatial and temporal crop diversification on yield, ecosystem services, and biodiversity. In patchCROP, crops were planted in square, 0.5 ha (72 × 72 m) "patches" and compared to surrounding commercial fields.

The digital yellow water traps and AI were evaluated and found to be useful for gauging pollen beetle immigration into rapeseed fields. Across all years, insect pest pressure was higher in the patches but did not necessarily compromise yields. Implementation of reduced pesticide management strategies, including targeted insecticide applications at specific thresholds, were not associated with reduced yields in patches with flower strips. Future studies should consider the role of field size and diversification approaches to fine-tune insecticide reduction strategies at the landscape scale.

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ID: 765

Where The Wild Dogs Are: Range-wide distribution modelling of an endangered African carnivore

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Knowledge of threatened species' distributions is essential for conservation planning. Distribution assessments can, however, be difficult for rare or elusive species. The African wild dog (Lycaon pictus, 'wild dog') is an endangered carnivore which has become extirpated throughout much of its historic range due to threats including habitat fragmentation, conflict with humans, and infectious disease. Current known wild dog 'resident' range represents just 7% of historic range, but range-wide experts have estimated that the species' status is uncertain in a further 40%. An additional 2% has been identified as potentially suitable for reintroduction to recover suitable former range. Species distribution modelling (SDM) can be used to identify associations between environmental variables and known occurrence records to characterise areas suitable for a species. Here, we use SDM methods to evaluate suitability across wild dog historic range, with a focus on uncertain and recoverable range. These results will inform targeted field surveys, where any populations discovered, or reintroduced into areas of high suitability, could add significantly to current wild dog range. This will allow for more accurate evaluation of the wild dog's conservation status and increase its robustness to the emerging threat of climate change through recovery of climatically suitable habitat.

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ID: 767

Ecological Peace Corridors as a new conservation strategy for human and biological diversity

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Protected areas constitute a key tool for the conservation of biodiversity, ecosystem functions, and human well-being. However, in areas highly impacted by human activities, it is not easy to set new territories for strict protection. Therefore, the identification of ecological corridors that allow the reconnection of extant protected areas is fundamental for their effectiveness and, even more importantly, for their expansion as envisaged by the EU2030 Biodiversity Strategy and CDB 2030 targets. These connective areas are of fundamental importance in allowing species to move between different protected areas ensuring the gene flow and, in some areas of the world, can also represent the best way to promote peace among countries while supporting the conservation of biological diversity. In fact, in the last decades, Peace Parks have been proposed to rewild functional ecosystems that transcend man-made boundaries, protecting biological and human diversity that is vital to support peace for humankind and the natural world. With the same aims, Ecological Peace Corridors (EPCs) could serve as buffer, expansion, and connection zones that, at the same time, reduce the risk of conflicts between neighboring countries and support biodiversity. I will explain the methods to identify these EPCs through gap analysis and AI approaches.

ID: 769

Blocks and Stripes: Does shape matter? Landscape for the conservation of Insects.

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The shape of habitats and fragments may affect their function in protecting the biodiversity inside and its effect on neighbouring habitats. Edge effects may further influence ecosystem services such as pollination or predation. We investigate shape and edge effects in flower elements in agri-ecosystems. Ten 1-year old, flowering landscape elements in 5 agricultural fields in East Germany (Havelland) were equal in size (2.250 m2) and differed by shape (150mx15m versus 45mx50m). 200 pitfall traps measured the effect of shape on epigeal insect diversity, abundance and biomass. We specified diversity of carabids, a taxa with diverse and often perennial life cycles, whose conservational needs are rarely considered in the development of agri-environmental schemes (AES) for insect conservation.

During the first year of establishment, we found both higher abundance and richness of insects in the traditional WFS, likely due to a longer border area towards the adjacent uncultivated field margins, which attracts insects from the surrounding habitat disproportionately. Border length might affect colonisation of WFS, but does not guarantee adequate quality of WFS as suitable and persistence of habitats for insects over time. We will discuss the effects of differently shaped flowering elements as a way of improving the profit of AES.

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The study presented here is part of a long term experiment, where the conservational value of permanent but mobile, heterogenous composite blocks of flower stips (Rolling Wildflower blocks, Eccard 2022) is compared to the more conventional AES praxis of running elongate flower strips along field edges (Linde.Wildflower-Experiment https://zwillenberg-tietz-stiftung.de/en/linde-wildflower-experiment/). Conventional flower strips are sometimes considered as insect traps since they attract insects but do not provide permanent habitats (Ganser et al., 2019).

ID: 771

Prioritising Functionally Distinct and Globally Endangered (FuDGE) sharks for conservation action

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The ecological differences between species provide insights into their contribution to the functioning, stability and resilience of ecosystems. Measuring the ecological uniqueness of

species will help understand how species loss might impact ecosystem functions and services. However, robust species-level methods for quantifying ecological differences have yet to be incorporated into conservation strategies, and current prioritisation metrics that consider taxonomic or phylogenetic information alone do not seem to precisely capture functional diversity. Here, we describe a new approach to measure the unique contribution of species to overall functional diversity and incorporate it into actionable conservation strategy. We propose the Functionally Distinct and Globally Endangered (FuDGE) prioritisation metric for directing conservation action to species whose extinction would result in significant losses of irreplaceable functional diversity. We apply our new metric to identify which of the world's sharks are most Functionally Distinct and Globally Endangered (FUDGE). We compare and contrast FuDGE with the existing Evolutionarily Distinct and Globally Endangered (EDGE) metric, which is based on phylogenetic diversity. We explore how both EDGE and FuDGE metrics perform at capturing functional and phylogenetic diversity. We show that the most unique and threatened sharks also tend to be the most utilised by humans.

ID: 773

Disentangling direct and trophic-mediated effects of forest structure and retention measures on forest birds

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European forests are increasingly managed to harmonize production goals with conservation, through practices such as retention forestry. Forest specialist birds, and especially cavity-nesters, may directly profit from retention practices thanks to higher nest site availability. However, it remains unclear whether retention practices, implemented within continuous-cover silvicultural systems, may increase food resource availability for birds across foraging guilds, and if this translates to changes in bird abundance and richness. To answer these questions, we carried out bird point counts in 135 plots in southwestern Germany, from 2017 to 2022, and measured the abundance of invertebrate prey groups with flight interception traps, light traps and pitfall traps. We analyse the data with a two-step procedure: first a binomial N-mixture model to estimate bird abundances and their relation to forest structure and management; then structural equation models that incorporate abundances of invertebrate prey and discern direct from trophic-mediated effects of forest structure and management on the bird assemblage. We expect to find that retention practices result in direct effects for cavity-nesters, but also on food-mediated effects for the ground-foraging and foliage-gleaning guilds. We also hypothesize that forest composition and heterogeneity have stronger effects (both direct and indirect) on bird abundances than retention measures.

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ID: 784

Plasticity in resource selection along anthropogenic gradients

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Anthropogenic activity shapes the structure of the landscape. While resource selection by wildlife largely depends on what is available in the landscape (i.e., 'functional response'), human activity can also influence what resources wildlife use, and the extent to which they use them. Together with international network EUROMAMMALS, we use telemetry data to explore how gradients of anthropogenic pressure influence resource selection by wild boar (Sus scrofa) and roe deer (Capreolus capreolus) in Europe. These species are the most common and wide-spread ungulates throughout Europe but respond differently to human activity. Where behaviour plasticity and high tolerance of humans has allowed wild boar to occupy landscapes including urban areas, roe deer are more dependent on forest cover and are often pushed out of human-dominated areas. We demonstrate how human-activity (i.e., productive land-use types, human recreation, roads, and settlements) alters the distribution of roe deer and wild boar throughout in Europe. With the terrestrial landscape constantly changing, and the extent of intact forest slowly diminishing, it is important to quantify how human pressure is changing fundamental ecological processes, to better inform managements of species and landscapes, as well as to anticipate the needs of future populations and promote human-wildlife coexistence.

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Hyperbolic discounting underpins response curves of mammalian avoidance behaviour

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As humans continue to clear natural habitats they are brought into increased conflict with wild animals. Some conflict is direct, such as elevated exposure of people to a predator, but other is indirect, such as an herbivore abandoning suitable habitat because of increased human use of it. The magnitude of

avoidance is expected to track frequency of human activity (disturbance intensity), but the type of response is an open question. We postulated that animals do not respond passively to increased intensity, nor does response follow a power law; instead, we expected animals' ability to estimate magnitude (if not counting directly) leads to 'discounting' behaviour, as seen in classic time-to-reward economic models. We used a ten-year dataset for 53 camera traps to characterise response curves. Bayesian regressions of two non-discounting models, exponential and inverse polynomial, and two discounting models, hyperbolic and harmonic, revealed that discounting models better fit the curves. The Arps equation, taken from petroleum extraction models, allowed estimates of the discount exponent as well as taxon-specific 'sensitivity' to human disturbance. Discounting likely means rapid recovery from disturbance, but increased recreational pressure on reserves will limit recovery potential.

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ID: 791

The role of wildlife-human interactions in modelling communities

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Wildlife has recovered in both numbers and distribution following the gradual abandonment of the Alpine mountains by human populations in the 1960s. Animals with broad ecological plasticity, such as roe deer, expanded their distribution range, leading to complex competitive and predator-prey dynamics. Nevertheless, farming, hunting and tourism have persisted and recently increased. We modelled these wildlife-human interactions using multi-species occupancy models to investigate: (i) the role of interactions in shaping inter-specific communities, (ii) the impact of human activity on species detection probability and (iii) the hunting season's potential impact. We defined an experimental design randomly placing 60 camera traps in a 1.5x1.5km grid in the Western Alps. We provided evidence of roe deer, wolves and red deer interdependence, revealing that pairwise interactions among species had greater impact than only considering individual environmental effects. Most importantly, the hunting season significantly reduced the likelihood of capturing roe deer, the only game species, without affecting red deer and wolves. Our results proved the relevance of including prey, predators and human dynamics as whole. Our findings quantify hunting as an important covariate in explaining predator-prey occurrences, which is relevant for guiding management decisions and indicating good practices to minimise human impacts in shared systems.

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Biodiversity gradients trough a river basin: markers, methods and tributaries in an eDNA case of study.

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Freshwater ecosystems are the most endangered worldwide, mostly due to anthropogenic factors. While riverine vertebrates are often present in monitoring campaigns, macro and micro-invertebrates are frequently overlooked. Moreover, standardized and widespread monitoring methods (such as electrofishing) are beginning to be questioned for ethical reasons. Environnmental DNA metabarcoding is confirming itself as a non-impacting and effective method for portraying rivers biodiversity, especially when visual census is difficult to apply. Notwithstanding the huge bibliographical effort in the last decades, little is known about the spatial and temporal resolution of the method in natural environments.

In this study, we sampled eDNA from the main stem, primary and secondary tributaries from sites inside the river Serchio Basin, central-northern Italy. eDNA was sampled with three methods: filtering, sediments and passive sampling, and amplified with three markers, COI for macroinvertebrates, 12S for vertebrates and 18S for macroinvertebrates. In each site, macroinvertebrates community was monitored trough kick-netting.

A holistic portrait of Serchio basin biodiversity was generated, and some patterns observed: eDNA converges in the main stem from the upstream tributaries, and methods strongly differ in their biodiversity output. Passive sampling worked the best for vertebrates, while sediment for macroinvertebrates, giving results comparable to visual census.

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ID: 796

The effects of landscape woody features cover and spatial configuration on bat activity – implications for woodland creation

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How we best target woodland creation to accrue the greatest biodiversity benefits has become an important question given ambitious habitat restoration targets. The importance of landscape context, including cover and configuration of existing habitat, on the effectiveness of restoration projects is unclear, however, it has been suggested that conservation actions are most effective in landscapes with intermediate habitat cover. Bats in the United Kingdom are highly mobile woodland taxa likely to benefit from woodland creation and are sensitive to landscape effects. To investigate the effects of woodlands and trees outside of woodland (ToW) on landscape wide bat activity, we surveyed ~600 locations across 60 agricultural landscapes in the UK. The resulting ~15,000 hours of recordings were analysed by the Bat Conservation Trust's automatic ID pipeline. Across our surveys we detected ~16 million calls from 8 species. Preliminary analyses found that the amount of woodland cover surrounding sampling locations has a relatively limited impact on bat activity. In contrast, many species responded positively to landscape ToW cover and activity at ToW sites was similar to activity at woodland edges. These results highlight the importance of hedges, tree lines and individual trees as habitat for bats in agricultural landscapes.

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Genetic Management and Population Rescue of an Inbred Felid: a Case Study on Dinaric Population of Eurasian Lynx

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In small populations, inbreeding depression poses a severe threat, resulting in fixation of deleterious mutations and a decline in survival probability. While establishing natural gene flow is an ideal long-term solution, implementing it under real-life conditions is often impossible due to the lack of habitat connectivity. Thus, population reinforcement, involving translocations of individuals from larger populations, is a viable conservation strategy.

This study focuses on the Dinaric lynx population, reintroduced in 1973, which started facing extinction due to inbreeding depression at the end of the 20th century. Between 2019 and 2023, we implemented a population reinforcement initiative, translocating 12 outbred individuals to the Dinaric Mountains. We used comprehensive genetic monitoring, and assessed genetic status before and during the reinforcement. We used individual-based genetic-demographic modeling to predict long-term viability under various management scenarios, highlighting the ongoing necessity of genetic management.

Results indicate that reinforcement is just an initial step, and continuous genetic management is imperative. The Dinaric lynx case provides important insights for successful management genetics for population conservation. The knowledge gained is not only crucial for the long-term conservation of this particular population, but also serves as a model for other wildlife populations facing extinction risks due to inbreeding.

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ID: 805

Urban biodiversity in drylands – trends, mechanisms, uniqueness, and future perspectives

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The world is becoming more urbanized, a process that has vast implications on natural systems. Yet, most research on urbanization's impacts on biodiversity has centered on temperate biomes. Conversely, drylands, which are the largest global biome, remain understudied. Here, we synthesize the key mechanistic differences of urbanization's impacts on biodiversity between temperate and dryland biomes. First, we highlight how irrigation shapes dryland urban ecology, leading to a greener and sometimes more biodiverse landscape than local unmodified wildlands compared to temperate urban ecology patterns. Nevertheless, these high biodiversity areas often include many invasive, synanthropic, and human-commensal species. Second, we point out how socioeconomic gradients—locally and globally—may shape biodiversity patterns differently between biomes. This is primarily due to the

impact of irrigation and non-native vegetation in wealthier dryland neighborhoods, cities, and countries. Finally, we suggest several research priorities, that could improve our understanding of urban ecology across systems, and promote more rigorous, just, and relevant conservation policy. Primarily, we suggest (1) to bridge the research gap in dryland urban biodiversity by prioritizing research in dryland cities with low GDP per capita and (2) to implement biome-specific, scientifically grounded management and policy.

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ID: 808

Movement and habitat choice of PIT-tagged Italian riffle dace (Telestes muticellus) in a small mountain stream

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Freshwater biodiversity is declining worldwide. Knowledge of the ecology and habitat use is important to understand anthropogenic threats and to protect fish fauna. At the same time, there is an almost general lack of scientific knowledge on habitat use and movement of many fish species, particularly for small sized species with restricted areas of distribution. With this in mind, we study behavior, habitat use and movement patterns of Italian riffle dace (Telestes muticellus) in a small Appennine stream. Individual fish movements and habitat use were tracked manually using PIT (Passive Integrated Transponder) telemetry. Within the available stream habitats, Italian riffle dace showed a strong preference for pools and slow flowing water. Most fish remained relatively close to their capture locations, while a few individuals embarked on movements over several hundreds of meters. The majority of fish from an intermittent river stretch, however, survived drought by upstream movements to perennially watered reaches. No directed spawning migration was detected, perhaps explained by the diversity of available habitat and substrates in the study stream.

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ID: 812

Demographic effects of Eurasian lynx population reinforcement: a case study from the Dinaric Mountains and South-Eastern Alps

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Eurasian lynx (Lynx lynx) in the Dinaric Mountains was until recently at the brink of extinction due to high levels of inbreeding. To prevent that, a population reinforcement program initiated within an international »LIFE Lynx« project. In total, 18 lynx from the Carpathian population were translocated to the Dinaric Mountains and South Eastern Alps between 2019 and 2023. Eight lynx have successfully integrated in the remnant population in the Dinaric Mountains. Besides genetic assessment, a robust transnational monitoring program was established to evaluate the demographic changes. Its central activity, i.e. camera trapping, was based on involvement of local hunters and protected area rangers as the main camera operators. In the Slovenian Dinaric Mountains where lynx population comes to its edge, the lynx density and abundance more than doubled over a 5-year period, despite negligible changes in its distribution there. Moreover, litter size of translocated lynx was larger compared to remnant lynx. Finally, five translocated lynx created a prosperous new stepping-stone population in the Slovenian Alps, with six litters detected since the reintroduction in 2021. These results indicate a positive developement of an endangered felid population and can serve as a good practice example for similar efforts in other populations.

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ID: 828

A simple measure of habitat heterogeneity is a good proxy of species of conservation concern

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Biodiversity assessment is a fundamental part of sustainable forestry and biodiversity conservation. We tested if habitat heterogeneity or habitat amount measures could predict biodiversity in Swedish boreal forests. We used 77 forest stands varying from structurally simple forests to woodland key habitats, to evaluate the relationship between habitat heterogeneity, habitat amount and richness and abundance of species of conservation concern (SoCC). We found stand-level habitat heterogeneity to be the best proxy to explain the richness of SoCC, but when only red-listed species were included, deadwood and age of the oldest tree proved to be more precise proxies. Finally, we calculated threshold values for deadwood volume and habitat heterogeneity score depicting the level above which the number of red-listed species is significantly higher, and found this value to be higher in the more intensively managed southern region than in the north where forest management has a shorter history. These thresholds can be used as guidance when identifying coniferous forests with high enough qualities to support red-listed species. We conclude that habitat heterogeneity can be used as a reliable proxy of the species of conservation concern, but it must not be used to prioritize conservation between geographical regions.

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ID: 836

Comparing climate-induced changes of marine megafauna species and functional diversity across scenarios to identify potential climate refugia

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Current approaches in conservation planning typically aim to identify and protect climate refugia defined as i) areas with persistent species taxonomic diversity over space and time, or ii) areas with stable climatic conditions (i.e., climate analogs). However, this approach critically overlooks complex shifts in functional diversity of community assemblages driven by climate-induced turnover of species and related functional traits. Here, we innovatively define climate refugia as areas where functional diversity persists over space and time, independent from persistence in species taxonomic diversity and/or climate analogs. We performed a scenario analysis by modelling the functional space of marine megafauna in the Northeast Pacific using 15 functional traits. We analyzed functional diversity and redundancy in relation to species diversity and turnover. Although moving northwards, some ecoregions' functional diversity changed at lower rate than taxonomic diversity, meaning that the turnover of species did not correspond to a similar functional diversity shift. By analyzing taxonomic and functional diversity combinations we also identified areas where their relative change will give place to new systems. This novel approach to climate refugia will help shape future protection and goals of conservation while considering the future capacity of these new systems to provide functions and related ecosystem services.

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ID: 839

Stakeholders' perceptions of wild deer and lethal methods to mitigate their impacts

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In recent decades, wild deer populations have expanded across the northern hemisphere, increasing human-deer interactions and affecting ecosystem services. Despite being culturally and economically valued by many, high densities of deer can have negative consequences for tree regeneration, biodiversity, crop production, and public health. With ambitious government targets to increase tree cover in the UK, managing deer populations and mitigating their impacts is crucial to ensuring resilient treescapes for people and nature. Currently, 'best-practice' guidance for deer management emphasises the need for collaborative landscape-scale partnerships among landowners. However, lethal control may be considered controversial. Understanding the relationships between people and deer is key to their effective management. Using a questionnaire distributed to the public and land management professionals across England and Wales, we investigate how value orientations, socio-demographic variables, and perceptions towards deer and their impacts are linked to the acceptance of lethal and non-lethal management practices. Profiling stakeholders according to value orientations toward wild deer and their management, our research contributes to the development of socially acceptable deer management strategies.

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ID: 841

The untapped potential of camera traps for farmland biodiversity monitoring

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European agroecosystems are experiencing a biodiversity crisis. Biodiversity monitoring is needed to inform conservation, but existing monitoring schemes lack standardisation and are biased towards birds, insects and plants. Automated monitoring techniques offer a promising solution, but while ecoacoustic and remote sensing applications are increasingly used, the potential of camera traps (CTs) in farmland remains underexplored. We reviewed CT publications from the last 30 years which sampled farmland in Europe and found a limited use of CTs in farmland habitats. The main research topics addressed management or (avian) conservation issues, such as monitoring wildlife-livestock interactions (including disease transmission), nest predation, and the use of feeders and water troughs. Fewer studies employed landscape-wide approaches to investigate species' habitat use or activity patterns over large agricultural areas. We discuss existing barriers to a more widespread use of CTs in farmland and suggest strategies to overcome them: AI advances in image classification, citizen science participation, and "boxed" CTs tailored for small mammals, reptiles and amphibians, provide opportunities for broad-scale, automated and taxonomically representative monitoring schemes. Finally, we propose some outstanding agroecological questions that could be addressed through CT applications, which could inform management and conservation efforts and deepen our ecological understanding of agricultural landscapes.

ID: 842

Substantial noise in expert judgements for conservation translocations: a case study of disease risk analysis in an extinct in the wild species

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Disease risks are one of the main risk categories highlighted in conservation translocations by the IUCN Guidelines for Reintroductions and Other Conservation Translocations. They are challenging to assess because of the limited knowledge on the range of relevant hazards that may affect a conservation translocation. In all cases disease risk analysis (DRA) requires expert judgements based on available evidence. Current approaches suffer from poor transparency in expert judgement including not evaluating noise. We critically evaluate the process of DRA using a proposed conservation introduction of the Extinct in the Wild sihek (Guam kingfisher, Todiramphus cinnamominus). We show two straight forward ways DRA can be improved: firstly by providing a direct comparison of expert opinion on risk across various options for disease risk management, and secondly by including the opinions of multiple wildlife veterinarians. These relatively simple improvements can reveal noise in current judgement. Noise is the variation between the judgements of experts and is substantial in the case of the proposed sihek conservation introduction. In addition, better elicitation of expert judgements provides a platform to reduce but not hide this noise, and hence provide decision makers with better information from which to make their conservation translocation decisions.

ID: 848

Short-distance migratory birds with faster range shifts show delays in their passage dates

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Assessing species' climate response rates is central to conservation, the former often considered insufficient. Avian species advance spring migration phenology as a key mitigation, extensively studied through passage dates across observatories en route. However, as breeding ranges shift polewards, average destinations also shift into areas with a later green-up and thus optimal local arrival, hence also migration. This might bias passage date time series (and their typical interpretation) if these do not truly reflect local phenology advances due to warming. Analyzing 33 species across 4 Nordic observatories, we found a positive relationship for short-distance migrants (SDM) between passage phenology and corresponding range shifts. As the average range shifts were near zero in our historical study period, corrections did not alter SDM group passage dates. However, at a species level, this

bias comprised large percentual delays compared to the overall advance trends in many species, inflicting a considerable underestimation. For time windows with consistent range shifts, such as more recent time series, also the mean estimated arrival trends will be underestimated. Acknowledging and correcting these biases pose a methodological advance, essential for accurately monitoring what species match or mismatch environmental changes - one precursor for their persistence under climate change.

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ID: 861

Variation in tolerance behavior of the threatened Nubian ibex inside human settlements

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The tolerance of wildlife to humans enables some populations to inhabit human habitats and often leads to human-wildlife conflict. To improve our ability to mitigate such conflicts, we investigated how life in settlements shapes the tolerance behavior of the threatened Nubian ibex (Capra nubiana). We studied the behavior of 29 tagged females from two separate populations inhabiting two settlements in the Negev desert of Israel: Mitzpe-Ramon (MR) and Midreshet-Ben-Gurion (MBG). The settlements differ in size and attitudes of humans towards ibex (MR being larger and with people approaching and feeding ibex). We repeatedly measured the flight initiation distance of individual ibex when a human or a human with a dog approached them. We also performed social network analyses and calculated individual home-ranges. We found that ibex in MBG were warier of humans but habituated over time. In MR the ibex behavior was determined by their social group associations and anthropogenic characteristics of their home-range, with some groups being warier of dogs, leading to a negative correlation between their responses to human and human with a dog. Our results demonstrate the importance of people's attitudes in shaping human-wildlife conflict and provide insights into the study of adaptations to changing environments.

ID: 864

Harnessing species-level data to support post-2020 ecosystem extent mapping

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Losses of ecosystem extents threaten both biodiversity and people. The Kunming-Montreal Global Biodiversity Framework (GBF) aims to halt ecosystem losses by 2030. High-quality data that allow tracking changes in extents of different ecosystem types are vital for ecosystem monitoring under the GBF and the System of Environmental-Economic Accounting (SEEA-EA). Distinguishing ecosystem types reliably and consistently, however, requires reference data on ecosystem occurrences for training predictive models or remote-sensing algorithms and validating their mapping outputs. Yet, global databases of direct ecosystem observations are lacking, with existing reference data sources often being inaccessible, insufficiently detailed, or non-standardized. By contrast, billions of species-occurrence records are being shared and globally integrated. Combined with expert knowledge on species-ecosystem associations, these data provide an indirect path to ecosystem observations. Following this premise, we designed a standardized and reproducible workflow to derive ecosystem-type occurrences by linking species records from GBIF and other sources to standardized information on species habitat preferences from the IUCN Red List, while addressing each record's spatial and thematic uncertainties. We will present this workflow, showcase its use in deriving ~40 million occurrences of 60 ecosystem types, and discuss next nest steps needed for addressing ecosystems without readily available lists of closely associated species.

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ID: 871

Using TrailGuard AI as an early-warning system for local forest staff and communities to promote human-elephant coexistence in Jhargram, West Bengal

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Negative interactions between humans and wildlife can result in human injuries, fatalities, crop losses, loss of livestock, and livelihoods. Where Asiatic elephant populations persist in multi-use landscapes and where natural habitat consists of forest fragments, conflict is often inevitable. Real-time alerts of elephants moving through multi-use landscapes can anticipate conflict and trigger effective response before losses occur. To this end, we deployed the TrailGuard AI camera-alert system that uses state-of-the-art AI algorithms to detect elephants approaching the settlements and farmlands of nearby village communities in Jhargram forest division, West Bengal, India. These AI-embedded camera-alert systems detected and transmitted over 200 real-time alerts of Asiatic elephants within @40 seconds to reach the cell phones of designated Rapid Response Teams constituted by the forest department. These alerts induced rapid responses from the respective forest staff with a mean duration of 20 minutes elapsing from the transmission of alerts to teams arriving at the scene to strategically manage the incident or even prevent damage before it occurred. TrailGuard AI as an early warning system can scale as an innovative solution to mitigate human-wildlife conflict and promote coexistence in conservation landscapes.

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ID: 873

Increasing invasive rat numbers in cities linked to climate warming and human population, with impacts on native species

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Invasive rats are a notorious set of pest species that imperil native species, consume and contaminate food, and transmit zoonotic diseases. These rats are now present globally in many habitats, but thrive in cities by exploiting the resources accompanying high human population density. Yet little systematic data exists on how rat numbers are changing, and how that impacts urban ecosystems. Identifying long-term trends in rat numbers and how they may be shaped by environmental changes like urban development and climate change is critical to implementing effective rodent management strategies. In this study, we use trend analyses of public complaint and inspection data in 15 cities around the world to estimate trends in rat numbers over an average of 12 years. 73% of cities had significant increasing trends in rat numbers, including Amsterdam, Toronto and New York City. Cities experiencing faster climate warming patterns and larger human population growth saw larger increases in rat numbers. Climate warming and human population growth may play a role in the growth of rat populations by expanding their seasonal activity periods and food resource availability within urban environments. Implications for the urban ecology of native species in cities around the world will be discussed.

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ID: 876

Exploring small-scale fishing in southern Italy's marine protected areas: unveiling essential habitats for ecosystem conservation

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Small-scale fishery is the main activity carried out by the Italian fleet. Due to its high heterogeneity it requires a multidisciplinary approach to identify critical aspects that may affect its sustainability both ecological and social. In this study, the Métier-based Approach (local practices + fishing gear + target species) was employed to characterize small-scale fishing peculiarities during the main activity season, within five Marine Protected Areas in Southern Italy. A spatial distribution modelling approach was used to integrate fleet characteristics (e.g., LFT), ecological aspects (e.g., target species habitats), environmental features (e.g., bathymetry) and fishermen behaviour to define the essential habitats of target species, in order to identify priority areas for conservation.

Results show that trammel nets, gillnets, and longlines are the main fishing gears used to catch the most common target species. The key feature influencing the choice of fishing gear is the extension of dominant habitats while the location of fishing activity is due the habitat patchwork. The findings support the importance of an effective spatial planning of MPAs.

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ID: 881

Vulnerability assessment guide for European climate-smart MPA development

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A promising strategy for preserving marine biodiversity is the development of Marine Protected Area (MPA) networks to achieve a 30% target of waters protected by 2030. The impact of climate change on marine biodiversity urges us to fully integrate connectivity and climate vulnerability into MPA identification and management. To improve science-based maritime spatial planning (MSP) for safeguarding and restoring biodiversity in MPAs, we propose a guidance for policy makers and managers for integrating climate vulnerability assessment

within decision processes. The guidance, developed within the Europeans project MSP4BIO, reposes on a review of sensitivity and adaptability trait-based criteria related to management objectives and will guide managers into a step-by-step approach from the identification of the purpose of the network to the decision process. The guidance helps to identify most vulnerable areas to a variety of climatic stressors considering multiple levels of biological diversity (population, species, habitat, ecosystems) and including considerations on connectivity. We also highlight approaches to deal with feasibility and uncertainty in dealing with data gaps, choosing methods, and addressing prioritization decisions regarding conservation objectives. The guidance is currently tested in a series of case studies across European waters but is adaptable to different marine regions and conservation challenges.

ID: 889

New monitoring tool to unravel fine-scale plant-pollinator interactions

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Bee populations are declining worldwide due to several man-made threats (e.g. land use and climate change, introduction of alien species) [1,2]. Interspecific trophic competition might be one of the ways through which such threats affect bees, although its role is not clear yet [3,4]. Useful insight could come from distinguishing between the different types of floral rewards collected by bees as well as from behavioural observations that are often neglected by traditional monitoring techniques (e.g. transect walks).

We designed and built a phototrap set up to run a specifically developed software based on motion detection [5] that can be deployed on field to monitor and differentiate between types of plant-pollinators’ interactions.

The device has been tested in high-altitude habitats in the Majella National Park (Abruzzo, Italy) and collected data have been used to (1) contribute to the faunistic knowledge of the study area, (2) characterize the plant-pollinator networks for pollen and for nectar in each study site, and (3) analyze bees’ foraging times to account for potential interference competition.

Overall, the phototrap has proven to be a useful and effective tool (provided ~80% of all records, saved 50% of monitoring time, zero false negatives), also showing room for further improvement.

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ID: 890

Born to be wild: wolves’ occupancy dynamics in the Italian Alps

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Wolves are in the process of recolonizing most European countries, including Italy. In the Italian Alps, it has been possible to follow recolonization by wolves closely since the species' natural return 30 years ago. Dynamic occupancy models are reliable tools for modelling changes in the distribution of a species over multiple years in relation to environmental covariates. In this work, we used data collected between 2014-2021 and a dynamic occupancy model to assess large-scale spatial wolf recolonisation patterns in the Italian Alps. By using a spatial random effect, the model was able to exploit information about the occupancy status of neighbouring cells. This allowed us to account for spatial autocorrelation when modelling complex dynamics as recolonization and extinction. We evidenced how human-related covariates, such as human population density, negatively affect wolf recolonization. At a time when conflicts between carnivores and humans are high, our results suggest that the paradigm of wolves avoiding humans at the population level is still valid, and that is crucial for the management implications of the species.

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ID: 891

Field size and crop composition impact winter bird assemblages in agriculture-savanna mosaics of western India

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Avian biodiversity in agricultural landscapes is declining globally. In Europe and America, agricultural homogenization and loss of smallholder farming are significant drivers of bird population declines, but in parts of Asia, large expanses of heterogeneous agricultural landscapes still exist. In the Indian subcontinent, status and distribution of avian communities remains under-explored due to lack of information on composition and configuration of highly fragmented agriculture-grassland mosaics. We addressed this research gap by leveraging recent advancements in cloud computing-enabled remote sensing data to assess the effects of agricultural composition and configuration on wintering birds. Based on 371 point counts over an area of 664 km² in western India, our models showed that overall bird species richness was negatively impacted by large field size, but positively impacted by increasing Shannon's diversity (composition) of habitat mosaic. Similarly, bird abundance was positively impacted by a higher amount of seasonal cultivation. The abundance of carnivorous and ground-feeding long-distance migrants was negatively impacted by higher amount of year-round cultivation and woody vegetation cover respectively while species preferring shrubs benefited from higher amount of seasonal cultivation. We conclude that smallholder, traditional-seasonal cultivation landscapes in India's agriculture-grassland mosaics are more biodiverse than landscapes with larger fields and year-round cultivation

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The global biomass of mammals since 1850

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Over recent centuries, industrialization has enabled humanity to expand rapidly, often at the expense of wild mammals. The changes over time in the biomass distribution between the main groups in the class Mammalia (humans, livestock and wild mammals) can serve as an indicator of human expansion and its implications for wildlife. Here, we use a combination of data-driven methods to estimate the biomass trajectory of wild mammals, humans, and their domesticated mammals. We find that in the year 1850, the combined biomass of wild mammals was ≈200 Mt (million tonnes), roughly equal to that of humanity and its livestock at the time. Since then, human populations and their livestock grew rapidly, reaching their current combined biomass of ≈1000 Mt. At the same time, the total biomass of wild mammals shrunk by at least half. This work provides a quantitative perspective into the rapid growth of humanity and the considerable declines of wild mammals over the past two centuries.

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ID: 894

Making the most of wetlands: evaluation of factors driving habitat quality of restored Finnish wetlands for declining wetland birds

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Over the past few decades, Europe has put in significant efforts to restore and construct wetlands to halt ongoing losses. These endeavors require significant time, investment, and effort, and hence it is crucial to ensure that they are highly efficient in meeting their objectives. A major objective of such projects is the conservation of biodiversity, including wetland birds. A large proportion of Finnish breeding ducks breed outside of the protected areas in agricultural and forestry landscapes, making their conservation even more challenging. SOTKA Wetlands project was launched by the Ministry of Agriculture and Forestry, Finland in 2020, with one aim being to curb the loss of waterbird diversity by constructing or restoring multiple wetlands in collaboration with multiple organizations and local stakeholders outside protected areas across Finland. Natural Resources Institute Finland (Luke) has coordinated the monitoring of breeding birds of these and similar sites in their part of the project (SOTKA Luke), including some established under Life-project Kosteikko-Life. We analyse responses of bird metrics like species diversity and breeding success to habitat and landscape characteristics of these wetlands, to help identify key elements of high-quality wetland habitats, thus improving the planning of future restoration efforts.

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Intercropping maize with biodiversity-enhancing partners – compromising between yield, biodiversity and ecosystem service provision

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Cultivating maize is highly efficient and profitable but its productivity comes at the expanse of low biodiversity. Diversifying maize by inter-cropping with flowering-partner crops provides an opportunity for increasing within-field heterogeneity and thus biodiversity. Flowering-partners grown with maize can promote pollinators by providing additional food sources. Further, increased habitat structure might support arthropods and related pest control services. However, few studies address maize inter-cropping since competition between maize and inter-cropping partners can reduce yield substantially.

In a field experiment, we established plots of maize and six different inter-cropping partners (clover, mallow, cress, vetch, marigold, fescue) and their pure pendants. We recorded maize yields, flower and bare ground cover, pollinator visits, activity-density of epigeic arthropods and proxies related to biological pest control.

Maize yields were lower for inter-cropping treatments in comparison to pure maize and varied upon partners from ~ 15 to 75 % yield reduction. Pollinator visits were higher in pure inter-crops and under low maize yields while arthropods and their related services showed contrasting responses but generally profited from inter-cropping. Here, we present in various scenarios the biodiversity -yield trade-off and discuss the point at which yield, biodiversity and ecosystem functions can be compromised.

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Defining the evolutionary footprint for an evocentric conservation

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Despite evolution was a core concept in the development of conservation biology (Soulé, 1985), it is hardly present in global perspectives, assessments and policies targeting the biodiversity crisis. Nevertheless, evolution is crucial for most issues of biodiversity governance and sustainable development (Jørgensen et al. 2019). Moreover, evolution is mostly invoked to support the conservation of ecological entities and processes that are generally significant for humans, whereas conservation should also be implemented to maintain the free evolution of these ecological entities and processes beyond human needs (Sarrazin & Lecomte 2016). Such evocentric conservation would account for short and long terms perspectives in conservation and help discriminating between ends and means in conservation approaches.

In that aim, we propose here a comprehensive approach to estimating and reducing the evolutionary footprint of humans on other living beings, incorporating both macroevolutive (phylogenetic metrics), and microevolutive (change in traits and in genetic diversity of populations) perspectives. Defining evolutionary footprints and their metrics allows us to set up indicators of human pressures that might enhance this footprint. Identifying such indicators is crucial for reducing a priori these evolutionary consequences and paving the way for a more integrative and evocentric approach to conservation.

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ID: 901

Enhancing honeybee conservation through gut microbiota insights

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Introduction: Honeybees (Apis mellifera) are critical to ecological balance and agricultural productivity due to their pollination activities. Recently, their populations have faced significant threats, including habitat loss, pesticides, and diseases.

Connection to Conservation: Gut microbiota is crucial in honeybees' nutrition, immunity, and pathogen resistance. Understanding these microbial communities is essential for developing effective conservation practices, especially in the context of environmental stressors that disrupt microbial balance and bee health.

Research Focus/Methods: Our research examines the composition and function of the gut microbiota in honeybees across different habitats and conditions. We employed metagenomic sequencing and bioinformatic analysis to characterise the microbial diversity within the bee gut and its correlation with health indicators.

Findings/Implications: There is a significant correlation between gut microbial diversity and bee health. Bees with more diverse microbiota exhibit higher resistance to common pathogens and stressors. This underscores the importance of microbiota diversity in honeybee conservation efforts, suggesting that restoring healthy gut microbiota could enhance bee resilience.

Conclusion: The gut microbiota of honeybees emerges as a crucial factor in overall health and survival. Conservation strategies should incorporate measures to support the integrity and diversity of these microbial communities, offering a novel approach to mitigate the global decline of honeybees.

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Using environmental DNA to search for the rare, endemic and endangered Apennine yellow bellied toad (Bombina pachypus) and its main threatening factor

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Worldwide amphibian populations are experiencing significant decline due to multiple threats. The Apennine yellow-bellied toad Bombina pachypus (Bombinatoridae, Anura) is endemic to the Italian Apennines, listed as Endangered (EN) in the Italian Red List [1] and experiencing a severe decline across its whole range [2], also caused by the spreading of the mycete Batrachochytrium dendrobatidis [3]. We tested the efficacy of the new promising environmental DNA (eDNA) technique [4] to detect both B. pachypus and B. dendrobatidis in 20 freshwater bodies of Central Italy. A species-specific primer was developed for B. pachypus through three validation steps (in silico, in vitro, and in situ). At each site, 3l water sample was collected with two temporal replicas (2021 and 2022), filtered, and eDNA extracted and analysed through qPCR by using species specific markers. A total of 51 environmental factors were measured at each site to identify factors affecting both eDNA and species detection. Environmental DNA allowed to detect B. pachypus at 60% of sampling sites (n=12), whereas B. dendrobatis was only found at one site, co-occurring with B. pachypus. PCA ran on environmental factors suggested that detection was negatively affected by increasing of agricultural areas, river width, altitude, artificial surfaces, and slope.

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ID: 914

Reproductive success of arable weeds does not benefit from flower strips

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The decline of animal-pollinated arable weeds is well-documented. But little is known about the effect of biodiversity measures, such as flower strips, on the naturally occurring arable weeds both within the measures and in adjacent crops. We investigated the potential of flower strips compared to grassy field margins to enhance reproductive success of arable weeds in adjacent conventional cereal fields. We recorded the pollinator visitation rate and quantified the reproductive success of three arable weed species (Sinapis arvensis, Centaurea cyanus, Consolida regalis) dependent on margin type and distance to field margin. The patterns in visitation rates varied between species but were, for example, higher next to flower strips for C. cyanus. Increased visitation rates did not lead inevitably to higher reproductive success. Seed number was higher for all species in grassy strips than in flower strips, and declined towards the field centre, but the results for thousand seed weight and germination rate did not show a strong pattern. We conclude that in-crop arable weed populations do not profit from flower strips via their effects on pollination. The decline in seed number towards the field centre suggests that at least some arable plant species would benefit from smaller field sizes.

ID: 916

Crafting a forest biodiversity index: uncovering the relationship between forest structure and bird occupancy

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Forests are areas rich in biodiversity which have long bestowed invaluable ecosystem services upon us. Nowadays, we possess the capability to manage them strategically, harnessing services while enhancing resilience against climate change. Nevertheless, the impacts of such management often elude direct evaluation, relying on indirect measures such as % of forest or dead wood volume, which are not accurately linked to changes of biodiversity. Thus, there is a need to bridge this gap by developing indicators that specifically discern the repercussions of forest management on biodiversity. My research focuses on this need, targeting Mediterranean forests, particularly vulnerable to the global change. Taking Catalonia, Spain, as a case study, we employ hierarchical abundance modeling and annual bird monitoring data to explore the direct links between forest structural variables and bird species abundances. The results show complex patterns that form the foundation for a comprehensive forest biodiversity indicator. Future steps involve model validation through historical bird monitoring, scenario-based predictions, and utilizing the

indicator to set planning actions in potentially rewilding areas, where knowledge gaps persist in simultaneously enhancing biodiversity well-being and mitigating risks such as wildfires and droughts.

ID: 920

Nutrient loading and warm temperatures drive an annual cycle of colonization and ecosystem collapse

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Microbes and aquatic macrophytes caused rapid ecosystem collapse in a small floodplain pond. Mesocosms were used to isolate the effects of nutrient loading and environmental warming on dissolved oxygen (DO) and pH in patches of aquatic macrophytes. Nutrient loading and warming increased competition for light, and caused a shift from submerged macrophytes in summer to floating macrophytes in the fall. In spring, high rates of photosynthesis produced long periods of hyperoxia (12 – 16 h/day with a maximum of 447% supersaturation) and basicity (10 h to 2 h/day of pH > 9.0), whereas high rates of microbial respiration produced long periods of severe hypoxia (4.8 h to 19.6 h/day of DO < 0.1 mg/L), resulting in high rates of fish mortality in summer. All macrophyte patches were heterotrophic in summer. The ability of submerged and floating macrophytes to stably coexist produced an annual cycle of colonization in spring and ecosystem collapse in summer. This cycle was not a transition to an alternative stable state as in many tropical lentic ecosystems. It is a newly defined transition between submerged and floating macrophytes reset by winter die-off of aquatic macrophytes. Small wetlands may signal the potential collapse of larger lentic systems due to global warming and nutrient enrichment.

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ID: 928

The Role of Biophobia, Nature Relatedness, and Knowledge on ESS in the Acceptance of NbS in Urban Areas- A Hybrid Choice Experiment

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Making cities sustainable, livable and climate-resilient is one of the greatest challenges of the Anthropocene epoch. Raising to this challenge, Nature-based Solutions (NbS) gained growing attention, as they help solve environmental and societal challenges while delivering a plethora of ecosystem-services (ESSs). Despite the general consensus that NbS in cities increase well-being, the extent to which dwellers are willing to adopt natural elements, remained understudied.

We test the hypothesis that greener environments are more desirable in the context of the willingness-to-adopt (WTA) green façades. We perform a stated choice experiment, simulating designs with varying degrees of green coverage, plant-biodiversity, and animal species that may inhibit it. We also incorporate a priming condition, where some individuals are exposed to information regarding ESS functions. Respondents' inherent connection to the natural world is also estimated via a hybrid choice model.

Our results show that the desire for greener environments is not a monolith: i) The choice probability of greener façades can decrease; ii) Biodiversity does not affect the WTA; iii) Awareness of ESSs leads to a higher WTA for all façade-types; iv) Wildlife reduces the WTA all designs; however, v) People with higher levels of nature-connectedness are more open toward designs which incorporate wildlife.

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Multi-taxa assessment of endangered and invasive alien species by environmental DNA revealed new opportunities to plan new protected areas

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Environmental DNA (eDNA) is a highly promising technique for traditional species monitoring [1]. We implemented a multi-species eDNA protocol aimed at the rapid detection of freshwater species occurring in Central Italy, ranging from Fungi to Mammals. We focused on 22 species either cryptic and endangered, or representing threats to freshwater native communities (invasive alien species (IAS) [2], transfaunate fish, and pathogens). We developed new species-specific primers for 13 of the 22 target species. We collected eDNA from water across 52 sampling sites located in either protected or highly natural (Natura 2000 and regional ecological network) areas, with two temporal replicates. eDNA allowed to collect 116 occurrences of 17 target species at most of sampling sites. Endangered species were often discovered outside European protected areas or still unnoticed in them. IAS were found to co-occur with endangered species at 15 sites. Low detection rates

were revealed for species with low metabolic rates and exoskeletons [3]. Compared to traditional multi expert-based surveys eDNA represent an accurate, promising and cost-effective method for large scale monitoring of freshwater biodiversity, especially when addressed to reporting obligations by the Habitat Directive, protected areas planning, and early warning of IAS.

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ID: 937

Unlocking Europe's hidden species diversity: a molecular phylogenetic study of the European lesser blind mole rats and its conservation consequences

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Well-established taxonomy is essential for species-based conservation; otherwise, it is easy to fail to recognize endemic species with a limited distribution. These overlooked taxa easily end up in a critical situation or may even become extinct because of the absence of effective conservation measures. The unclear taxonomy of the European blind mole rats led to a similar situation, significantly hindering the effective protection of endangered taxa. Based on a distribution-wide representative sampling (including all but three of the scientifically distinguished lesser blind mole rat taxa), multilocus phylogenetics and statistical species delineation methods, it was possible for the first time to get a comprehensive picture of the systematics of the whole group. We found that, in contrast to the previously followed single-species concept, European lesser blind mole rats can be classified into three distinct super-species and 11 well-separated species, all endemic to Europe. Many of the newly recognised taxa characterised by very restricted distribution and/or declining populations. They poses a significant new challenge for the conservation of Europe's biodiversity.

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ID: 940

Disentangling the effects of management, landscape composition and configuration on biological communities in intensive apple orchards

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Despite recent policies pushing towards sustainability, European food production is still highly dependent on intensive agriculture. Intensive farming is associated with high chemical inputs and deep habitat simplification, due to the conversion of large areas into monocultures, and the removal of other landscape features to ease mechanized management and maximize production. Such agroecosystems have strong impacts on biodiversity, with some groups (farmland birds and wild pollinators inter alia) undergoing steep declines, with potential consequences on the supply of key ecosystem services (ES), essential to agricultural production and for the reduction of agro-chemicals.

In this study, we focussed on three taxa (birds, insect pollinators, and rodents) responsible for relevant ecosystem services and disservices in apple orchards (weed and pest control, apple pollination, and tree damaging, respectively) in the Non Valley, Trentino (Italy). We investigated how they respond to management, landscape composition and configuration around and within intensive apple plantations. Results suggest that more heterogeneous landscapes (with semi-natural habitats interspersed within the orchard matrix) host richer communities and have the highest pest-control and pollination potential. Moreover, some management practices could boost ES provisioning while having limited if no impact on production.

ID: 941

Planning Wildlife Crossing Structures along roads in an Open Natural Ecosystem

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Linear infrastructures can negatively impact wildlife by fragmenting habitats and causing collisions. This conflict between economic development and ecological processes can be minimized through appropriate mitigation measures. Planning mitigation measures in open natural ecosystems is challenging where animals do not follow fixed trails. We describe an approach of prioritising road segments for mitigation based on neighbouring habitat, connectivity, and vehicle-collision patterns. We demonstrate this approach on National Highway-11 (63km), crossing through Desert National Park, India, with Chinkara and Desert fox as the focal species. We collected occurrence and collision information to model connectivity among core habitats, identified through the habitat use ensemble models and circuit theory within a 10km impact zone. We calculated mechanistic and empirical collision probabilities using traversability and logistic models. We prepared composite priority scores by overlaying indices of connectivity, collision and species' abundance, thereafter selecting segments with top 10-percentile scores. Habitat use models yielded high classification accuracy. Species' collisions

were influenced by vehicle frequency, proportion of visibility obstruction, habitat connectivity and animal encounter rates. Total 11 and 19 road segments were prioritised for Chinkara and Desert fox. Our study showcases a data-driven strategy for managing infrastructure-wildlife conflicts and accounting for the maximal covering location problem.

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ID: 944

Ecological plasticity of charophytes across a latitudinal gradient (southern Italy-Egypt) and its implications for conservation

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Charophytes are a group of benthic macroalgae, which are important both from the ecological and from the evolutionary standpoints. They play crucial roles in controlling ecosystem dynamics, and in supporting biodiversity. Charophytes are one of the most endangered groups of macrophytes, threatened by various forms of aquatic environment alteration, which are determining a progressive decline in their abundance and diversity worldwide. The definition of charophyte ecological niches, with a better understanding of how environmental drivers shape their occurrence, is thus crucial in evaluating their present and future diversity in changing environments, and in planning suitable conservation strategies. This is specifically urgent in the Mediterranean Basin due to rapid ongoing global climate change, increasing human pressure, and hydrological fluctuations. To fill this knowledge gap, this research aims at evaluating the ecological niche hypervolume of 10 charophyte populations, belonging to the genera Chara, Nitella, and Tolypella, and studied across a latitudinal gradient encompassing southern Italy [1] and Egypt [2,3]. Results revealed that the Egyptian populations exhibit larger ecological plasticity than the Italian populations and a differentiation in the occupied hypervolume, suggesting that warmer climates may force charophytes to adapt to challenging environmental conditions in coping with the scarcity of freshwater environments.

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ID: 948

Assessing climate change impacts on Congo Basin biodiversity from a local ecological knowledge perspective

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In the second-largest continuous tropical rainforest in the world, the Congo Basin, climate change affects biodiversity as well as forest-dependent local communities. In the region, the lack of accurate meteorological data prevents a comprehensive analysis of climate change impacts on its biophysical systems. In this context, local ecological knowledge, building on local communities' long history of interactions with their environment, can improve the understanding of interwoven environmental changes linked with climate change and biodiversity loss. This study builds on a 6-months field data collection in the Lac Télé Community Reserve, Republic of Congo, where local climatic changes, impacts on biophysical systems, and perceived drivers of change were documented through the knowledge of local communities. Results suggest that a wide range of climate change impacts are already apparent in the area, including changes in temperature and precipitation and the intensification of flooding events. Associated impacts on local biodiversity have also been observed, ranging from increased tree mortality, disrupted fish reproduction, disrupted migratory patterns in mammal species and reduced fruit production. Our results are discussed in terms of biocultural diversity maintenance and climate change adaptation for people and nature.

ID: 949

Supporting biocultural connections in conservation translocations

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Translocation is an important tool to safeguard species from decline, but translocation decision-making globally rarely accounts for relationships of place. We analysed geographical and archival sources related to the kākā parrot (Nestor meridionalis) in New Zealand, to investigate Indigenous Māori place-based knowledge of kākā ecology and human relationships, and how these might inform decision-making. Mapping placenames revealed 'hotspots' of landscape features bearing Māori names associated with kākā harvesting and ecology. Most street names were modern subdivision assignations, and were not informative of place-based biocultural relationships. Historical print archives (newspapers, magazines and journals) from 1842 - 1984 revealed a range of themes relating to kākā. Collaboration with local knowledge holders on a subset of place names demonstrated the importance of understanding the context of these names. Together, sources show temporal changes in the geographical distribution and recorded observations of kākā ecology could inform translocation decision-making, and partnering with local communities is critical to understanding these relationships. We recommend that translocation guidelines support and place-

based knowledge and relationships of Indigenous and other local communities. Translocations have the potential to restore species in and of themselves, but also biocultural connections and biodiversity.

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ID: 950

Impact of introduced fish on the Eurasian water shrew Neomys fodiens Pennant (1771) populations in alpine high mountain lakes

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Widespread introductions of fish into originally fishless mountain lakes had severe consequences for native biota, including aquatic macroinvertebrates, providing important food subsidies for native terrestrial and semiaquatic insectivores, such as the Eurasian water shrew Neomys fodiens. Since both fish and water shrews rely on aquatic macroinvertebrates as food, we investigated whether the presence of fish had adverse effects on N. fodiens. Baited tubes were deployed to monitor the presence/absence of N. fodiens by collecting faecal pellets in lakes with and without introduced fish in the western Italian Alps. The results indicated that i) fish significantly reduced the probability of detecting N. fodiens, ii) the most significant effects were observed in lakes with large-bodied fish (i.e. salmonids), and iii) both large salmonids and small introduced fish (e.g., minnows) exerted the greatest negative effects when they did not coexist. Overall, the findings suggest that the impact is mediated by a complex interplay of competition and predation between fish and water shrews. While it is unclear whether this poses a severe conservation problem for shrews, given their ability to rely on various other habitats, water shrews possess enough charisma to serve as a flagship species for advocating improved regulation of high-altitude fisheries management.

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ID: 954

Predicting effectivenes of river barrier removal for mitigating climate change impact on freshwater biodiversity in Switzerland

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Effective habitat and connectivity restoration in rivers represents a critical conservation challenge to safeguard globally declining freshwater biodiversity. However, the recovery of free-flowing rivers alone will not necessarily restore biodiversity and ecosystem functioning if we do not jointly consider the barriers alongside historical loss and future change in the populations and species they fragment. Switzerland presents an important but complex case for developing data-driven strategies to prioritize dam removal and restore fish movement, having rapid climate change, extremely dense barriers, and historical contractions of species ranges. In this context, we aimed to quantify how neglecting biodiversity baselines and future changes in climate impacts priority setting and affects conservation planning. To achieve this, we combined national records of fishes with high resolution environmental data and predictions of future climate change to model changes in species` distributions. We applied a novel approach of combining predictions of species-explicit sensitivities to threats and climate change with network connectivity models to evaluate effectiveness of alternative conservation actions in rivers. We conclude that understanding changes in past, current and future distribution of species will be critical to inform national restoration plans that allow the persistence and recovery of freshwater biodiversity and functioning of ecosystem processes.

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ID: 956

A local welfare perspective on biodiversity offsetting policy: A mixed methods case-study from Southeast England

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Increasingly, governments are signing up to No-Net-Loss or Net-Gain in biodiversity associated with developments (e.g. England's recent Biodiversity Net Gain (BNG) policy). While such policies aim to balance competing ecological and social needs at multiple scales, considerable scope for good, and harm, resides locally, where the impacts of development and biodiversity's contributions to wellbeing are most direct and diverse. To "do no harm, and where possible, do good" for local people's wellbeing, operational guidelines and project-level implementation should be socially and empirically informed. Despite this, there has been little empirical scrutiny of such policies from a local wellbeing perspective. We conducted a mixed-method study in Southeast England, comprised of a choice-experiment survey and scenario-led focus groups to assess the local welfare implications of BNG. Access and biodiversity were most important for offset acceptability, relative to other features; this was conditioned by sociopsychological, socioeconomic and geographic factors. Biodiversity-derived wellbeing was plural and place-specific, albeit with shared mechanisms. Compensation acceptance was influenced by institutional distrust, underpinned by negative legacies of previous development. Achieving welfare benefits from BNG requires better top-down guidance and more emphasis on place-based assessment and participation in BNG design. This can reveal plural values, while building trust and stewardship.

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ID: 957

Spatial context and playback of conspecific calls affect the success of artificial nests as a conservation measure in a migratory songbird

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The House Martin (Delichon urbicum) is a migratory species and categorized as near threatened in Switzerland. Placement of artificial nests is a widely applied conservation measure and playback of House Martin calls is selectively used to boost the colonization of unoccupied artificial nests. Yet, the success of this measure varies strongly, and the determining factors are poorly understood.

We conducted an experiment on 120 unoccupied sites with artificial nests to test whether and under which conditions playback of conspecific calls influence the presence and colonization probability of House Martins. We also tested the importance of local availability of artificial nests, distance to the next occupied breeding site, and seasonal timing of playback.

Presence and colonization probability increased with proximity to the next occupied breeding site, whereas the number of available nests showed no effect. Playback in spring more than doubled the House Martin presence and colonization probability compared to non-playback control sites. Playback in late summer, when birds presumably prospect for breeding sites, showed no substantial effect. The results highlight that playback of conspecific calls at unoccupied nests can positively influence House Martin breeding site selection, but it is even more efficient to place nests close to already occupied sites.

ID: 960

Countrywide, high-resolution maps to support the conservation of endangered bird species

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Actors involved in species conservation are inevitably faced with the question of where to allocate their efforts. Spatial data on species distributions, habitats, and other relevant factors are a pre-requisite for spatial analysis and prioritization. Rapid advances in remote sensing technology and processing offer new opportunities to describe habitat characteristics at increasingly high spatial, thematic, and temporal resolutions across large extents.

Here we develop a routine to generate country-wide maps for decision-making regarding where to take which action for the endangered, conservation dependent Whinchat Saxicola rubetra. As early mowing of meadows is the major threat of this species, we first derive the timing of the first management event from recently developed maps on grassland-use intensity. In combination with land cover and other nationwide data, we then infer potential breeding habitat at a resolution of 10x10m across Switzerland. Considering known occurrences and connectivity among potentially suitable areas, we further identify areas where Whinchat habitat should be protected from unfavorable developments and areas where the habitat quality should be enhanced or restored to allow species recovery or expansion. Our spatially explicit approach can be expanded to other conservation dependent species.

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ID: 965

Human impact influences Eurasian lynx foraging ecology at various spatial scales

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Human presence influences wildlife species, causing both positive effects (e.g. increased food sources, shelter), as well as negative consequences (e.g. higher mortality, habitat alteration). Large predators, in particular, exemplify such trade-offs between resource availability and the diverse risks posed by anthropogenic landscapes. Here, we studied the anthropogenic impact of human impact on the foraging ecology of Eurasian lynx, using a large dataset of GPS data and kill sites across Europe. We observed that lynx feeding time was overall negatively affected by human impact, suggesting reduce food intake in more disturbed areas. However, we found differences among populations, indicating local adaptations by lynx. Next, at a smaller scale (Dinaric population), we observed that naïve (i.e. translocated and sub-adult) lynx killed their prey closer to artificial feeding sites, where encountering prey may be more likely but risk of kleptoparasitism by bears is high, while experienced (i.e. resident adult) lynx avoided these sites for hunting. We discuss the implications of our results under the light of the increasing anthropogenic pressure, as well as the implications for lynx management conservation programmes based on translocation and population restoration of the lynx.

ID: 966

Assessing the landscape of digital identifiers for capturing online species data

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Effective biodiversity conservation requires a solid knowledge basis that can support conservation planning and action. Gaps in this knowledge basis can be filled using the internet to capture the increasingly large volumes of digital data documenting biodiversity and the ways humans interact with it. One of the challenges in collecting this data is the ability to identify and collect relevant information from various platforms for specific species due to language complexity. In this context, the emergence of platform-specific digital identifiers can be a possible solution. Here, we assess the current landscape of digital identifiers and characterize their availability across different biological groups and knowledge areas. Our results suggest there the uptake of digital identifiers by online platforms is well developed for biological databases, but shows major taxonomic biases for other knowledge areas. Similarly, we identified strong biases at the species level with more popular species being represented in a larger number of databases, and less popular ones represented in only a few. The further development and compilation of digital identifiers for species to ensure a better taxonomic representation across multiple areas of knowledge could facilitate the use and integration of digital data in conservation applications.

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ID: 968

Evaluating diversionary feeding as a method to resolve conservation conflicts between recovering predators and endangered prey.

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The recovery of mammalian predators of conservation concern is a success story with positive ecosystem benefits. However, if predation impacts rare prey species that are also in decline, this may create conservation conflicts. This calls for effective intervention that mitigates predator impacts without compromising the predators' recovery.

We evaluated diversionary feeding as a management intervention tool to reduce depredation by protected native predators (Pine Marten and Badger) on nests of declining Western Capercaillies in Scotland. We studied the influence of diversionary feeding on the fates of artificial nests using a replicated, representative, and randomised landscape-scale experiment.

Diversionary feeding substantially reduced the predation of artificial nests, translating into a predicted 83% increase in nest survival. The increase was mostly accounted for by reducing the probability that a pine marten, the main nest predator, depredated eggs. Indicating that it is a suitable management tool for reducing the impact of nest depredation.

This provides an evidence based, conservation management solution for practitioners to add to there intervention tools.

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Evaluating diversionary feeding as a method to resolve conservation conflicts in a recovering ecosystem
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ID: 969

Public preference for the rewilding framework: a choice experiment in the oder delta

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Rewilding is an emerging paradigm in restoration science, and is increasingly gaining popularity as a cost-effective ecosystem restoration option. In this study, we utilised a discrete choice experiment in Germany and Poland to investigate public preference for rewilding in the Oder Delta. The transnational nature of the study area, spanning both Germany and Poland, allowed us to compared preferences within two distinct societal contexts. Anchored in the rewilding framework, our experimental design focused on three central elements: trophic

complexity, stochastic disturbances, and species dispersal. In both countries, we found respondents were willing to pay for rewilding interventions when compared against a status quo option. Notably, preferences were strongest for restoring trophic complexity through promoting the comeback of large mammals. However, a divergence was observed between local residents and the wider national populations, with the former expressing negative willingness to pay for certain rewilding measures. This study not only advances our understanding of societal opinion on rewilding, but also highlights the critical need for biodiversity democracy, effectively integrating social-ecological considerations into conservation planning.

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ID: 970

Interactions between livestock guarding dogs and wildlife in the Carpathian Mountains, Romania

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Livestock guarding dogs (LGDs) are considered effective at preventing livestock losses, so are often suggested as a tool to help facilitate coexistence with carnivores. However, little is known about the ecological impacts of using LGDs. Thus, we aimed to characterise and quantify LGD-wildlife interactions in the southern Carpathian Mountains of Romania; an area which hosts some of Europe's largest populations of large carnivores.

In the summer of 2021 we interviewed shepherds, GPS-tracked their sheep and LGDs and collected LGD scats for dietary analysis. We also monitored LGD and wildlife activity using camera traps deployed across pastures and forests.

Shepherds reported that their LGDs sometimes chased, injured, and killed non-target wildlife including deer, wild boar, wildcats, foxes, and hares. However, there was little empirical evidence to suggest that LGDs have substantial effects on co-occurring wildlife: there were low occurrences of wildlife in LGD scats, LGDs largely remained near livestock, and, of the five species studied, only red deer showed potential avoidance of LGDs in space and time.

These findings help to establish that LGDs can be used with limited detrimental impacts to wildlife and are, therefore, a suitable candidate tool for reducing the need for lethal control of wild predators.

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ID: 972

Returning and restoring biodiversity: guidance on human dimensions

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Conservation translocations (CTs) are widely used management interventions to restore locally extinct or augment severely depleted species to promote biodiversity. Restoring a species that has been absent for a number of year involves biological, environmental and social dimensions. The key role of human-wildlife interactions (HWIs) in biodiversity conservation has been recognized by the Kunming-Montreal Global Biodiversity Framework. Such growing evidence suggests that CT efforts are more likely to succeed in improving ecosystems and benefiting humanity when we understand positive and negative human-wildlife interactions (HWIs). The Human-Wildlife Interactions Working Group (HWIWG) of the IUCN/SSC CTSG facilitates discussions and workshops with practitioners, researchers and academics from across the globe, on a range of aspects of human-wildlife interactions in conservation translocations. The group is producing a set of Guidelines for HWIs in CT to support planning, decision making and monitoring human dimensions of conservation translocation projects. In this presentation I will introduce an overview of these guidelines and discuss their value in promoting long term biodiversity conservation.

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ID: 977

Harnessing ChatGPT towards Developing a Global Database on Human-Wildlife Conflict

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Competing interests of humans and wildlife causes conflict in many rural regions throughout the world, negatively impacting peoples' livelihood and safety as well as wildlife habitat. Human-wildlife conflict (HWC) impedes progress towards sustainable development goals in multiple key areas such as protecting life on land and promoting good health and well-being. Despite increasing recognition of this issue in public and academic discourse, we still lack a global database for HWC. We recognize challenges to achieve such database as the large volume of literature on HWC as well as ambiguity around the definition of conflicts makes manual review and synthesis a time-consuming task. Here, we demonstrate an innovative approach to rapidly reviewing, and extracting key information from large amounts of scientific literature using ChatGPT within the framework of a semi-structured review. We demonstrate its utility in streamlining the literature and information review process towards developing a global database of HWC. Importantly, we find the ChatGPT-based tool to be particularly useful for assisting in the tasks of summary, synthesis, and named entity extraction. Furthermore, we discuss the strengths and limitations of the approach, including the importance of verification of output information.

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Avoiding parachute science when addressing conflict over wildlife
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The curious story of sympatric bees and their viruses: the implication of floral resources and bee immunity on virus sharing across bee taxa

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Among various causes for bee decline, viral diseases are considered a potential major concern. Shared floral resources are suspected to be a main hub for inter-specific virus sharing. Therefore, foraging patterns on different flowers are anticipated to affect virus sharing across taxa. However, the differences in immune defences among bee taxa and the effect on their viral profile are unknown. We surveyed five sites in a Mediterranean agroecosystem in central Israel, recording bee-flower visits, and collecting honey bees (Apis mellifera) and three dominant co-foraging wild bee genera - Andrena, Eucera and Hylaeus over in 5 to7 consecutive censuses along the activity season. In RNA sequencing of bees pooled by genus, we found shared bee viruses (Lake Sinai Viruses) only between bees from the genus Eucera and honey bees. These two groups largely overlapped in foraged plant species, which were mostly legumes and composites. As both genera are within the Apidae, we examined their similarities in post-transcriptional immune defence. Sequencing revealed that the siRNA profiles of Eucera and honey bees are more closely clustered compared to the other mentioned genera, possibly associated with their shared viruses, foraging patterns and common ancestor.

ID: 983

Practical and package walk-through: Assessing Time-Varying Demographic Resilience

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After the previous lectures in which participants will learn about (i) the historical development of resilience and stability as concepts in the field of community ecology and (ii) the theory of demographic resilience (DR), a recently formally defined concept, the participants will learn the importance of accounting for temporal variation when assessing DR. Until now, DR has been assumed to be static, which prevents pinpointing the periods in time when disturbances occurred. Yet, DR can vary over time as a response to changes in demographic rates of a population.

In this third part of the workshop, we will present "demres", the R package we have developed for applying the time-varying approach. This third part will follow the format of a practical, and participants will be guided through R scripts on how to apply both time-invariant and time-varying approaches using our package to quantify DR metrics. We will demonstrate the functionality of the available functions as well as the figures that are possible to plot, in order to visualize the different metrics values over time.

ID: 991

Bridging gaps: citizen science contributions to wild pollinator conservation in NATURA 2000 parks

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Over the last decades, a sharp decline in wild pollinator abundance and diversity has emerged in the European Union and around the World (IPBES, 2016; Van der Sluijs, 2020). Responding to this challenge, the role of NATURA 2000 protected areas network is of primary importance to safeguard wild pollinators, as highlighted in the revised EU Pollinators Initiative (European Commission, 2023). Through the various observations uploaded as photos by citizens, the LIFE4POLLINATORS web-platform, activated 3 years ago, offers a valid tool to gather information on pollinators and their preferred plants. Users can upload photo-records of pollinator-plant interactions, which are subsequently identified by expert taxonomists. At present, over 1800 photos have been uploaded, half of which were taken inside NATURA 2000 sites. Almost 800 photos were used to identify at species level a total of 226 plants and 202 pollinators. Of these, 7 and 20 respectively have a conservation status in the IUCN European red list, and more are present in the countries' list. The observations of several Data Deficient species suggest that citizen science could be an effective tool for wide data gathering. This could fill data gaps, which is fundamental for the protection of mutually dependent pollinators and plants.

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ID: 994

Why are there so few CEE researchers involved in the CBD and how this could change?

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Most Central and Eastern Europe countries signed the Convention on Biological Diversity in 1992, and ratified it through their national legislative processes within five years. This played a crucial role in their efforts to preserve and sustainably manage their rich biodiversity, as it provided a basis for national legal frameworks. However, the number of CEE experts involved in CBD processes is still very low, though their expertise on the specifics of the region is much needed. Historical (political) factors have led to limited opportunities for scientific research and international collaboration, funding shortages, and inadequate research infrastructure. These constraints still hinder the ability of researchers in the region to engage in international initiatives from their own country. Language and differences in scientific communication practices can also be barriers. Addressing these challenges would require long-term commitments from governments and concerted efforts to strengthen institutional capacity and investment in research infrastructure. Funding opportunities to promote international collaboration and networking could support training and capacity building for researchers to understand CBD processes and mechanisms. Their participation can be further motivated by the opportunity to meet other fellows, produce high impact scientific papers and engage in research projects that can enhance their career prospects.

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ID: 995

Seagrass movement: oceanographic modelling and genetic data reveal connectivity patterns of Posidonia oceanica along the Western coast of Sicily

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Movement is fundamental to the ecology and evolutionary dynamics of species and populations. In marine environment, seed dispersal plays a key role in shaping the distribution and genetic complexity of seagrass meadows and affect their resilience capacity under disturbance. Understanding seed movement pathways is thus critical to support effective conservation and restoration actions.

We collected beach-cast fruits of the Mediterranean seagrass Posidonia oceanica from nine localities along the Western coast of Sicily, along with adult shoots from eight putative donor meadows. We determined levels of genetic diversity of both established meadows and seed cohorts, and their genetic differentiation. Genetic assignment tests were used to infer the most likely meadow of origin of seeds and were complemented with Lagrangian simulations to assess all possible connections among seed sources and collection sites based on ocean surface currents.

A significant genetic differentiation was found between beached seeds and adjacent meadows, indicating mixing of dispersing seeds across the study area, and long-distance dispersal events. Oceanographic simulations highlighted that the potential connectivity between sites was conditioned by marine circulation features. Key source meadows were identified based on their ability to provide sexual propagules. Such information can guide management actions and advance conservation of marine biodiversity.

ID: 996

Applying behavioural insights to drive biodiversity conservation

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At their core, biodiversity conservation challenges are contingent on human behaviour at both, individual and systemic levels. Thus, behavioural science is ideally positioned to inform conservation interventions and policy, fostering effective, socially just, and long-term change. A striking case is that of human-elephant conflict in northeast India, impacting the quality of life and also resulting in several fatalities among local residents and wild Asian elephants. To create safe, shared spaces, we adopt an interdisciplinary approach combining behavioural science and ecology to design and implement a conservation intervention. Here, we improve communication by designing certification-mandated outreach materials such as signboards and posters in tea estates that are used by elephants. We use ethnographic tools to identify behaviour change levers, combining them with ecological information to create, test, and design outreach materials with the target audience's input. Partnering with major tea producers, these outcomes are intended for implementation across 32,000 hectares of tea estates with over 300,000 residents.

Amidst global and local movements for socially just and participatory conservation policy, particularly the Global Biodiversity Framework, behavioural science promises to be a strong avenue for driving positive change.

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ID: 1001

Uncovering past and present fish growth dynamics using a coupled structural, microchemical and geochronological approach on otoliths

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Otoliths, the calcified biominerals in the inner ear of teleost fishes, provide a unique opportunity to investigate growth in historical and modern fish populations. They are life history archives that grow continuously through the accretion of alternating mineral- and protein-rich layers.

We aim to test the hypothesis that growth rate and body size of Adriatic black gobies (Gobius niger Linnaeus, 1758) have changed during the late Holocene and Anthropocene because of climate warming and other human-induced stressors. As a first step, we employ sclerochronological analyses on otoliths from gobies sampled alive and on radiocarbon-dated Holocene otoliths from a sediment core off the coast of Piran, Slovenia. It is crucial to verify the accuracy of historical growth patterns before reconstructing reliable long-term growth chronologies. Our comprehensive approach involves comparing modern and historical otoliths through visual, structural and microchemical techniques, analysing macro- and micro-optical features and chemical variations within the incremental record.

Our study provides a direct comparison between modern and historical otoliths, offering insights into past and present fish size and growth patterns before and during significant human-induced environmental changes. This has implications for fisheries management and conservation.

ID: 1002

Beekeeping challenges in fragile ecosystems: insights from Giannutri Open Air Laboratory project"

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The massive presence of human-managed honey bees (Apis mellifera) emerged as a threat to local pollinators in fragile ecosystems such as small Mediterranean islands. The G.O.A.L. (Giannutri Open Air Laboratory) project, started in 2021, investigates the competition between managed honey bees and wild bees on Giannutri Island. Adopting a manipulative and multifaceted experimental design, we measured the effect of honey bees on the availability and exploitation of trophic resources by wild bees by temporarily closing the hives. We monitored the abundance and behaviour of wild bees on the two most abundant Apoidea (Anthophora dispar and Bombus terrestris) in two experimental conditions: presence of A. mellifera workers (hives open) and their absence (hives closed). A worrying and constant decline in wild bees abundance over three years was recorded along linear transects. Moreover, we observed a reduction in foraging time and an increase in foraging rate near the apiary in hives open condition. We documented a generalised decline in wild bees populations which is likely due to a smaller energy uptake and higher energetic investment in the presence of a high density of honey bees. Overall, our findings emphasise the urgent need for precise guidelines in developing sustainable beekeeping in Mediterranean ecosystems.

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ID: 1004

LIFE4Pollinators: a challenging project to improve awareness among key stakeholders towards the conservation of wild pollinators

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Pollination is a fundamental ecosystem service, supplied mainly by wild pollinators. Nevertheless, people's level of awareness on this issue is generally low, especially in the Mediterranean countries, where many initiatives still focus almost exclusively on honeybees, and attempts to address specific policies are scattered or just starting. LIFE4Pollinators (www.life4pollinators.eu, LIFE18/GIE/IT000755) aims to encourage the change of behavior in key stakeholders and civil society, by improving awareness on pollinator importance and spreading pollinator-friendly practices in Italy, Greece, Spain and Slovenia. It includes regional and national governance activities towards the inclusion of pollinators as bio-indicators in agroecosystems and the implementation of the Pollinator Initiative in Italy. The project foresees different approaches: courses and workshops involving farmers, conservation practitioners and urban garden operators, citizen science projects for schools, social media campaigns, bioblitz in Nature2000 sites. A set of materials was produced consisting of field-guides, handbooks for key stakeholders, code of conduct and declaration of intents, 3D animation videos and a mobile exhibition. Moreover, several working groups and tools were created, and a specific monitoring methodology was built to assess the impact of the project KPI. Results on project achievements, management strategy and monitoring tools, are here presented.

ID: 1005

Freshwater macrobenthos in southern Italy: a biodiversity hotspot and its conservation priorities

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Freshwater macrobenthos is a key component of aquatic biodiversity, ensuring functional trophic webs and nutrient recycling. This group includes several bioindicator species, with well-known ecological sensitivity to habitat modifications; despite this, the diversity of these organisms still has received little attention from eco-evolutionary and conservation perspectives. To check the efficiency of actual conservation practices of Italian protected areas and investigate community composition, we monitored the state of biodiversity of some benthic macroinvertebrates (Ephemeroptera, Plecoptera, Trichoptera) within the Aspromonte Mountain massif (Calabria, southern Italy), one of the main hotspots of Mediterranean endemisms. The sampling strategy was chosen to account for the area's high environmental heterogeneity and the different protection levels currently adopted by the Aspromonte National Park. No clear correspondence between the distribution of taxa and the protection scheme was recovered, suggesting that the current protection scheme does not reflect biodiversity patterns within the area. Moreover, DNA barcoding revealed the occurrence of several highly differentiated and previously unknown intraspecific lineages, compared to the rest of the peninsula, and of putative new species. Overall, our integrative approach highlights the extreme value of the Aspromonte massif for the conservation of Mediterranean biodiversity, and the need to consider freshwater biodiversity in future conservation planning.

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ID: 1011

Long-term trends in the size structure of mollusc indicator species of the northern Adriatic Sea

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Humans have been affecting marine communities for centuries, but ecological time series rarely exceed few years to decades. Sediment cores provide records of environmental change preceding the onset of systematic monitoring. We use multiple cores from the northern Adriatic Sea (NAS) capturing the last 150 to 7,000 years to study size changes in two benthic species common in this region: the bivalve Varicorbula gibba (Olivi, 1792) and the gastropod Turritellinella tricarinata (Brocchi, 1814) (= Turritella communis, Risso, 1826). Previous studies have shown that the opportunistic V. gibba increased in abundance during the 20th century, replacing T. tricarinata as the dominant species of soft bottom communities, and in average size. These changes were likely driven by eutrophication and increased frequency of hypoxia. Our preliminary results suggest that, despite a decrease in abundance, T. tricarinata also increased in average size during the 20th century. Further results will clarify whether this response occurred throughout the NAS during the 20th century and identify possible causes. Size data from T. tricarinata and V. gibba, dating back multiple centuries to millennia, will answer whether natural environmental change induced comparable size changes before the onset of increased anthropogenic impact.

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ID: 1017

B3 as a solution to simplify and speed up the accessibility of spatiotemporal data; implication for conservation.

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The B-Cubed project (Biodiversity Building Blocks for Policy) was initiated with the aim of ensuring that monitoring data be easily accessible, reliable, and useful, thereby enhancing the efficiency of future conservation-related decision making. The ongoing global biodiversity crisis necessitates robust, precise, reliable and recurrent biodiversity monitoring data for effective policy assessment. A considerable amount of data has already been collected, such as datasets coming from Habitat Directive reports of the European Union. However many of these dataset are not easily accessible, with temporal and spatial data often kept separately or not harmonized in terms of taxonomy. Additionally, biodiversity data are often influenced by errors that make their applicability uncertain in modeling species distribution. First, the project aims to integrate the use of virtual species and simulation, to assess how spatio-temporal and taxonomic uncertainty can affect our understanding of ecological niche and conservation needs of real species. Furthermore, through the use of the data cube format, B-Cubed aims to organize biodiversity data spatially, temporally, and taxonomically, making them easily usable and increasing efficiency in modeling change and status of biodiversity. These B-Cubed goals are crucial to align with the Biodiversity Strategy for 2030 and provide relevant recommendations for effective conservation planning.

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ID: 1025

Using the youngest fossil record to reconstruct life history changes in the exploited bivalve Arca noae in the northern Adriatic Sea

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Changes in life history of marine species in response to harvesting and human-induced environmental changes are frequently observed in modern ecosystems, but the true magnitude of these shifts is difficult to evaluate without the pre-impact data. The edible bivalve Noah's Ark shell (Arca noae L.) is commercially exploited in the Adriatic Sea, where its fishery rapidly expanded until a population collapse in the late 1940s. In spite of partial recovery, the lack of data on growth parameters of this species prior to that event complicates establishing sustainable levels of harvesting. To provide a baseline for assessment of the current state of populations of A. noae we compared modern and fossil (middle to late Holocene) specimens from the northern Adriatic using samples from benthic surveys and sediment cores. The maximum lifespan of fossil specimens estimated based on sclerochronological methods exceeded 85 years – more than twice the longevity documented in modern individuals. Our results indicate that modern populations of A. noae are characterized by faster individual growth and shorter lifespan compared to their Holocene counterparts, suggesting that harvesting pressure combined with warming and eutrophication of the northern Adriatic Sea had a significant impact on the life history of this species.

ID: 1026

The management of brackish inland lakes: the case study of Pergusa Lake (Sicily) with its sexual population of Chara canescens (Charophyceae)

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Pergusa Lake is a brackish endorheic lake, located in the centre of Sicily. In 1951 a racetrack was built all around the lake: this, in addition to reclamation of swamp areas, digging of wells, the construction of a village, and recently the introduction of alien species and the input of freshwater from other basins, impacted significantly on the lake ecosystem. Nowadays the lake falls within a Special Nature Reserve, a Natura2000 site, and a Geopark.

The lake is important also because it hosts one of the 8 known bisexual populations of the dioecious charophyte Chara canescens Loisel.: the species is limited to saline habitats with a restricted salinity range, but most populations are made only by female individuals (1).

A Biodiversa+ project ("ProPartS") focused on this species across Europe is currently ongoing. Its main goal is to develop management plans for inland brackish water sites that meet the requirements of Chara canescens, thus including primary producers alongside birds and other "flag" species. After the disappearance of the species from Pergusa Lake (2), we were happy to verify its return, and we are now interacting with managers and stakeholders to also include it in the management plans of the site.

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ID: 1027

A framework for understanding the experience of nature through cognitive mapping

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Human behavior plays a pivotal role in the biodiversity crisis and has a major impact on it. Yet, processes contributing to biodiversity decline (e.g., urbanization) also alienate people from nature. While connecting people to nature through nature experiences is considered a primary conservation challenge, our understanding of what constitutes nature experiences remains elusive. Here, we aim to understand what constitutes the experience of nature and propose a holistic framework. We conducted a multistage conceptual content cognitive map (3CM) process with 106 participants, employing a mixed-method approach across three different cultures (US, Switzerland, and Israel). Our findings reveal that the nature experience comprises three dimensions: interactions, encountered circumstances and internal response. These dimensions encompass 33 components which are consistently identified across the cultures. Frequently mentioned components include observing wildlife, landscapes or scenery, lack of human influence, weather conditions, relaxing, and awe for nature. Conversely, fear and home-based nature experiences were the least mentioned components. These results reveal that nature experience is a subjective perception shaped by three interconnected dimensions. The emphasized components underscore the significance of providing access to extensive, less human-influenced natural spaces. This, in turn, can foster a profound nature experience, promoting feelings of connectedness and care for nature.

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ID: 1034

Theory of demographic resilience

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This lecture will introduce the framework of demographic resilience (DR) that was recently proposed (Capdevila et al. 2020) to quantify resilience of populations to disturbances, inspired by a similar concept from community ecology. As with resilience in community ecology, DR is a multidimensional concept that consists of several different metrics. These metrics can be broadly grouped under two main resilience components: resistance and recovery. In addition to resistance that is measured analogously as at the community level (as the extent of the decline in population size after disturbance), compensation can be measured as part of DR (measured as the extent of increase in population size after disturbance) as some populations may exhibit overcompensatory dynamics . Similarly to how community matrices can be used to quantify resilience of communities, population matrix models can be subjected to the analysis of transient dynamics to compute DR metrics. This lecture will explain how to compute a set of such DR metrics, including: damping ratio, reactivity, maximal attenuation and maximal amplification. Further, we will introduce the transient envelope, which encompasses the most extreme possible increases and decreases of the population size after disturbance, and can thus be especially useful in comparative studies.

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ID: 1039

Developing a decision-making tool for sustainable climate action while harmonizing economic, GHG, and ecosystem service indicators in local initiative

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In the global pursuit of climate change mitigation and biodiversity conservation, effective leadership from public decision-makers is paramount. In this context, the carbon market serves as a tool to incentivize the development of sustainable habitat restoration initiatives. The objective of this research was to develop carbon compensation projects involving buffer strips on croplands that are socially, economically and environmentally viable. Specifically, we used state-of-the-art carbon accounting approaches to evaluate the viability of two enlarged buffer strip scenarios: switchgrass crops for the energy market and willow crops for the bioproducts market. We tested the parameter sensitivity of our economic model, including carbon source-sinks, time horizon, costs, revenues, and conversion factors. Our breakeven analysis showed that the two scenarios allow for the long-term maintenance of sustainable agriculture practices at lower cost while deficits quantify the value of the ecosystem services rendered. Our work illustrates the challenges of arbitrating between the economic costs and benefits of a buffer strip project lead by local farmers and the production of ecosystem services in terms of water quality and wildlife habitat restoration.

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ID: 1046

Climate extremes show higher importance than climate means in limiting mammals species ranges

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Environmental factors have been used to explain species' distributions for centuries. The relative importance of those environmental factors in determining species' occurrences may vary across space, being a non-stationary process. Furthermore, alternative measurements of the same variables, such as maximum, minimum, or mean values, may also have different strengths in explaining species' distributions. Thus, although species tend to thrive under their optimal conditions, the relative importance of extreme values of environmental variables is expected to be higher towards species' range edges. In order to quantify the contribution of individual variables across species' ranges, we employ SHapley Additive exPlanations (SHAP) to analyse the importance of climatic variables to individual occurrence points in Species Distribution models of 50 mammal species, verifying whether extremes versus means contribute differently to species suitability across the species range. Our preliminary findings point that extreme temperature measurements show higher explanatory power towards the species range edges than mean measurements of the same variables. Understanding the non-stationarity of variable contribution across species' ranges is a promising asset to range dynamics studies and species conservation.

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ID: 1050

Plant invasions in grasslands of Switzerland: invaders, spatial patterns and effects on biodiversity

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Neophytes are perceived as a major threat to biodiversity, but the evidence for this assumption is rather mixed. We thus asked for the grasslands of Switzerland: (1) How frequent and dominant are neophytes? (2) Which effect do neophytes have on plot-scale species richness? We extracted 8,108 10-m2 vegetation plots from the three biodiversity monitoring programs of Switzerland and uses a subset with statistical weights to calculate the average frequency, richness and relative cover of neophytes. We then created multiple GLMs to explain plot-scale species richness by main ecological niche dimensions (represented by mean indicator values) and the presence of the 21 neophyte species with at least five occurrences in the full dataset. We found a total of 42 neophytes in the normal landscape dataset, with Lolium multiflorum (20.9%) being most frequent. Richness and cover of neophyte species strongly decreased with elevation. In the multiple GLM, six neophytes had a significant negative effect on plot-scale biodiversity (L. multiflorum, Medicato sativa, Bromus inermis, Impatiens glandulifera, Onobrychis viciifolia, Artemisia verlotiorum), and five a positive one (Veronica persica, V. filiformis, Erigeron annuus, Conyza canadensis aggr., Solidago gigantea). We conclude that partly the wrong neophyte species are in the focus of conservationists.

ID: 1055

Depicting vegetation dynamics along the Tagliamento river bars: a remote sensing approach to monitor biodiversity in alpine rivers

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Rivers play a critical role in biodiversity conservation and ecological connectivity. Understanding how plant communities vary in these dynamic systems and how their changes are visible using remote sensing is crucial for implementing effective conservation strategies. The Tagliamento river (N-E Italy) is characterized by flood events and a wide pristine gravel-bed where river bars are characterized by complex habitats corresponding to different successional stages. It is therefore subjected to nature conservation initiatives.

In this area, 51 plots of 100 m2 area have been sampled during 2022 and 2023 seasons, within an Erasmus+ program involving four European countries. In each plot we performed vegetation surveys and collected soil data. Moreover, we analysed satellite images back to the 1980s to calculate principal multispectral indices and the age of the river bars. We found satellite-derived indices very effective in tracing changes of vegetation over time. NDVI was strongly positively related to the river bars age. Moreover, the plant functional diversity of the community appears to be driven by the river bars age, and linked to the NDVI.

Our results provide new insights into the dynamics of riverbed vegetation and the application of satellite imagery for remote sensing and conservation of these valuable habitats.

ID: 1058

Podarcis raffonei SOS! LIFE EOLIZARD to the rescue! Kick off an international conservation project to save the Aeolian wall lizard.

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Podarcis raffonei, endemic to the Aeolian archipelago, is among the most endangered European reptiles. With only four known populations surviving on three tiny islets and on a small promontory, this critically endangered lizard is on the verge of extinction due to the very limited range, severely fragmented distribution, and low genetic variability. The species was confined to its current distribution by habitat loss and degradation, and the anthropic introduction of Podarcis siculus, an extremely competitive species that already had negative repercussions on native biota in other Mediterranean islands. The LIFE EOLIZARD[101114121] project aims to tackle the pending extinction of the Aeolian wall lizard through actions of conservation directed at existing populations and the creation of a sanctuary for P. raffonei on the islets of Lisca Bianca and Bottaro. Translocation of P. siculus from these islets to Panarea island and the release of genetically selected captive-bred P. raffonei to this newly available area will have a significant impact on the conservation of the Aeolian wall lizard through a 320% increase of the range and a 50% increase in the number of populations, all free from P. siculus, hence, contributing to the effective reduction of the extinction risk.

ID: 1060

Blast from the Past: A Retrospective analysis of 250 years of change in forest, defaunation, and recolonization in a rewilding landscape in Europe

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Rewilding has become an established concept of restoring natural processes, while enhancing biodiversity potential of the landscape. Rewilding creates resilient, self-regulating and self-sustaining ecosystems, while promoting human-wellbeing. The Oder delta is one such landscape chosen for rewilding. It is located at the Baltic coast between Poland and Germany, where the complex ecosystems spanning forests, agricultural land, peatland, and lagoons create ample opportunities for rewilding of a diverse assemblage of biodiversity and recolonization potential for locally extinct species such as the European Bison (Bison bonasus) and Moose (Alces alces).

Here, we present our findings of a retrospective time-series analysis of ~250 years of change (1740 - 2020) in forest cover within a selected region in this landscape. We also present our findings of defaunation events in the past, and more recent recolonization and reestablishment of populations of iconic key-stone species in this region. We analyze various factors including human population dynamics that has affected defaunation, landcover-change, and rewilding success in the Oder delta. We elaborate on change in trophic complexity as a rewilding indicator for this landscape, and suggest various rewilding pathways.

ID: 1065

The lichen biota of the Dolomites in a climate change scenario

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Mountain ecosystems are critically affected by climate change. The Alps are experiencing twice the warming rate of the Northern Hemisphere. Under this scenario, many species may face range shifts and local extinction. This is the case for many neglected organisms that, however, contribute to ecosystem functioning, such as lichens, very sensitive to environmental change due to their symbiotic physiology. The Dolomites, with their peculiar topography, are one of the more relevant and lichenologically best-known areas in Italy. The Dolichens project provides an accurate georeferenced database about the lichen of the Dolomites, aggregating occurrences from several sources. Using these data, we performed SDMs to predict shifts in lichen distribution under different climate change scenarios at fine spatial resolution. For each species, we quantified the gain and loss and then we modeled these predicted changes along the elevational gradient. Our results show that alpine areas will be strongly affected by climate change more than lowland areas. Indeed, at high elevations, many lowland species increase their suitability, thus an increase in competition and a reduction of the alpine species is expected. This study addresses the urgent need to improve lichens' conservation in the mountain ecosystems, to cope with the effects of global changes.

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ID: 1072

Tracing the historical footprint of a warming climate on sea turtle populations

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Rising global temperatures threaten biodiversity worldwide. Species with temperature-dependent sex determination are especially at risk, as a warming climate can skew population sex ratios to unsustainable levels. Female sea turtles are produced at warmer incubation temperatures. Therefore, increasing numbers of female nesting sea turtles are expected in the future as temperatures rise. In Cabo Verde (East Atlantic), the nesting population of loggerhead sea turtles has increased dramatically in recent years. However, it is unclear whether this stems from favourable conditions and conservation efforts, or if it already emerges from rising

temperatures and population feminization. While there was no significant relationship between population size and current ocean conditions (chlorophyll-a, temperature), we found historical air temperature strongly and positively correlated with population size. Expanding this analysis to 17 loggerhead populations globally revealed similar positive correlations. To explore a possible causal link, we modelled population dynamics which further highlighted the role of climate warming and population feminization in increasing sea turtle population sizes. Overall, we call for urgent conservation strategies to mitigate the impact of rising temperatures on sex-biased wildlife populations.

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ID: 1076

Human Disturbance and its Effects on Large Mammal Communities in a Rewilding area in the Southwestern Carpathians

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The expansion of humanity and the pressures on wildlife this brought about has driven a widespread defaunation wave, affecting the integrity of ecosystems in Europe. Land abandonment and favorable conservation policies now provide opportunities for reversing these trends through trophic rewilding. This restoration, however, does happen in landscapes that are not devoid of human influence, requiring wild species to adapt to the human presence. We focused on the southwestern Romanian Carpathians to understand the impact of human disturbance on the co-occurrence of eight large mammals, including the recently reintroduced European bison. Employing Bayesian dynamic occupancy models, we evaluated livestock grazing, active logging activity, past logging activity and traffic on species occupancy and detection. Our findings show that brown bear responded most strongly to human disturbances, followed by the European bison, wolves, wild boars, red deer, and roe deer. Past logging exhibited a strong positive effect on European bison, red deer, roe deer, and brown bear, while livestock pressure impacted brown bear and red deer negatively. European bison displayed a negative correlation with active logging. In conclusion, our results suggest that European bison are in an early stage of adapting to human pressures, following patterns observed in other wild large mammals.

ID: 1077

Biodiversity resilience in old-growth forests: An investigation of species diversity dynamics pre- and post-pest outbreaks peaks

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A comprehensive approach was implemented for assessment of tree species diversity before and after the bark beetle outbreak peaks to the Bialowieza Forest (BF), a UNESCO heritage site. In three communities employing distinct management strategies and covered by mixed coniferous and broadleaved stands, 493 sample plot were surveyed in summer 2015 (pre-pest outbreak peak, PrPOP) and 2019 (post-pest outbreak peak, PoPOP). The findings showed no significant differences in alpha diversity indices among the communities for the PrPOP and PoPOP. However, the Permutational Multivariate Analysis of Variance for the average beta diversity indicated more similarity of the communities for the PrPOP compared to the PoPOP. Additionally, the temporal beta diversity exhibited significant changes in species abundances. The Wilcoxon test revealed no distinction (p-value = 0.40) between average gamma diversities of the PrPOP and PoPOP. Notably, the leading species in terms of density, dominance, and importance were consistent across two communities, however, Picea abies was replaced by Carpinus betulus in the third community after the peak. Overall, the findings highlight the resilience of species diversity in the face of pest outbreaks according to no significant changes of biodiversity indices; however, losses in species abundances dominated gains within the BF communities.

ID: 1081

The CBD and the role of experts in the process

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The success implementation of the Convention on Biological Diversity (CBD), is dependant on the effective use of expertise held in different sectors including researchers. Recognising this, a central component to the CBD is the implementation of technical and scientific cooperation. This presentation will focus on: 1) the process and mechanisms for technical and scientific cooperation, and 2) the benefits for experts to engaged in the implementation of the CBD. The presentation will draw on a range of experiences but will specifically draw on the activities from the EU funded COOP4CBD project. It is anticipated the resulting discussion will focus on opportunities and barriers for experts to engage in CBD processes at the global and national level.

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ID: 1082

Cashing in, or selling out? Measuring attitudes towards market-oriented conservation in non-expert audiences.

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The conservation movement is diverse, with conservationists holding a wide range of opinions about the way conservation goals should be pursued. One area of active debate is the role of businesses and markets in conservation, including the use of economic valuation techniques and market-based instruments. Whilst tools to measure attitudes toward market-oriented conservation exist among sector professionals, they remain inaccessible to non-expert audiences. Therefore, we developed a psychometric survey instrument to provide novel insights into the attitudes surrounding market-based conservation within the general public. Designed through a series of expert-led workshops and building upon prior studies, we developed an initial list of 40 statements designed to capture different facets of market-oriented conservation attitudes. The survey was piloted online using a gender-balanced sample, and analysed with exploratory factor analysis to examine the dimensionality and structure of the data. We tested the validity of the resulting scales by examining their correlation with endorsement of relevant conservation scenarios. The result of our work is a novel scale for measuring attitudes towards market-oriented conservation within non-expert audiences suitable for use by conservation organisations and researchers.

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ID: 1085

Insect meal in aquaculture: what Italian consumers think about it?

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The Green Deal and its pillars underline a strategic vision for sustainable aquaculture production in the future. Italy's 2021 aquaculture production reached 146K tonnes, valued at 547 million euros, prompting a shift toward circular and sustainable practices, notably embracing insect meal in fish diets. Studies highlight its benefits (Busti et al., 2023; Sogari 2023), offering a path to more eco-friendly models. However, farm capacity alone may fall short, necessitating collaborative efforts along the value chain. Consumer acceptance proves pivotal, with varied perceptions impacting insect meal adoption in fish farming.

Understanding consumer preferences, sustainability, price, and information dissemination are key factors influencing acceptance (Mancuso et al., 2016; Popoff et al., 2017; Llagostera et al., 2019; Bazoche and Poret, 2020; Rumbos et al., 2021; Arru et al., 2022).

This study aims to analyse the perspectives of Italian consumers of fish products fed with insect meal. The improved understanding of their perceptions was made possible using multivariate statistical analysis. In addition, the study analyses the role of information on the acceptance of the innovative feeding practice and the willingness of Italian consumers to spend more on fish products raised with insect meal. The study can offer insights for academics, practitioners, and policy makers.

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ID: 1087

Climate and land use explain mid-elevation declines in open-land birds

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Ongoing declines in European and North American birds have been particularly pronounced for species in open habitats. Agricultural intensification, land abandonment, forest expansion, and changing climate contribute to declines through altered habitat suitability. Understanding the patterns and drivers of such declines is important to conservation efforts moving forward. Here, we investigated the environmental drivers of change in diversity of open-land avian communities over two decades in Switzerland. We used estimates of species abundance from territory mapping surveys conducted for two Swiss Breeding Bird Atlases (1990s and 2010s). We restricted survey locations to km squares that were surveyed in both atlas periods and contained over 40% open-land cover. Metrics of diversity were calculated for the full communities and open-land communities (included only species for which at least 50% of the total observations were in open-land habitats). Over the 20-year period, diversity of the full communities and open-land communities increased above 1500 m. In open-land communities, however, diversity declined between 1000 and 1500 m. While variables for climate and land cover were included in the AIC top model, early season NDVI and seasonal scope of NDVI were the strongest predictors of observed changes in open-land diversity.

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ID: 1088

Multidimensional conservation gaps and indications in seahorses

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Seahorses (Hippocampus spp.) are flagship animals inspiring numerous conservation programs. On the basis of our knowledge, no study has integrated information on conservation status, including trends in abundance, diversity, and threats, hindering seahorses' worldwide effective management. Here, we bridge these gaps by taking advantage of the available geographic, ecological, and genomic data on the Hippocampus species at a global scale and present the most comprehensive study of the seahorses' conservation status to date. Specifically, we explore species distributions and perform ecological niche modeling, phylogenomic mapping, comparative genomic applications, and conservation gap analyses. We consider their evolutionary history and genomic erosion, including genetic load, which have been largely disregarded by current conservation policies. We investigate the degree and type of protective measures currently granted to seahorses and the biological and ecological factors that are contributing to their existing and future extinction risk. Our results raise questions on whether the current conservation indicators and practices are effective in preserving the present diversity and function of these iconic fishes, as well as their future evolutionary potential and ecological resilience. These insights provide a broad, more complete picture of the status and trends of seahorses and inform successful conservation initiatives.

ID: 1089

Urbanization and landscape simplification reduce village biodiversity, while their remoteness to cities increases social inequity

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Both agricultural intensification and urbanization threaten biodiversity. Here, we studied biodiversity of Hungarian and Romanian villages (64) in semi-natural forested vs. agricultural landscapes and with contrasting distances to mid-sized cities, thus in villages in the agglomeration often characterized by houses with ornamental gardens (city near) vs. villages characterized by houses with rather typical traditional rural gardening (city far). We sampled village centres vs. village edges by surveying plants, arthropods with pitfall traps, D-vac and trap nests, and birds. We registered 375 herbaceous wild plant species, 665 arthropod species (carabids, isopods, spiders, true bugs, bees, wasps, parasitoids) and 82 bird species. At the village level, we found that agricultural villages in city agglomeration have the highest, whereas villages in forested landscapes far from cities have the lowest human footprint index. Further, inhabitants of villages far from cities have lower incomes, lower rates of higher education and less developed amenities. In contrast, biodiversity was little affected by city vicinity. However, modelling multidiversity indices, we found a strong decline from village edge to centre and in agricultural landscapes. In summary, we suggest improving urban green infrastructures in village centres and agricultural landscapes, whereas preserving the existing ones in village edges and forested landscapes.

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ID: 1094

Spatial coincidence between mining rights and areas of high biodiversity value in Spain

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In 2020, the anthropogenic mass of the planet outweighed all of Earth's living biomass. Over 90% of that mass is made of construction minerals, which represent the largest volume of solid material extracted in the world. An increasing number of species are reporting mining threats, but knowledge about the extent and magnitude of the risks posed to biodiversity is still limited. Here, we use data from the Spanish Mining Cadastre to analyse the spatial overlap between mining rights, the Natura 2000 network, and priority habitats of listed in Annex I of the Habitats Directive. We classified mining rights in terms of mineral extracted and mining right status. Over 20% of granted mining rights overlap with Natura 2000 Sites, and almost 25% with priority habitats. In addition, 27% of Sites of Community Interest (SCI), 30% of Special Protection Areas for Birds (SPA) and 50% of priority habitats overlap with authorized mining operations. The number and area of mining operations encroaching into protected areas and priority habitats could increase significantly in the future, as 37% of (SCI), 40% of (SPA) and 62% of priority habitats have exploration permits granted.

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Spatial prioritization using orchids as target species

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Prioritization of sites in which to expand protected areas (PAs) to limit biodiversity loss is a crucial challenge in national and international politics. Italy, thanks to its environmental heterogeneity and biological richness, can serve as a model for broader generalizations in biological conservation. This study aims to develop a comprehensive framework for prioritizing biodiversity conservation sites using orchids as target species. Utilizing a combination of biological, ecological and spatial indicators, we assess the conservation importance of 2x2km cells in sustaining diverse ecosystems. The prioritization model considers factors such as species richness, phylogenetic diversity, functional diversity and endemic taxa occurrences. By integrating georeferenced data and eco-evolutionary information, this approach ensures a holistic and sustainable approach to protect and enhance the natural heritage.The outcomes of this research will guide conservation efforts, enabling targeted strategies to safeguard Italy's unique biodiversity.

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ID: 1102

Comparative study of habitats & sustainability of natural & reintroduced populations of Greater One-Horned Rhinoceros

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This study sought to make a comparative assessment of the habitats of Greater One-horned Rhinoceros populations in two protected areas of India- one naturally occurring and the other being a translocated/reintroduced population. The research combines existing data gained from habitat assessments, population surveys and reports to gain insights into the factors influencing the survival and long-term viability of these populations. Results reveal significant differences in habitat suitability, resource availability, and anthropogenic impacts between natural and reintroduced populations. Furthermore, we go over the sustainability factors and trends for both of the populations, highlighting the challenges of the translocated population and its possible solutions. The findings contribute to the understanding of the ecological requirements and conservation implications for the Greater One-Horned Rhinoceros, providing valuable insights for wildlife managers and policymakers.

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ID: 1106

Estimating Ne for the Global Biodiversity Framewok through proxies: how far can we go?

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The effective size Ne is a key summary statistic in conservation, and its adoption as a headline genetic indicator by the global biodiversity framework (GBF) means it will have to be applied regularly across many species.

However, it is impossible and undesirable to use molecular methods to estimate Ne across tens of thousands of populations of thousands of species. We can use indirect proxies of Ne instead to provide a first glance of the genetic conservation status of populations, before deciding to spend time and money on actual molecular genetic work.

Here we showcase how we used proxies to evaluate for the GBF the genetic conservation criteria for 118 species in Belgium. We used a variety of existing data sources, mostly citizen science entries in biodiversity observation platforms, to delineate populations, estimate census sizes directly and indirectly, and test the performance of these proxies against actual genetic molecular methods for two species.

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ID: 1115

Action Competence for Insect Conservation – A new educational framework for transformational change

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Insects are essential for many ecosystems, which makes sustaining insect biodiversity critical for biological conservation. However, several groups of insects are declining at alarming rates. Solutions for sustaining insect biodiversity are available, but a gap exists between awareness of insect declines and the implementation of conservation actions. A solution to overcome this implementation gap is education empowering people from all levels of society to take actions. For this means, we have developed the innovative educational framework Action Competence for Insect Conservation. This framework goes beyond raising awareness, but focuses on people's action-oriented knowledge, confidence, and willingness to take actions. The framework supports educators and conservation biologists in fostering people's competence to take beneficial conservation actions.

The presentation at ECCB will outline the framework and two practical applications. As a first application, the framework led to an educational approach for secondary schools, which significantly improved students' self-perceived competence to take conservation actions. As a second application, the framework builds the foundation for a current conservation project in Sweden that cooperates with various stakeholders in society, such as schools, universities, municipalities, and housing agencies. Hence, the framework has high potential to support the transformation of societies for becoming biodiversity positive.

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ID: 1119

From landscape-scale restoration to species conservation: Unraveling the diversity of rewilding initiatives in Europe

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'Rewilding' is increasingly recognized as a holistic, nature-based approach to restore ecological processes and biodiversity at a landscape scale, providing socio-economic benefits to local communities. Although numerous rewilding initiatives have been launched in Europe over the last decade, the specific practices associated with these initiatives and the underlying human-nature relationships remain unclear. To acquire a preliminary understanding of the diversity of rewilding practices within the European Rewilding Network, we systematically categorized 91 rewilding initiatives. This categorization was based on the provided descriptions from Rewilding Europe, coupled with information from their respective websites. Our focus was on discerning their stated ecological and societal objectives, implemented rewilding practices, and the intended relationships between humans and nature. Preliminary results reveal a broad spectrum of approaches, practices, and objectives within the rewilding initiatives, ranging from endeavors distinctly concentrated on restoring ecological processes and fostering landscapes conducive to autonomous natural development, to those with more conventional conservation paradigms, involving the safeguarding and restoration of specific species under strict human supervision. These seemingly opposing approaches frequently overlap. Irrespective of their restoration approaches and ecological objectives, most projects anticipate achieving socio-economic benefits through the restored natural environment, primarily through nature-based tourism.

ID: 1120

Saving the sihek: sex-specific impacts of reproductive effort and body condition on mortality risk in an Extinct in the Wild bird

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Increased reproductive effort can be associated with decreased survival, yet the potential implications of this for conservation breeding and release programs are rarely considered. Further, individuals' body condition may also impact mortality risk, potentially mediating or exacerbating effects of reproductive effort. Here, we use detailed reproduction and body weight data from the ex-situ population of the Extinct-in-the-Wild sihek (Guam kingfisher, Todiramphus cinnamominus) to carry out multi-state survival analyses and determine effects of weight and reproductive states on probability of survival and transition between states. We found that female sihek have increased mortality and senescence rate compared to males in the ex-situ population. Both mid- and high-weight states were associated with relatively high survival probability, but this was dependent on reproductive state. In particular, mid-weight and producing hatchlings was associated with higher survival than not producing hatchlings, but being mid-weight and in a breeding pair was associated with lower survival probability than not being in a breeding pair, potentially suggesting a survival cost to breeding. Our results have important implications for management of ex-situ populations of threatened species, and highlight a potential trade-off between high offspring production for releases and maintaining survival rates to ensure ex-situ population viability.

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ID: 1121

Diet and ecological drivers of free-ranging cat activity and abundance on a subtropical oceanic island

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Free-ranging cats (Felis catus) pose a significant threat to biodiversity. However, little is known about their trophic ecology, population status, and ecological drivers in insular ecosystems. This study used traditional approaches and DNA metabarcoding to assess the diet of free-ranging cats and camera traps to investigate their abundance and activity in a peri-urban protected area on the subtropical Madeira Island in Portugal. Cats were found to consume a wide range of native and non-native vertebrates, including multiple endemic taxa (e.g., Madeira Wall lizards – present in over 40% of the analysed samples). Based on 582 trapping-nights we estimated a density of 1.4 cats per km² and landscape-scale analysis showed that cat activity was positively influenced by the proportion of rocky areas in the landscape and the distance to human resource subsidies. Cats were particularly abundant in the vicinity of the only known breeding colony of Manx shearwater (Puffinus puffinus) on the island. Our results support that evidence-based management of insular cat populations is urgently needed.

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ID: 1124

How changes in legal status affect wolf population dynamics

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In December 2023, the European Commission presented a proposal to change the level of protection of gray wolves (Canis lupus) under the Bern Convention from strictly protected to protected species. In European Union (EU) legislation, this may be followed by moving wolves from Annex IV (strictly protected) to Annex V of the Habitats Directive, which would allow EU member states to permit their hunting as long as their "favourable conservation status" was maintained. The demographic consequences of these legal changes at EU level remain uncertain, as no change in the legal status of wolves under EU law has occurred before. We illustrate the potential consequences of these legal changes by looking at the dynamics of wolf populations in the United States (US), which have undergone numerous changes in legal status, including their listing as either "endangered" or "threatened" under the Endangered Species Act, as well as their delisting. We built hierarchical Bayesian state space models to assess how changes in legal protection influenced gray wolf population trends in the US. We infer what consequences downlisting could bring for wolves in the EU, while highlighting the differences between the legal and biological contexts of wolf recovery in the US and Europe.

ID: 1127

Goats and islands: not always a matter of eradication

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Many islands are characterized by the presence of feral goat populations. In the Mediterranean, most of them have been introduced in recent years. However, Montecristo Island (Italy) hosts a goat population since the Neolithic, when animals at an early stage of domestication were introduced. Here we show how it has been managed and investigated so far. The population has been subjected to heavy poaching till after Second World War, then Government-run control activities started with the aim of reducing grazing pressure, from 1970 to late 1990. In the last decades it has been the target of several studies focused on demographic, phenotypic, health and genetic aspects, as well as on impact on the island ecosystem. During project "RESTO con LIFE", a management plan of the population has also been formulated. If this population is worth conserving is a matter of debate. Beside its ancient origin, the value of Montecristo goat population lies on its pivotal role as a driver for the protection of the island in the early 1970s, leading to the present designation of State Nature Reserve. Nevertheless, its conservation should be guaranteed while ensuring the preservation of the other ecosystem components.

ID: 1128

Resilience: history of use in community ecology

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This lecture will focus on the historical development of the terms “stability” and “resilience” in community ecology. Although both terms are central concepts to the field of ecology, their definition, meaning and applications have generated multiple controversies over the past decades. Indeed, resilience is often used in its narrow meaning as the ability of the system to recover to its pre-disturbed state following a disturbance (“engineering resilience”), which is centered on the existence of a single stable equilibrium. However, when defined sensu Holling, resilience is not limited to a single stable equilibrium and is more broadly applicable to the systems with multiple stable states, which are much more likely to be found in nature. Much confusion around the terms stability and resilience and the fact they were defined in multiple ways demonstrate the multidimensional character of both stability and resilience. This lecture will highlight different dimensions that can be measured for both stability and resilience and clarify the relation between these two concepts.

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ID: 1131

A pond of knowledge: applying multi-disciplinary approaches to amphibian conservation

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Habitat degradation due to intensive agriculture and urbanization is the most important contributing factor to amphibian diversity loss in Europe, particularly in the Mediterranean region. As their natural habitats decrease, amphibians often resort to using artificial water bodies as reproductive sites. Here, using presence data from an environmental DNA-based monitoring study on amphibian biodiversity from 37 freshwater sites in the Province of Trento (including both protected areas and artificial or human-impacted water bodies), we used a multivariate analysis, integrated with regression tests, to identify distinct presence/absence patterns in relation to ecological and landscape variables that are known to significantly influence the structure of the amphibian community. For example, we show that farm ponds may be important reproductive sites for amphibians, with a higher species richness than expected, even though these habitats have been virtually ignored in monitoring programmes up to now. This study provides methodological improvements by generating ‘ecological condition indices’, which can be applied to identifying meaningful correlations between the environment, human

behaviour and amphibian species, i.e. powerful transdisciplinary tools with applications in endangered species monitoring, environmental and landscape assessment, urban ecology and policy development, in relation to habitat alterations accelerated by climate changes and/or other environmental crises.

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ID: 1132

The ecological consequences of treescape expansion through planting and natural colonisation

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Treescape expansion in the UK, a focal point for biodiversity recovery and climate change mitigation, traditionally emphasizes tree planting. While government commitments prioritize increased tree coverage, there is a growing interest in integrating 'natural colonisation' as a complementary strategy for large-scale woodland expansion. Advocates argue that naturally formed woodlands may offer greater structural diversity, ecological complexity, and resilience. Despite potential advantages, critical knowledge gaps persist in understanding the outcomes of woodland creation through natural colonisation in the UK context.

Addressing this gap, the Treescape Expansion through Planting and Natural colonisation (TreE_PlaNat) project systematically compares biodiversity, structural characteristics, and ecological functions across woodland sites established through planting, natural colonisation, and hybrid approaches. Preliminary analyses indicate similar plant and moth diversity across all methods, with slightly higher species richness in mixed sites; this is despite differences in structural characteristics, such as higher tree and seedling densities in naturally colonised sites. Our study further explores the significance of species traits and broader landscape characteristics on biodiversity outcomes of woodland creation. Our findings provide valuable insights into the challenges and benefits of diverse treescape expansion methods, guiding the development of sustainable woodland creation practices for the future resilience and longevity of the UK's treescapes.

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ID: 1135

How ecologically ambitious can incentive programmes get? The case of incentives for ecological forest management in Germany

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Forest biodiversity is considered essential for the resilience and adaptive capacity of forest ecosystems towards climate change. However, large forests tracts are managed for timber and are undergoing substantial biodiversity losses. To halt this trend, state policies may opt for monetary incentives where legal restrictions collide with opposition.

In 2023, the German government commissioned our consortium of forest ecologists, economists and law experts to draft a list of ecological funding criteria for an incentive programme (of 900 m Euro volume) addressing private and municipal forest owners.

First, we elaborated a longlist of 28 forest management criteria targeting the enhancement of ecosystem resilience and adaptive capacity. The criteria stretched from sound management of soil and water to aspects of forest structure and timber extraction.

We then carried out workshops, interviews and an online survey, inviting forestry practitioners to share their views on feasibility (costs, acceptance) and impact (effective forest conservation, synergies and conflicts with entrepreneurial goals) of forest management options under climate change. This led to a final proposal of 13 criteria.

I will conclude my talk with a critical reflection on how effective we have been as advisors to the German government for the formulation of the new incentive programme.

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ID: 1146

Conservation assessment of Fazao – Malfakassa NP, Togo: an African protected area at the crossroads

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Protected areas are one of the cornerstones of biodiversity conservation globally, as confirmed by the 30x30 target. Yet, the effective protection of existing protected areas is as important as the creation of new ones. If adequate funding, political will and effective law enforcement are not combined, many protected areas are bound to remain "paper parks". We focused on Togo's Fazao-Malfakassa NP, the country's largest yet understudied protected area. The park underwent a change of management in 2015, from a foreign foundation to the Togolese state. In 2022-2023, we surveyed the park's birds and primates, recorded all illegal human activities and assessed the park's management. We found 238 bird and 6 primate species, including several surviving globally threatened species such as White-thighed Colobus CR, Martial Eagle and Bateleur EN, while Hooded and White-backed Vultures CR are already extinct. Pervasive illegal human activities include poaching, tree felling for wild honey, charcoal and timber, cattle grazing and agricultural encroachment. These have been associated with a drop in funding, resources and ranger patrolling and salaries since 2015. Beyond its Afrotropical context, Fazao-Malfakassa stands as a stark example of what a protected area can become within a few years following a change of management.

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ID: 1156

Exploring the toolbox for harmonising vascular plant species point-occurrence data

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The emergence and continuous improvement of global-scale biodiversity databases (e.g., GBIF) has opened new opportunities for the development of species distribution models at wide geographical scales, a powerful tool for guiding evidence-based conservation decisions. However, pulling the most out of this huge amount of data, the so-called 'biodiversity big data', is a challenge. Point-occurrence records often contain taxonomic, spatial and temporal uncertainties, potentially leading to biased results and ill-informed decisions.

We tested a set of different tools for cleaning vascular plant species occurrence data obtained from public databases. After integrating the data, several R packages and workflows for taxonomic harmonisation and coordinate correction were assessed. All methods were compared with the aim of establishing a set of good practices and developing a robust and straightforward protocol when dealing with data from heterogeneous biodiversity data sources.

This study - addressing each step of biodiversity data cleaning in detail for the first time - helps navigate the enormous landscape of tools for the cleaning of point-occurrence data, a critical and time-consuming process that is often overlooked.

ID: 1157

Conservation genomics of a neglected European mammal, the garden dormouse

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Conservation of small mammals such as rodents is often inhibited by lower research effort and subsequent lack of information on species' phyletic relationships and demographics, even in well-characterized regions such as Central Europe. Genomics can provide baseline knowledge necessary for conservation planning but, as yet, remains a limited tool in European rodent conservation. The garden dormouse (Eliomys quercinus) is a small rodent species that has experienced one of the most extensive modern population declines on the European continent. Here, we conducted the first population genomic analysis across the contemporary range of the garden dormouse to investigate patterns of connectivity between regions and population processes that may help explain current declines. We found clear evidence for population structuring across the species' core Central European range, with strong differentiation in particular for the Alpine region. Remnant eastern populations show signs of recent isolation. Overall, findings from this study suggest that garden dormouse conservation may be enhanced in Europe through designation of differentiated evolutionary significant units (ESUs). Further research is needed to determine if these ESUs are experiencing local adaptation to environmental factors such as temperature, and how this may influence future population viability in the face of climate change.

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ID: 1158

Bioclimatic velocity effects on tree species shifts in Mediterranean island mountains

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The largest mediterranean islands hosts mountains which have provided refuge to many endemic species relics of past biogeographical patterns. There is mounting evidence for climatic change in the region resulting in biological responses which include upward elevation shifts of more thermophilous species towards higher bioclimatic zones. These changes are often manifested as increased interspecific competition, the extent of which is likely to depend among other things on the speed of climatic changes.

We tested this assumption in the five largest mediterranean islands (Sicily, Sardinia, Cyprus, Corsica, Crete). For every island we used a pair of trees comprising one species which dominates the supra- mediterranean (1000 – 1700) and one which dominates the mountain-mediterranean (1500 – 2300) zone (e.g. from Cyprus Pinus brutia and Pinus nigra ssp. palasiana). We calculated bioclimatic based on two climate change scenarios (SSP1-2.6 and SSP5-8.5) in two time-periods, mid-century and late-century. Data on the present distribution of the selected tree species were extracted from the GBIF database.

Our models reveal differences in velocities among islands and pairs of species. We discuss our findings in the context of existing protected areas and propose targeted conservation and mitigation measures which should be island specific.

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ID: 1159

Evaluating the effectiveness of a large scale campaign aimed at reducing demand for wild meat in the megacity of Kinshasa, DRC

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One of the main drivers of wildlife declines across Central Africa is the flow of wild meat to satisfy consumer demand in urban centres, yet few conservation projects have focused on addressing this demand. After conducting research into consumers, the Wildlife Conservation Society launched a large-scale multi-media campaign in the megacity of Kinshasa, Democratic Republic of Congo, in 2021. Targeting the campaign at three demographic groups with higher levels of education and wealth, the campaign aimed to demonstrate that it is possible to buy and prepare delicious Congolese food without using wild meat. The campaign ran for three years and was divided into two phases. The impact evaluation of the campaign involved the use of quantitative surveys before and after each phase, initially using interactive voice response mobile phone surveys and later face-to-face household interviews. Qualitative interviews were also conducted with key stakeholder groups. Responses to the campaign were generally positive but the impact evaluation has reinforced the fact that behaviour change takes time, particularly in large cities with busy media environments. To result in sustained behaviour change, messages must be disseminated on a multi-year basis with the establishment of local coalitions to maximise audience exposure and continue momentum.

ID: 1160

Lack of population differentiation of common tern (Sterna hirundo) populations in Europe

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The common tern (Sterna hirundo) is a migratory seabird that breeds in temperate and subarctic regions and winters in tropical and subtropical coastal regions. European populations have declined due to various threats, including habitat destruction, human disturbance, and predation. In contrast to the marine colonies, those located inland are particularly at risk due to flooding of their breeding sites. Genetic markers can provide important information about the connectivity of populations. Because of philopatry, geographical distance, use of different habitats and migration routes, we expect European populations to show some level of genetic structure. Therefore, we used 18 microsatellite markers to infer the population genetic structure of 219 common terns from 12 breeding locations in Europe, which we grouped into three clusters: Northern (Germany), Southern Inland (Hungary, continental Slovenia and Croatia) and Southern Marine (Italy, coastal Slovenia and Croatia). We found a relatively high level of genetic diversity with an expected heterozygosity ranging from 0.67 to 0.71. Surprisingly, no population structuring was detected and the most likely number of identified subpopulations was one, suggesting a limited influence of factors promoting the isolation of breeding colonies.

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ID: 1163

Preserving the Ground beneath the Paws: does the Biodiversity Hypothesis matter for Wildlife Health?

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Mounting evidence supports the biodiversity hypothesis stating that contact to immunoprotective factors in the environment is required for development of a balanced immune system, explaining the prevalence of allergies and other inflammatory disorders in humans inhabiting post-industrial societies. Yet, while urban areas are the most rapidly expanding ecosystems on Earth, little is known how the biodiversity hypothesis applies to wildlife.

We performed a soil exposure experiment using the ecological model bank vole (Myodes glareolus), where laboratory-born vole pups were exposed to different forest soil mixtures and sterile bedding in individually ventilated cages for four weeks and monitored metataxonomic changes in gut microbiota. Treatment soil was collected from urban forests and national parks, considering that soil microbiota can greatly differ between levels of human development index.

We found that soil treatment decreases species evenness and increases dispersal in beta diversity estimates in faecal samples compared to sterile control. This dataset will be further analyzed for inflammation markers such as Foxp3 and Il-17 using qPCR. These data can inform conservation of soil

microbiomes and enhance rewilding interventions, and also inform planning of urban greenspaces and improve domestic and zoo animal wellbeing.

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ID: 1164

Multifunctional landscapes as a tool for conservation of forest biodiversity

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To halt the negative impacts on forest biodiversity and to implement a landscape perspective regarding forest management, the state-owned forestry company Sveaskog has established large multifunctional forest landscapes, called ecoparks, with the goal of combining forestry with biodiversity conservation. The management plan of an ecopark, aimed at recreating and maintaining a high quality matrix, includes restoration activities such as prescribed burnings, restoration of wetlands, and recreation of broadleaf-rich forests. We sampled saproxylic beetles from newly created high stumps in several ecoparks and business as usual (BAU) production landscapes. We collected fungal DNA from the same high stumps nine years later to study the effects of microhabitat, local deadwood amounts and landscape properties on beetle and fungal communities. We found different beetle and fungal communities in ecoparks comared to BAU landscapes with more red-listed species in ecoparks. Microhabitat, local deadwood and forest types in the surrounding landscape all contribute in shaping deadwood beetle and fungal assemblages. Our results highlight the potential of multifunctional forests in conserving biodiversity of deadwood associated biodiversity.

ID: 1170

Multi-taxa habitat suitability and connectivity maps to inform local communities

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Wind farms can have negative ecological impacts when species collide with turbines or show spatial avoidance behaviour, leading to habitat loss and fragmentation. While in recent decades wind farms in Austria have mainly been erected on agricultural land, forested areas are currently more in focus for wind farm construction. In order to enhance awareness of potential overlaps between habitats of these species and potential future wind farm locations in Austria, this study aims to provide users of a Web-GIS interactive platform with high-resolution spatial information on important habitats and areas of connectivity of threatened forest species (9 birds, 3 bats, 10 butterflies, and 5 amphibians). The study has two objectives. Firstly, to model habitat suitability of different species using an ensemble of machine learning algorithms. Secondly, to model functional connectivity of habitats using circuit theory via Omniscape. First results showed that habitat suitability varied between the different species, with no single area supporting all 27 species. Functional connectivity was highest along the high-altitude areas of Austria.

The results will be combined with other factors such as wind speed and power density to help users determine which areas would meet their energy needs while minimising the impact on different species.

ID: 1173

Buzzing in the concrete jungle: Unraveling wild bees' health in urban contexts through different molecular and morphological analysis

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Bees are declining due to anthropogenic phenomena, among which urbanization, eliciting stressors, such as high temperature and green areas fragmentation, on them. Despite this, some wild bees thrive in cities but the impact on their health is poorly investigated. In our latest studies, we evaluated the impact of urban stressors on bumblebees' pathogen load and stress makers in wild bees along an urbanization gradient in Milan (Italy). To evaluate the impact of landscape and local features on bumblebees' infections, we screened for pathogens, 180 bumblebees (Bombus terrestris and Bombus pascuorum) collected from 19 sites. We found variation in parasites' occurrence and highlighted that local scale factors instead of landscape factors, such as floral resources abundance, have a major role in shaping parasite occurrence. To evaluate oxidative and developmental stress we analyzed a total of 370 individuals of 4 different species, namely Apis mellifera, B. terrestris, Osmia cornuta and Anthophora plumipes, collected from 17 sites. Specifically, we quantified oxidation products and fluctuanting wing asymmetry since they increase with different stressors. The impact of urbanization on these markers was species-specific possibly due to ecological aspects like sociality and nesting behavior. Finally, our studies help in improving conservation policies for pollinators facing urbanization.

ID: 1175

The six Austrian national parks: biodiversity coverage and gaps

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To analyse the effectiveness of the Austrian network of protected areas, species occurrence data provided by the six Austrian national parks were compiled, assigned to current taxonomic concepts and matched with national checklists to analyse the coverage of Austrian vertebrates, vascular plants, Red List species, endemic species. In a similar way, habitats from Annex I of the EU Habitats Directive were assessed. The coverage of all national parks combined ranged from 69% for Austrian vascular plants to 94% for breeding birds. With a coverage of 68% of Austrian breeding birds, Neusiedler See – Seewinkel National Park is a hotspot of bird diversity, whereas 74% of the Austrian fish fauna are represented in Donau-Auen National Park. By contrast, the alpine national parks Gesäuse, Kalkalpen and Hohe Tauern are hotspots for Austrian endemic and subendemic species. As cluster analysis showed, alpine and eastern parks belong to different clusters, with Thayatal National Park situated in-between. Apparently, complementarity between lowland national parks and alpine national parks generate a high species and habitat representation on a relatively small area.

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ID: 1177

Human encroachment on charismatic species habitats – the case of orchids in Israel

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Mediterranean systems are high in plant diversity but face threats due to habitat conversion, especially in the Eastern Mediterranean basin. Orchids are charismatic plants, but in Mediterranean systems can be particularly threatened due to high levels of endemicity, and habitat specialization. Here, we explored spatio-temporal trends of orchids' distributions in Israel and adjacent areas (the Golan Heights under Israeli administration) with regards to changes in land-use in the past 50 years. Altogether we analyzed 30 species with over 20,000 point-localities. We explored for each species which of its past observations are found in regions that have been converted to human dwellings, roads, or agricultural fields during this period. Overall, we found that over 10% of locations where orchids have been found in the past have been converted to various human land-uses. Bee-orchids, that comprise 8 species, are more affected by habitat loss, and have on average lost 15% of their localities due to habitat modification. This is probably due to several of bee-orchids being restricted to the highly developed and developing Israeli coastal plain. Our work could promote dedicated conservation actions for this important group, and generally highlight the importance of acknowledging land use conversion on rare plant species.

ID: 1180

Biogeographical patterns of endemic flies in the islands of Corse and Sardinia

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Mediterranean islands are important biodiversity hotspots, with many endemic species of insects thriving within their most diverse habitats. In light of the ongoing global insect decline, it is crucial to identify sensible populations and habitats that need to be preserved. We developed species distributions models (SDMs) and area of habitat (AOH) maps for 10 endemic/sub endemic species of flies in the islands of Corse and Sardinia. We combined SDMs and AOH to investigate patterns of their geographic distribution and identify the environmental conditions that favor the presence of endemisms. Furthermore, we applied selected criteria of the IUCN RedList and Key Biodiversity Areas and assessed the species' relevance for conservation, also comparing the new potential KBAs with the current protected areas of the island.

ID: 1184

Historical records reveal the prolonged decline of an infaunal echinoid in the northern Adriatic Sea

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The consequences of prolonged human stressors on populations of marine species are generally difficult to assess due to the paucity of long-term monitoring data. We investigated the Holocene fossil record of the infaunal sea urchin Echinocyamus pusillus in the northern Adriatic Sea using sediment cores, grab samples and radiocarbon dating to reveal the long-term dynamics of this widespread echinoid. Significant fluctuations in E. pusillus abundance despite stable test sizes were observed during the last ~11,000 years and across sampling stations. Radiocarbon dating indicates a pronounced reduction in population densities over the last 200 years, which correlates with environmental changes at the onset of the Anthropocene. Further, post-mortem ages of tests from surface sediment samples range from centuries to millennia and the absence of observed body size shifts in sediment cores may be attributed to a combination of declining abundance and chronological mixing. These findings suggest that high abundance of dead tests observed in ecological surveys likely overestimates the current distribution of this species and masks recent population decline. Moreover, our results provide a framework for differentiating natural variability in E. pusillus populations from the effects of human impacts.

ID: 1186

Effects of phylogenetic associations on environmental and temporal niche partitioning among sympatric mammals

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In order to optimize resource utilization and minimize predation risk or competition, many animals diverge into using different spatial and temporal niches. Such niche partitioning can be influenced by phylogenetic history, which can have significant impacts on ecosystem structure and function. We used camera trapping data to analyze the activity patterns of twelve mammal species in the Apennines (Italy) by applying occupancy models, and then constructing a tri-partite network to illustrate the environmental and temporal partitioning of these species, which included herbivores, omnivores, and predators, ranging widely in size. We found that there was limited structuring of the network, indicating that species did not strongly partition their environmental and temporal niches. Additionally, we did not observe any phylogenetic signal in the contributions of species to the networks, and phylogenetic relatedness did not correlate with similarities in niche use. However, animals partitioned environmental niches more than temporal ones. This suggests that spatial variation in resource availability may have played a more significant role in shaping their activity patterns than temporal avoidance of predation risk or competition. Our study emphasizes the importance of considering the influence of evolutionary history on contemporary ecological processes.

ID: 1190

Floristic studies and their importance in biodiversity conservation

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Floristic studies are often considered “simply” traditional research. However, the knowledge of the flora of a territory is essential to slow down the effects of anthropic pressure on biodiversity and essential for most of the research activities of modern botany, such as molecular research on the taxonomy of critical genera, which requires in-depth floristic knowledge for the correct identification of the analyzed taxa. Management actions, planning strategies, and biodiversity conservation are efficient and effective only with an in-depth knowledge of how many and which taxa constitute the floristic richness of a territory. Therefore, floristic research has not only been important in the past, but still has an important role in botanical studies today, even in countries with a long tradition of floristic studies and where the flora is considered already well known (Wagensommer, 2023).

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ID: 1198

Mangrove restoration elevates local carbon storage but changes centennial-scale carbon burial dynamics

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Mangrove forests are some of the most effective carbon sinks on Earth, but they are globally threatened. Understanding the effects of active restoration efforts on mangrove blue carbon dynamics has therefore become a conservation priority. Here, we investigated mangrove carbon storage over time in and around the Xuan Thuy National Park in the Red River delta, northern Vietnam, comparing old-growth forests, areas of artificial restoration, and areas of natural spontaneous regeneration. The amount of carbon in the old-growth forest sediments has been higher than the restored or regenerated areas since the 1960s. Stable isotope signatures indicate the stored carbon has been consistently dominated by marine plants and algae for at least the past 120 years. However, since the 1960s in the restored mangrove area, there was a shift in the carbon source, to a dominance of mangrove-derived organic matter. This suggests that restoration activities may change the carbon cycling of mangrove forests, creating a ‘closed’ system of autochthonous carbon fixation and storage, and reduced interaction with marine-derived carbon. Mangrove restoration therefore holds potential for promoting blue carbon storage, but this may coincide with a loss in external linkages – which may have cascading impacts on wider ecosystem functioning.

ID: 1199

Reduced environmental impacts and mitigated climate change through diversification of vegetable oil production

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The expansion of vegetable oil production areas has caused biodiversity decline, habitat losses, and greenhouse gas emissions. In light of current vegetable oil supply shocks, ensuring environmentally friendly production is of major concern globally. In this talk, we propose diversification of vegetable oil production through alternative oil producing species as an important mid- to long-term solution. The tree crop Camellia oleifera is currently cultivated almost exclusively in China, where it can help protecting farmer livelihoods, preventing soil erosion, mitigating climate change, and increasing biodiversity. The seed oil contains a high amount of oleic acid (C18:1) and antioxidants with various biological activities, but low saturated fat. We show preliminary results of our global habitat suitability assessment, a comprehensive life cycle assessment and meta-analysis to assess Camellia oleifera’s performance in terms of yields, carbon emissions, water usage, land use, avoided pesticide application, and farmer income potential based on the six other major vegetable oil crops, palm, soy, olive, rape seed, groundnut, and sunflower. This work will support policymakers to seize critical opportunities to expand diversified vegetable oil production to advance on mitigating natural habitat losses and climate

change in a time when vegetable oil supply is both critical and jeopardized.

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Free organisms for bending the curve of biodiversity loss

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Up until now, conservation practices have not been very successful in stopping the decline of biodiversity, which has led to the call for an integrated strategy for 'Bending the curve'. However, it is still an unanswered question what exactly that curve is: what is on the Y-axis? Moreover, what do we mean by: Biodiversity positive by 2030?

For finding an answer, we focused on the preconditions that determine the origins, presence, and future of biodiversity. We argue that freedom for organisms is an essential precondition for ecosystems in which evolution can continue to develop in any directions. Such freedom includes free interaction of organisms, free access and exposure to abiotic resources, and free possibility to move in space and survive over time. By quantifying the degree in which freedom for organisms is violated, a metric can be constructed for the success of conservation policy and a target can be set for the future. The concept of freedom for organisms can also be used to formulate the rights of organisms, and ultimately, the rights of nature.

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ID: 1203

Ecology and conservation of a vulnerable migratory bird, European Hoopoe, during a sensitive stage of its annual life cycle

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Effective management of wildlife populations depends upon the quantification of demographic metrics across the annual life cycle, especially sensitive life history stages that drive population growth trajectories. The post-fledging stage of avian development occurs during the first weeks after leaving the nest when juvenile mortality rates are exceptionally high. In Switzerland, the European Hoopoe is a vulnerable species currently undergoing recovery interventions, yet no information exists on the species during the post-fledging period. Using radio telemetry, we tracked the survival and behavioral development of N = 60 fledgling Hoopoes in Valais, Switzerland, 2022 – 2023. Based on known-fate survival models in Program MARK, we found that mortality peaked in the first three days (daily survival rate = 0.92 +/- 0.02), with cumulative survival during the first week estimated at phi = 0.67. Compared to other terrestrial birds, Hoopoe fledglings exhibited exceptional ability to move and forage independently within a few days after leaving the nest. Fledglings appeared to be behaviorally independent within 2-3 weeks, performing prospecting movements of many kilometers in a single day. Our results will be used to improve long-term population growth estimates for the species and inform habitat management in support of its conservation in agricultural landscapes.

ID: 1217

Congruent long-term declines in carbon and biodiversity are a signature of forest degradation

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Climate change and biodiversity loss are pressing threats globally, yet rarely are policy solutions pursued in tandem. Assessing such biodiversity-carbon co-benefits require long-term, accurate, fine-resolution spatial models of both the habitat and the carbon value of forests. Here, we present a new machine learning model implemented in Google Earth Engine that links on-the-ground forest inventory plots to remotely sensed data (Landsat). We modelled the distribution and amount of carbon at fine resolutions (30 m2) across entire province of New Brunswick and used remote sensing to back-cast above-ground carbon to estimate carbon gain/loss over a 35-year period (1985-2020) to explore the potential for spatial overlap in biodiversity and carbon storage. Model predictions for above-ground biomass were highly correlated with independent observed data not used in model building (r = 0.77). Over the 35-year period observed, we estimate that above-ground biomass has been reduced by 1.35 million metric tonnes (Mg). We found a strong positive correlation between above-ground carbon and modeled habitat for a number of mature-forest associated bird species. Assuming that markets for carbon expand, this concordance between habitat amount and above-ground carbon enables the opportunity to incentivize both carbon storage and habitat conservation.

ID: 1219

Roadless areas are cool!

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Roadless areas can represent critical ecosystems with unique environmental characteristics. Understanding the dynamics of land surface temperature (LST) in these areas is essential for assessing their ecosystem functionality and resilience. In this study, the relationship between roadless areas and LST is investigated using remote sensing data and spatial analysis techniques.

Landsat satellite imagery was used to obtain high-resolution LST data on roadless areas and adjacent landscapes in a selected region of Poland. We investigated the distribution of LST and its variability in different land cover types in addition to determining the influence of elevation, aspect and slope on LST patterns in roadless areas of different size classes.

Our results provide interesting insights into the thermal patterns of roadless areas and their surrounding landscapes. We found considerable differences in LST between roadless areas and built -up areas, highlighting the role of roads and infrastructure in altering local temperature regimes. Furthermore, we observed variations in LST within roadless areas depending on land cover type, and elevation differences. These findings have significant implications for conservation efforts and land management strategies in roadless areas, where maintaining natural thermal regimes is crucial for preserving biodiversity and ecosystem health.

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ID: 1222

Enemy effect: wolves and humans altering ungulates spatiotemporal interactions

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Ungulates can coexist in highly diverse assemblages, where the use of space and time of one species can affect the spatiotemporal behavior of other interacting species. Furthermore, such interactions may be modulated by the presence of "enemies", mostly represented by natural predators and humans. We assessed spatiotemporal interactions among ungulates in the Apuan Alps, in Central Italy. Human presence in the study area is pervasive, and the only large predator, the wolf, has recently returned to the area after more than a century. We integrated systematic camera trapping and multi-species occupancy models to evaluate whether and how human and wolf presence affected the spatiotemporal behavior of wild ungulates and their interactions. We focused on wild boar, roe deer and red deer, the most abundant ungulates in the area, and found different patterns of spatiotemporal association among them, together with variable effects of wolves and humans in shaping their interactions. The relationships we found suggest the occurrence of complex dynamics, and partially support the effect of predators and humans in affecting the coexistence of wild ungulates in space and time. Thus, the combined effect of natural predators and humans should be considered when addressing ungulates conservation.

ID: 1236

Harnessing FAIR biodiversity data and services to assess incidence and habitat vulnerability to non-indigenous species in Italy

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The LifeWatch ERIC e-infrastructure offers data and services to empower research activities on biodiversity and ecosystems and to tackle some of the most critical ecological challenges such as the spread and establishment of non-indigenous species (NIS). By working closely with scientists, LifeWatch has developed a number of resources to facilitate the monitoring and impact assessment of NIS. In this case study, biodiversity data and an analytical workflow are used to evaluate the incidence of NIS in Italy and to highlight habitats and ecosystems of conservation concern. The assessment is carried out by exploiting over 32,000 geo-referenced occurrence records of 12,780 native and alien taxa distributed across 564 sites and 32 EUNIS habitats in aquatic and terrestrial ecosystems. These FAIR data and services can be integrated for broader assessments and to monitor biodiversity changes at different geographical scales. The use of open, web-based and annotated analytical resources guarantees the reproducibility and reusability of these tools which can be used any time novel evidence come to light. This is paramount to provide the most up-to-date strategies to limit the spread and the successful establishment of NIS, especially in those areas that appear more threatened by biological invasions.

ID: 1237

Enhancing biodiversity conservation analysis through data harmonization

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Organisms modulate their spatial behaviour primarily to optimize their energy acquisition. Understanding the spatial and temporal contexts in which interactions among species occur, as well as the dynamics of resource-mediated interactions, is critical for investigating the mechanisms underlying interspecific coexistence. However, external factors can influence energy requirements and hence space use behavior, especially within the climate and environmental change era. This requires a huge effort in data harmonization by systematically aligning, integrating, and standardizing heterogeneous datasets from multiple sources to strengthen and expand spatial and temporal home range analysis. In this context, LifeWatch ERIC, the European e-Science Infrastructure for Biodiversity and Ecosystem Services, technologically supports collaboration between researchers and stakeholders by providing several e-Science facilities such as a unified platform, web services and tools for data harmonization, exchange and analysis and long-term sustainability. Here we present the application of data harmonization using LifeWatch data services that resulted in the production of a large Findable, Accessible, Interoperable and Reusable (FAIR) dataset of chordate organisms. This integrated dataset facilitates comprehensive measurements and estimates of home range, body mass, metabolic rate, longevity, thermal tolerance across temperature range, which would allow us to understand the impact of climate change to biodiversity organization and conservation.

Abstracts of speed talks

ID: 180

Tracking social bird behaviour highlights the changing value of human resources for desert species across seasons.

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The Anthropocene is characterized by rapid and intense environmental changes, necessitating species to produce accelerated and diverse coping mechanisms. Animal behaviour can potentially be quickly modified to help animals adjust to these rapid changes. For desert species, human development may help buffer against resource scarcity and provide reliable resources in an otherwise stark environment. We used high-throughput tracking technology to explore group behaviour of a social living bird (the Arabian babbler - Argya squamiceps) in a mosaic of human-modified and semi-natural habitats in the Negev desert, Israel. We tracked 21 birds that belonged to 10 groups over 134 days, collecting 727,605 localizations from late summer to early winter, a period in which natural resources increases. We highlighted that groups made use of different habitats as seasons changed. Toward winter, we found groups spent more time outside settlements, had smaller home-ranges, and were less territorial. Moreover, birds' resource dependence inside settlements altered inter-group interactions. We further found that even a small section of uncultivated agriculture land (~1 km2) prevented daily movement. All together, we see how the interaction between resource availability and modified or natural habitat, alongside seasonal environmental changes, are key to understanding animal behaviour in the Anthropocene.

ID: 195

Safeguarding the future of subterranean biodiversity in Europe

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Subterranean ecosystems (e.g., caves, aquifers, fissured systems) harbor a broad diversity of specialized organisms that contribute significantly to global taxonomic, phylogenetic, and functional diversity. This biodiversity is increasingly threatened by human activities. Currently, the network of surface-designed protected areas is inadequate to safeguard subterranean biodiversity, as only 6.9% of known subterranean ecosystems overlap with (surface) protected areas globally. Expanding the coverage of subterranean protected areas is challenging. Firstly, there are technical obstacles in mapping three-dimensional ecosystems with uncertain boundaries. Secondly, the rarity and endemism of subterranean organisms, combined with a scarcity of taxonomists, delay the accumulation of essential biodiversity knowledge. Thirdly, establishing agreements to preserve subterranean ecosystems requires collaboration among multiple actors with often competing interests. Addressing these intertwined challenges is the objective of the transnational Biodiversa+ project called "DarCo." Stemming from DarCo, we examine the status of European subterranean protected areas and propose solutions to enhance their coverage and effectiveness.

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ID: 226

Mitigating the impacts of wind energy in forests for bats: Potential and limitations

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The growing use of wind energy in Europe is leading to increased deployment of wind turbines in structurally rich habitats such as forests, which could affect legally protected bats. On the one hand, forest-dwelling bats lose habitats when forests are cleared for the construction and operation of wind turbines. On the other hand, clearings around turbines offer new habitats for species at high risk of collision, such as aerial insectivorous bats. Therefore, fatality rates at wind turbines in forests are expected to be high. Potentially, bat fatalities in forests can be mitigated by curtailment, i.e. temporary suspension of turbine operation during periods of high bat activity. However, its effectiveness has not been thoroughly investigated throughout Europe. Recently, we have observed forest bats avoiding wind turbines over up to 500 m distances. This avoidance is associated with turbine operation at relatively high wind speeds, suggesting that factors associated with turbine operation, such as noise emissions, are causing the avoidance in bats. In summary, wind turbines in forests cause several problems for bats, highlighting the need for wind turbines to be sited outside forests or in structurally poor forests. Curtailment practice seems key for naturally inclusive wind energy production in forests.

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ID: 227

Wildlife behavioural plasticity contributes to fine-scale spatio-temporal avoidance of humans

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Anthropogenic disturbance elicits adaptive responses in wildlife aimed at risk-avoidance, ultimately imposing constraints on their spatial and temporal niche. While long-term adaptive responses to humans have been well documented, short-term responses to fine-scale variations in human presence have been overlooked.

Here we estimate short-term deviations from local habitat use and diel activity in response to rapid variation in human disturbance. We employed an year-long intense camera-trapping within a small private reserve, and recorded spatio-temporal information on all sources of anthropogenic disturbance in the area. We then explored fine-scale avoidance strategies in 7 mammal species, while controlling for their average habitat use and diel activity.

We found species to avoid humans on either the spatial or temporal axis. Foxes, pine and beech marten, roe deers, and porcupines favored temporal avoidance, whereas badgers favored spatial avoidance. Notably, foxes displayed spatial attraction, likely due to anthropogenic trophic resources. Wild boars, however, did not display human-avoidance behaviors.

Our study highlights the role of behavioural plasticity in adjusting daily habitat use and activity patterns to varying levels of human presence over space and time, emphasizing the species-specific nature of responses to human disturbances, contributing to our understanding of behavioral strategies that allow wildlife-human coexistence.

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ID: 241

Comparing nature conservation policies using a Bayesian decision network: modeling sequential effects on adoption, farming practices, and biodiversity

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Identifying and implementing policy measures to reduce on-farm biodiversity loss requires a better understanding of complex system interactions. Studies on policy challenges to enhance on-farm biodiversity can be divided into those focusing on biodiversity-enhancing practices on farms versus those focusing on the success of policies in terms of farmers adoption rates. In this study, we combine both parts within an ad-hoc decision analytic method to predict which policy-scenario is most likely to improve biodiversity on smallholder farms across the European Union. We apply a Bayesian decision network (BDN) to assess on-farm biodiversity outcomes under five policy scenarios including a) regulatory, b) market-based, c) incentive-based, d) voluntary information-driven, and e) policy mix. We collect and combine information from existing literature along with expert elicitation from a workshop held with decision makers and other stakeholders. We found the highest probability of positive biodiversity outcomes (48%) under a regulatory policy but the result was strongly dependent on the expected rate of adoption. We showcase a novel approach combining knowledge from different knowledge strains and sources that accounts for layers of uncertainty while informing biodiversity policy decisions.

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ID: 254

A Systematic Map of the evidence for mesopredator release in terrestrial mammalian systems.

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Mesopredator release is the name given to the ecological cascade process that occurs when the local decline in population of a dominant carnivore causes the increase in population of a subordinate mesopredator as a result of being released from top-down pressure. This can have widespread impact on the local ecosystems, however it has been shown that the process may not be as widespread as commonly thought. Here we seek to look for global trends in the literature and compare the occurrence of mesopredator release across different systems with different carnivore community species composition. We reviewed peer-reviewed publications on the Web of Science Core Collection, BIOSIS Citation Index, Zoological Record, Scopus, and Google Scholar databases to collate the literature on mesopredator release from terrestrial systems around the world. This resulted in 5224 unique results after de-duplicating, of these 509 were referring to terrestrial mammals and monitored the abundance or distribution of two or more carnivores.

ID: 261

Protected areas in Tunisia between biodiversity conservation and territorial management

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One of the characteristics of forests in Tunisia is the fact that they are inhabited. The local population, despite the local way of life acquired over the centuries, voluntarily or involuntarily exerts anthropozoic pressure on forest and natural resources which are already fragile and are facing several threats, namely fires and the effects of climate change. In protected areas, the problem is amplified in view of the objectives of creating these areas, which all converge towards the conservation of fragile ecosystems and the protection of endangered species of fauna and/or flora. In consultation with local populations, scientists and experts have developed management methods that both meet conservation objectives and take into consideration the needs of populations living there. In the best contexts, local people, aware of the importance of resources and ecosystems, become in turn protectors and managers of resources and protected areas. Facing current declining environmental, social and governance situation, a management model must be put in place in Tunisia which draws inspiration from its history and from its regional and international experience, and that congregates both the growing needs of inhabitants and users of forest areas, and the objectives of conservation and enhancement of ecosystems and species.

ID: 263

Comparative landscape genetics of two partly sympatric hare species

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In France, the mountain hare (Lepus timidus) distribution is restricted to alpine environments. Confined to high altitudes, mountain hare populations are biogeographically isolated and recent evidences indicate a decline in their spatial range. This decrease is most probably due to global warming and human activities, but an additional threat might come from the competition with the European hare (L. europaeus). The range of the two species overlap over an area from 1000 to 2000 m asl, and the larger European hare is supposed to outcompete and displace the smaller mountain hare. Maintenance of mountain hare genetic variation is of critical importance since low levels will limit its ability to respond to these different threats. As this maintenance is partly depending on gene flow within and among populations, we aimed to characterize the environmental determinants of the gene flow of both species and to assess whether the inter-specific competition impact it or not. We used a machine-learning landscape genetics approach on > 1000 individuals of each species covering most of the French Alps and genotyped at 12 microsatellites loci to identify the main variables affecting connectivity. Results will be used to inform management strategies for the conservation of the mountain hare.

ID: 278

Environmental amelioration of run-down and minor areas for the conservation of wild bees and other pollinating insects along river belts in Italy

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Recent projections show that the current decline of pollinators leads to a depressing effect on the fitness of many flowering plants causing the erosion of several terrestrial niches and ecosystems. The loss of pollinators is mainly due to human activities causing fragmentation, degradation, and loss of habitats. Against this, the European Union has announced a package of laws within the “Nature Restoration Law” that aims to restore 20 % of EU terrestrial and marine habitats by 2030 and all degraded EU ecosystems by 2050. Reversing the decline of pollinators is one of the Law’s targets. Our study takes place under these perspectives and aims to realize the amelioration of marginal areas, recently remodelled to obtain detention basins, for the support and conservation of pollinators. These improvements involved sowing and managing entomophilous plant mixtures, while their effectiveness on the Apoidea community (Hymenoptera: Apoidea: Anthophila) was monitored. After almost three years of experimentation, results show a significant increase in the number of species of wild bees. These experiments also resulted in a package of guidelines on the management of degraded and marginal areas for the conservation of pollinating insects.

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ID: 295

Using gradient forest analysis to explore drivers of stream fish community structure in Eastern North America.

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North America has a diverse freshwater fish fauna facing multiple anthropogenic stressors such as watershed land use which affect the chemical, physical, and hydrological characteristics of inland waters. Small streams are especially vulnerable to watershed disturbances, yet in many regions more attention has been given to the dynamics of larger rivers and little is known about what drives fish biodiversity in small streams. Our project aims to evaluate anthropogenic and natural influences on fish communities in small streams in Eastern North America. Utilizing a large biomonitoring dataset from the United States’ Environmental Protection Agency, which includes a comprehensive set of predictor variables (land use, water chemistry, physical habitat, and climate), we employ a machine learning algorithm–Gradient Forest Analysis (GFA)– to identify key drivers of stream fish community composition in the Northeastern US. We also assess the relative influence of land use versus known natural drivers. Our study reveals complex interactions between natural and anthropogenic influences, leveraging the ability of GFA to understand non-linear relationships and interactions among variables. This analysis identifies key habitat variables that should be measured in monitoring programs focused on small streams in temperate regions, establishing a foundation for the sustainable management of these systems.

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ID: 297

An approach to maximize biodiversity outcomes from agroforestry as an alternative to agriculture in the Peruvian Amazon

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The UN's Sustainable Development Goals call for action to enhance human development and biodiversity conservation. However, global biodiversity decline persists. Peru, holding the Amazon rainforest's second-largest area, faces the challenge of balancing the local livelihoods that rely on forest-related activities like agriculture, with conflicting conservation aims. Agroforestry presents an alternative that could help align human and conservation needs. We developed an optimization approach to identify areas in the Peruvian Amazon where agroforestry conversion maximizes conservation benefits subject to a budget constraint based on the cost of incentivizing local farmers to switch their production mode. Using endangered birds as biodiversity indicator, we calculated the biodiversity benefits by modifying the Species Threat Abatement and Restoration (STAR) metric to assess the expected outcomes of reducing the agricultural threats. In our context, while northern San Martín holds higher biodiversity benefits, agroforestry transition there is likely costlier compared to Ucayali (at 8% discount rate: $55,754 vs. $13,976 per square Km), resulting in some Ucayali sites appearing in the optimal solution set. Our results highlight the importance of considering costs alongside biodiversity metrics like STAR. This approach offers guidance to organizations investing in sustainable agriculture, directing resources where they can yield the greatest biodiversity conservation impact.

ID: 299

Farmers' perspectives on the effectiveness of adaptation strategies for human–leopard cat coexistence: an importance–performance analysis in Taiwan

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In Taiwan, the leopard cat (Prionailurus bengalensis chinensis) remains the only extant native wild cat species. Previous studies have suggested anthropogenic factors caused their decline, mainly due to conflict with local farmers. Adaptation strategies that generate co-benefits are key to achieving human-wildlife coexistence. However, understanding of local views on the quality of such strategies to improve conservation outcomes is currently lacking. We performed the first regional assessment of the effectiveness of 10 adaptation strategies for human–leopard cat conflict management based on quantitative interviews with 418 farmers in Miaoli County, employing an importance–performance analysis. We also examined the impact of sociodemographic factors on the perceived gap between the importance and performance of these components. Our findings suggest that: 1) farmers' perspectives on the strategies' importance and performance significantly differed; 2) farmers most agreed with improvement in controlling stray dog populations that disturb humans and wildlife, incorporating local knowledge/skills into science and policy, and establishing adaptive co-management with local associations/NGOs; and 3) several sociodemographic factors were associated with increased gaps between the importance and performance of some strategies. Our findings provide guidelines for the future direction of the conservation and management of leopard cats that help achieve harmonious coexistence in shared landscapes.

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ID: 303

Variation in bat species richness and activity along an altitudinal gradient in the Western Alps: Insights from acoustic monitoring

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Bats are known to inhabit mountain areas at high altitudes. However, worldwide, few studies have investigated how the composition of bat populations changes with increasing altitude and how it varies over the activity season. Furthermore, monitoring bats in mountain environments is a priority in the context of global warming, considering that many bat species are decreasing and endangered in Europe.

We employed bat detectors distributed along an altitudinal gradient ranging from 700 to 3100m, every 300m in altitude, along two transects in two valleys. The bat detectors were activated at each station for two whole nights each month, from March to November 2023. All records were identified manually, often to the species level.

A total of 282 nights of recordings were acquired. Similar patterns were observed in both transects: bat activity and presence at higher altitude increased as the season advanced, followed by a decrease from September onwards. Notably, a mid-elevational peak at 1600m was identified in bat activity, foraging behaviour, and species richness from May to August/September. This result is attributed to the higher abundance of prey associated with the widespread distribution of water sources at those altitudes compared to the valley bottom.

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ID: 315

Will England's new flagship biodiversity compensation policy "Biodiversity Net Gain" deliver real conservation benefits?

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Biodiversity Net Gain policy in England is one of the world's most ambitious biodiversity compensation programmes to date. The legislation mandates that almost all approved planning applications in England deliver a minimum 10% net gain of biodiversity post-development, measured using the statutory Defra Biodiversity Metric. The metric uses habitat type, condition and area as a proxy for wider biodiversity, calculating the 'biodiversity units' associated with pre-development land. The policy has already been adopted by several local planning authorities in England and will come into force nationally in early 2024. One concern, however, is that the configuration of the metric may produce perverse biodiversity outcomes through the planning process. This study investigates how the metric scoring system influences post-development habitat size and choice, finding that the metric encourages developers to create a limited range of habitats to maximise unit-per-hectare value of land at the expense of wildlife-rich habitats. We question whether this pioneer of biodiversity markets – heralded as the key source of new private finance into conservation – can function effectively to provide biodiverse habitats vital for nature recovery. This has implications both for existing policy in England and future policies developed elsewhere that serve the new Global Biodiversity Framework.

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ID: 324

A new tracking technology reveals the movement and habitat use patterns of the invasive common myna (Acridotheres tristis) in a desert environment

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The common myna, one of the world's worst invasive species, has negative effects on many species and ecosystems. Despite much research and conservation efforts, its spread and establishment in new regions is not fully understood – especially in arid environments. Here, we used a novel, high spatio-temporal resolution tracking technology, to track adult and juvenile mynas in a desert habitat in rural Israel. We tracked over 30 individuals, each for an average of 68 days and 133657 locations between April 2023-January 2024 over a total area of ~12 km2 in a complex matrix of modified and natural habitats. Mynas spent most of their time inside settlements. We found seasonal variation in movement patterns and differences in movement patterns between juveniles and adults. Although mynas' home ranges were small (average 0.11 km2), many individuals moved often between settlements (situated 2.5 km apart). Moreover, Mynas used several roost locations during the tracking period, and changed the congeners they roosted with. We found that most long-distance daily movements occurred during either early mornings or late afternoons. Our results highlight the importance of high-throughput data to gain detailed insights on invasive species behavior. Such insights can consequently be turned into informed policy and management.

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ID: 330

Proximity to freshwater and seagrass availability mediate the impacts of climate change on the distribution of the west indian manatee

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How climate change alters the persistence and distribution of endangered species is an urgent question in current ecological research. However, many species distribution models do not consider consumers in the context of their resources. The distribution and survival of the West Indian manatee (Trichechus manatus) critically depend on seagrass resources and freshwater sources for drinking. We parameterized Maxent models with Bio-ORACLE environmental layers, freshwater proximity data, and modelled seagrass distance layers, to determine manatee and seagrass distributions under future climate change scenarios. We used two plausible IPCC Representative Concentration Pathways (RCP45 and RCP26, respectively) for the year 2050. The model fits had high accuracies and predicted a marked decline in seagrass coverage (RCP26: -1.9%, RCP45: -6%), coinciding with declines in manatee ranges (RCP26: -9%, RCP45: -11.8%). We observed poleward shifts in the geographical ranges of both species. Our findings suggest that manatees will lose substantial range due to future climate change, but the extent and direction of this change will be mediated by the degree of warming and its impact on the resources manatees depend on. Additionally, we discuss the significance of localised conservation efforts in turning the tide for the West Indian manatee, using Brazil as a case study.

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ID: 337

Urban pollinators in Italy: linking green areas with species diversity, interaction networks and ecosystem services for sustainable urban planning

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In the last decades, a global decline in biodiversity has been taking place due to the strong impact of anthropogenic activities. However, in large cities, refuge for pollinators persist and, from a One-Health and urban sustainability perspective, it is pivotal to implement suitable green areas to support functioning ecosystems and biodiversity.

To characterise pollination services, monitoring activities have been implemented across six major Italian cities, selecting sites according to different green area sizes and fragmentation. The research aims to assess pollinators' diversity and abundance, focusing on wild bees, and provide valuable information on pollination networks allowing a more comprehensive understanding of urban ecosystems. This took place in 2023, within the Spoke 5 activities (Urban Biodiversity) of the PNRR and NBFC plan.

More than 6,000 samples of wild bees and hoverflies and their interactions have been collected. Integrative techniques to identify the insects and their interactions (i.e., pollen) have been applied, allowing a more comprehensive understanding of pollination networks in urban ecosystems.

The study sheds light on the complex relationship between environment and regulating ecosystem services, contributing to the development of policies regarding management and implementation of food and nest resources for pollinators, for a more sustainable and healthful urban environment.

ID: 344

Effects of future climate extremes and land use changes on land vertebrates

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The biodiversity crisis is expected to intensify with further climate and anthropogenic land use changes. Despite much research and global commitments to halt ecosystem deterioration worldwide, biodiversity still faces many threats. Here, we assessed the combined effects of climate and land use changes, the two most detrimental factors impacting biodiversity, on the world's land vertebrates across four potential scenarios between 2015-2100. We evaluated species ranges exposure to extreme thermal events (considering frequency, duration, and intensity of exposure to maximum temperatures higher than experienced during 1950-2005), and land use changes, considering species' suitable habitats. By 2100, considering both factors, we project that land vertebrate species will lose, on average, 10-52% of their current range, depending on the scenario. Amphibians and reptiles, which generally have smaller ranges, are predicted to suffer greater losses than birds and mammals. Reductions in species range' suitability will be particularly noticeable across Africa, where land use changes and climate extremes separately would negatively impact biodiversity, and their combined effect would be synergetic. Our results highlight the dire consequences of two major threats to biodiversity by 2100 and where they may overlap. They further emphasise the need to act and follow a more just and environmentally aware policy.

ID: 364

Epigenetic biomarkers provide a non-lethal sexing method for endangered sea turtles with temperature-dependent sex determination

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The extinction risk of over 400 vertebrate species is exacerbated by global warming, as their sex is determined by temperature. Sea turtles are such endangered species threatened by increasingly female-skewed sex ratios under rising temperatures. Identifying the sex of neonates traditionally necessitates lethal and/or invasive techniques, however these are impractical for assessing sex ratios in situ on a large scale. Therefore, there is a pressing need for the development of a non-lethal sexing method, so that sex ratios can be evaluated to guide appropriate interventions as climate change progresses. DNA methylation is an epigenetic mechanism involved in gene expression regulation, including sex-related genes. We identified DNA methylation-based biomarkers to distinguish the sex of loggerhead turtle (Caretta caretta) neonates from small blood samples. We applied this method to a field-based, split-clutch design experiment in Cabo Verde, where nests were buried at different depths to expose them to male- or female-promoting temperatures in biologically relevant conditions. Methylation at candidate genomic sites successfully clustered neonates by sex, supporting their use as a molecular sexing tool. Overall, this set of biomarkers is a promising methodological advancement that will facilitate large-scale sex ratio studies in the field, to better monitor and manage marine turtle populations.

ID: 368

Conservation of the Regional biodiversity: the climate adaptation of the Piedmont Strategy

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To face the current impacts of climate change, urgent adaptive actions are imperative to mitigate severe consequences on biodiversity. Despite regional authorities playing a central role in adaptation, the lack of stringent guidelines hinders strategy implementation. Sectoral impacts and necessary adaptive measures are heterogenous across regions, thus specific results for each territory are needed. Regional impacts are often incompletely reported by literature, dataset and models, hindering the identification of specific adaptive measures. Traditional expert elicitation, while addressing this gap, poses challenges.

The Piedmont Strategy introduces an innovative approach, involving experts from private and public entities: regional authorities, academia, research institutes, parks, associations and NGOs. Collaborating in two work groups, they identify current and future impacts on biodiversity (both plant and animal) and ecosystems, and elaborate prioritised measures. Involving 143 experts of 46 affiliations, a cross-validated list of 110 impacts and 92 measures was quickly compiled with limited costs. Lastly, a public return of results took place. This approach proved to be effective, efficient and influenced the policymakers, overcoming the tendency to enact long-term actions to face climate change. It could be used internationally by subnational authorities also in other sectors.

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ID: 369

Ecological Dynamics and Coexistence Patterns of Wild and Domestic Mammals in an Abandoned Landscape in Northern Portugal

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In Southern Europe, agricultural land abandonment and reduced land-use intensity have created opportunities for rewilding and the resurgence of large mammal populations. Monitoring these changes is crucial to understand their impact on biodiversity, ecosystem services, and potential human-wildlife conflicts. Since 2015, we are conducting a comprehensive long-term monitoring program using camera traps in the Peneda-Gerês National Park, Portugal. Over the past six decades, this region has seen significant land-use changes due to agricultural abandonment, resulting in decreased agro-pastoral activities, facilitating natural succession, as well as an increase in large mammal species such as the wolf (Canis lupus) or the Iberian ibex (Capra pyrenaica).

We employed dynamic occupancy modeling to evaluate population trends, habitat usage, and potential interactions between wild and domestic herbivores. We observed stable overall occupancy trends for most of the species over the 8-year study period, with a notable exception for the Iberian ibex, which is currently in the process of repopulating the region. While we did not detect any spatial interactions between domestic and wild herbivores, our results suggest a need for further investigation into the interaction in terms of resource competition and ecological carrying capacity.

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ID: 370

Conservation measures facilitate Waterbird Responses to Climate Warming

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Biodiversity is increasingly affected by climate change, altering distributions and populations, which makes this issue a major concern for conservation. In particular bird species respond to rising temperatures by shifting their distribution ranges, but such a response can be affected by other anthropogenic pressures such as habitat degradation. Protected areas (PA) can facilitate such shifts in distribution by acting as migration corridors, stepping stones or buffers. However, an increasing body of literature suggests that not all PA support bird responses to climate warming equally, as the PA can differ in management actions and conservation funding. Here, we study waterbird community changes as a response to climate warming in relation to management actions and funding. We combined European bird surveys (i.e. International Waterbird Census) with data from the EU LIFE programme, the major conservation funding instrument of PA in the EU, which documents management actions and financial support of 1,450 Natura 2000 areas. Community adjustment to climate warming was faster at sites receiving funding targeted at wetland conservation compared to other conservation targets. Our results highlight that conservation actions can be used to support species responses to warming temperatures, ensuring long-term biodiversity conservation.

ID: 373

Bathymetric mapping and species recognition in the Indian Ocean: leveraging deep learning techniques for comprehensive environmental monitoring

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Aldabra Atoll, Saint-Brandon, and Saya de Malha, located in the Indian Ocean, are of paramount ecological importance due to their unique marine ecosystems and biodiversity. These regions are protected areas and have become the focus of major conservation efforts. This study presents a multifaceted investigation, combining a bathymetric analysis of the submerged terrain surrounding these locations with an innovative approach to automatic species recognition on underwater images.

Data are collected through the deployment of an open-source Autonomous Surface Vehicle (ASV) and with an Unmanned Aerial Vehicle (UAV). The ASV facilitated the collection of ground-truth data, which, in turn, validated the digital elevation models obtained from the UAV. This synergy enabled the creation of high-resolution depth maps covering larger areas.

Concurrently, deep learning techniques were applied to analyze underwater imagery allowing the classification of coral morphotypes, habitats and seagrass species. This study investigates the application of transformer-based deep learning models in underwater image classification. These models demonstrate high accuracy and outperform conventional methods. The proposed approach advances our understanding of these ecosystems and augments the effectiveness and precision of environmental monitoring techniques. As such, these tools can serve as a source for ongoing research and sustainable management practices within these regions.

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ID: 418

Challenges in population censuses of endangered species: what we learned from dormant geophytes

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Colchicum bulbocodium is an early spring geophyte protected in most of its disjunct distribution area. It is strictly protected in Hungary, where it has only few, isolated and declining populations. The reason of the decline is unknown, but reasons can be unfavourable management and/or changes in climatic conditions. In our study we aimed to study the effect of weather parameters on the C. bulbocodium population located in Újléta, East-Hungary. We performed yearly surveys in 20 permanent plots established in 2018 three times/year, when we recorded number of flowering- and non-flowering individuals and capsules production success. We identified and classified each individual into leaf-number categories, used photo-records and so we also accounted for dormant individuals. We tested the effect of five period's weather parameters (Hungarian Meteorological Service database) on the vegetative and generative characteristics of the plants. During the six study years we identified in total 1069 individuals. The total number of observable individuals was similar across the years, however, significant differences were found in case of leaf-number categories, dormant individuals, number of flowering individuals and capsules-production success. The effect of climatic variables was weaker than expected, suggesting that other parameters have a stronger effect on the population dynamics.

ID: 431

Threats to the conservation status of lowland heathlands neighbouring Milano Malpensa airport in north-west Italy: big concerns based on IUCN criteria

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Lowland heathlands dominated by Calluna vulgaris are recognized as a habitat of Community importance (habitat 4030, Annex I Directive 92/43/CEE), supporting several plants, invertebrate, and vertebrate species that are specialized, rare or declining, being restricted to this habitat. However, they are highly threatened by natural and anthropogenic pressures, especially those of the Po basin (NW Italy), being disjunct from the core distribution in Western and Central Europe and representing their southernmost limit.

The IUCN (International Union for Conservation of Nature) has developed criteria to perform risk assessments on ecosystems, creating the Red List of Ecosystems (RLE) methodology. It has been recently applied to all ecosystems of Italy, and heathlands themselves have been classified as vulnerable (VU). Here, we applied the RLE methodology to the specific case of lowland heathlands neighbouring Milano Malpensa airport, to evaluate more accurately their degradation up to the risk of extinction.

According to our results, the limited distribution is the key threat to lowland heathlands in this area. Land use change has led to a drastic reduction in the last century, and currently they occupy less than one third of their former distribution. Moreover, floristic degradation by invasive alien plant species increased consequently.

ID: 432

Contested institutions: Biodiversity offsetting and Urban land use planning

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Biodiversity offsetting is a conservation tool aiming to integrate socio-economic activity and biodiversity protection by compensating for the biodiversity losses caused by an activity by producing biodiversity gains elsewhere. In Finland, biodiversity offsetting was introduced in the new Nature Conservation Act in 2023. Despite being voluntary, several public and private actors are coming up with offsetting policies and schemes. Among them is the largest city in Finland, Helsinki: the city government has committed to halt biodiversity loss in Helsinki by 2030 and adopt biodiversity offsetting by 2027.

In this paper I look into the process of negotiating and shaping the policies and practices of biodiversity offsetting in the city of Helsinki. I draw on materials from a series of cross-sectoral co-creational workshops in which public administrators in collaboration with researchers discussed biodiversity offsetting and possibilities of integrating it into urban land use planning. Using the concept of institutional work, I address the interplay between institutions and actors and discuss how incorporating biodiversity offsetting into urban land use planning drives institutional change by maintaining, reordering and challenging institutional structures and fostering new practices and partnerships.

ID: 434

Navigating the path to 2030: integrating protected area support in development cooperation

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Protected areas are an important instrument of global biodiversity conservation. To conserve biodiversity in the long term, however, it is crucial to consider local populations' interests, capacities, and needs.

The German Federal Ministry for Economic Cooperation and Development (BMZ) pursues two overarching objectives in its promotion of protected areas: an environmental objective and a socio-economic objective. One the one hand, these objectives can be mutually reinforcing: promoting sustainable resource use is both a way of preserving biodiversity and combating (rural) poverty. On the other hand, tensions may

arise where they are not sufficiently aligned. Prioritizing one over the other can negatively affect either livelihoods of local communities or conservation plans.

Against this background, DEval has evaluated the German bilateral development cooperation for the support of protected areas. By reviewing if the set objectives have been achieved, the evaluation also considers whether the projects were suitable for mitigating tensions among the objectives.

The year 2030 as a finish line for the Agenda 2030 is quickly approaching. Considering the Global Biodiversity Framework, particularly its 30x30 target, the team will share its evaluation approach and methodology for examining lessons learned as well as challenges remaining on the road to 2030 and beyond.

ID: 439

Strip cropping with oilseed rape and wheat – a strategy for biodiversity conservation in conventional cropping systems?

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Given the environmental, social and economic objectives of modern agriculture, there is a growing awareness to reconcile food production with biodiversity conservation. Diversified cropping systems, in which several crops are grown on the same field, are emerging as a strategy to conserve farmland biodiversity while maintaining high yields.

Our study assesses the potential of strip cropping with oilseed rape and wheat to enhance biodiversity and associated ecosystem services in conventional farming systems. In 2022 and 2023, we assessed biodiversity and yield on 16 conventionally managed farms, comprising a total of 24 triplets. Each triplet consisted of a strip cropping field with alternating strips of machinery widths and a pure oilseed rape field and a pure wheat field as reference.

We hypothesise that strip cropping will promote a wider range of species and individuals across trophic levels due to increased crop diversity, edge density and habitat complexity. First results indicate a higher diversity in arable weed flora, benefits for natural predators such as carabids and increased numbers of farmland bird species and individuals in strip cropping compared to pure wheat or oilseed rape fields.

Hence, strip cropping may be a viable strategy for integrating biodiversity conservation into conventional agriculture.

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ID: 450

Does forest strict protection work for plants? Insights from a multifaceted diversity approach in an Italian national park

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The establishment of protected areas is an effective strategy to mitigate the global loss of forest diversity caused by human activities. However, the challenge is that not all measures of diversity are equally informative, and protected areas range from strict to sustainable exploitation. We explore how different facets of plant diversity change across strict protection and managed regimes in the forest Casentinesi National Park (Northern Apennines, Italy).

We selected 28 beech (Fagus sylvatica L.) forest plots in strict protection (n=14) and managed (n=14) areas. In each plot of 30m×30m, we recorded the presence of vascular plant, and measured specific leaf area and clonal traits of dominant species. We measured taxonomic, functional, and phylogenetic indices. We used Linear mixed models to assess the effect of the protection regime, non-metric multidimensional scaling (NMDS) and indicator species analyses to assess differences in species composition.

Strictly protected forests had a significantly higher ratio of specialist species and a higher functional richness of clonal strategies. Different indicator species and NMDS reflected species composition differences.

Species richness is an ineffective indicator of changing diversity between different protection regimes. Strict protection impacts forest plant assemblages and functions, promoting habitat specialist species and functional diversity.

ID: 465

Silence of the Dams: Stakeholder Perceptions of Reintroduced Beavers in Germany

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Nearly a century ago, European beavers (Castor fiber) were reintroduced to several German federal states for rewilding purposes. However, this ecosystem engineer is not always accepted, particularly in landscapes where it causes conflicts with humans. To better understand beaver acceptance, we conducted an online survey in Germany (ca. 1500 participants). We found that beavers were mostly perceived positively by the general public, but negatively by those working in agriculture and forestry as well as by participants from Bavaria. Beavers were most accepted in zoos, cities and protected areas, but highly disapproved of in private gardens and cultivated land. Negative perceptions were improved in places where management measures were implemented at first knowledge of beaver presence. To ensure the successful conservation of beavers and their positive impact on biodiversity, acceptance is crucial and achievable through proactive measures before damage in human-dominated landscapes occurs. Through our presentation, we inform researchers, policymakers, and practitioners about the current acceptance of beavers in Germany, and give guidance on proactive beaver measures in human-dominated landscapes.

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ID: 486

Wels catfish (Silurus glanis) management strategies in the LIFE Minnow Project: from telemetry studies to control and use in circular economy

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The introduction of invasive alien fish species is one of the main problems regarding the protection of the freshwater aquatic environment, especially when the presence of endemic fish species is high and extremely valuable. Alien species control is one of the main objectives of the LIFE Minnow Project, with a focus on Wels catfish (Silurus glanis). Wels catfish biomass reduction is planned over 440 Km in twenty Natura 2000 targeted sites in the northern part of the Po river basin. To verify the effectiveness of removal actions, we will examine already collected removal and abundance time series data from the Orba river, Italy. Furthermore, we are undertaking a campaign to collect data relating to stomach contents, to analyse the actual impact of this predator on local fish communities. We are also conducting a radio telemetry study to better understand Silurus glanis movement behaviour and environmental preferences in the Po River, which will allow the application of timely action with high effectiveness to contain this invasive and interfering species. As part of the LIFE Project and within a framework of circular economy resource reuse promotion, an agreement to deliver Wels catfish biomass to a pet food company as been setup.

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ID: 499

Comparing two native Mediterranean honey bee subspecies (Apis mellifera ligustica and Apis mellifera iberiensis) for resilience to climatic stressors

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Climate change poses a significant threat to honey bee welfare, exacerbating challenges like nutritional stress, pathogen susceptibility, and shortened flowering periods. The PRIMA project MEDIBEES (Monitoring the Mediterranean Honey Bee Subspecies and Their Resilience to Climate Change for Sustainable Agro-Ecosystems) seeks to comprehend the impact of climate change on different Apis mellifera subspecies in the Mediterranean region. Within the project, temperature tolerance and survival of different honey bee subspecies under extreme temperature and humidity conditions are studied. Here, we report the results of laboratory assays where heat/cold tolerance, survival rates, and dehydration of individual honey bee workers belonging to the subspecies native to mainland Italy (A. m. ligustica) and Iberian peninsula (A. m. iberiensis) were compared. The Iberian bees exhibited better survival and slower dehydration than the Italian subspecies. Both of them showed lower tolerance to high temperatures (45°C) compared to subspecies native to warmer climates. Temperature and humidity were identified as independent or synergistic stressors, impacting both survival rates and body water retention. This experiment is part of a wider study on the Mediterranean subspecies aiming to generate awareness about the preservation of the natural honey bee biodiversity as a response to climatic threats.

ID: 507

Multi-scale habitat suitability modelling for jaguars (Panthera onca) - a continental approach

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Humans have been altering nature for millennia, affecting directly wildlife populations worldwide. Habitat fragmentation and landscape conversion reduce capacities of animal movement between populations, leading to increased levels of inbreeding, susceptibility to diseases and genetic defects (Roques et al., 2016). Larger carnivores are particularly susceptible to anthropogenic threats. Jaguars (Panthera onca) have lost approximately 50% of their geographical range due to habitat loss coupled with human-carnivore conflict (Quigley et al., 2017). Understanding how jaguar respond to changes in the environment is paramount to identify core areas for the species and, with that, propose effective conservation efforts (Kaszta et al. 2019). We used 172 GPS-collared jaguars and a multi-scale approach to predict the first continental habitat suitability model, encompassing the entire range of the species and assessing the effectiveness of protected areas to protect jaguar core habitats. Overall, the models suggest that jaguars prefer habitats with higher productivity and proximity to water sources. Simultaneously, they tend to steer clear of regions under substantial anthropogenic pressure, particularly those heavily populated or modified by human activities, as well as areas dominated by livestock farming. Furthermore, our predictions highlight the Amazonian Rainforest and the Mayan Forest as the most important habitats for the species.

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ID: 512

Development of novel eDNA-based tools for supporting sturgeon repopulation monitoring plans

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The Po River basin (Italy) is a complex freshwater ecosystem flowing into one of the most populated European regions (Po plan). The entire ecosystem is largely altered and impacted by human activities and recently also by climatic stressors. In the last years, more attention has been spent on conservation management of local fauna, both promoting conservation strategies of target species and recovering habitat connectivity through projects of river defragmentation. The reintroduction of sturgeon species (Huso huso and Acipenser naccarii), extinct since ‘70s, represents one important goal of ecosystem restoration programs. Currently in place, the LIFE NATURA project (Life Ticino BIOSOURCE) has the specific aim of reintroducing through captive breeding programs both species. Sturgeons are bred in seminatural tanks at the Ticino Park on the Ticino River, a main tributary of the Po River, and specimens are released into both rivers. To support monitoring actions, molecular approaches based on environmental DNA (eDNA)-based detection have been proven reliable in aiding monitoring actions. Hence, two Taqman-based assays, specific for the endemic two sturgeon’s species, have been developed targeting the mitochondrial cytochrome b region. The assays have been validated through in silico, in vivo, and in situ trials by quantitative polymerase chain reaction (qPCR).

ID: 529

The conservation role of small but heterogenous landscape features in agricultural landscapes

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In our study we aimed to reveal the relations between environmental heterogeneity and biodiversity on small landscape features acting as biodiversity hotspots in agricultural landscapes. We studied ancient burial mounds covered by semi-natural grasslands in Hungary and Bulgaria. We designated 16 study sites, each containing a few-metre-high mound with five microsites (top, north-, east-, south- and west-facing slopes) and a nearby plain grassland. At each microsite, we measured soil moisture, soil chemical properties, solar radiation and microclimate; and recorded the cover of vascular plants. Topographical heterogeneity was associated with sharp differences in microclimate and soil properties. Besides the contrast between mild north-facing and harsh south-facing slopes, east- and west-facing slopes also sustained unique microsites characterised by dynamic diurnal changes in temperature and vapour pressure deficit. Various combinations of the EH components resulted in unique plant species compositions within the microsites, and supported the co-occurrence of species typical of contrasting habitat types, even within a couple of metres. By combining high resolution measurements of abiotic factors with fine-scale vegetation sampling, we provide evidence that landscape features with complex topography can harbour several grassland-specialist plant species and introduce a high level of heterogeneity to otherwise homogeneous plain landscapes.

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ID: 537

Change in the global extinction risk of mammals from 1996 to date

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The IUCN Red List of Threatened Species plays a crucial role in promoting biodiversity conservation and informing policy making. The Red List Index (RLI) measures changes over time in the conservation status of taxa. It shows the aggregated extinction risk across groups of species, based only on genuine improvements or deteriorations in status, resulting from increasing threats or implemented conservation actions, that warrant moving species between IUCN threat categories. The aim of this research was to use the RLI to evaluate the global change in the extinction risk of mammals from 1996 to date, both aggregated for all mammals, and disaggregated for specific groups of species (identified by natural systems, biogeographical realms, main habitats, and taxonomic orders). Globally, the mammal RLI declined monotonically over the past 30 years. The Primates have the lowest RLI and, overall, approach extinction faster than all the other orders. Generally, large-bodied species are more threatened with extinction, and show lower RLI values than small mammals. Mammals distributed in the tropics (South America, Sub-Saharan Africa, and South-East Asia) decline at a faster rate than European and North American species, mainly due to habitat loss and hunting.

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ID: 540

Conservation management tools for increasing structural and compositional biodiversity in Natura2000 oak forests Life4OakForests LIFE16NAT/IT/000245

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General goals: the oak forests biodiversity is declining because of intensive commercial use. The goal of nature conservation interventions is to promote the regeneration and restoration of the diversity of forest structure, native tree species composition and microhabitats. Mammals, birds, insects, plants, and fungi will increase and preserved.

Objectives: increase the biodiversity of EU priority oak forests (*91AA, *91G0, *91H0, *91I0) & 91M0 in the National Parks' managed protected Natura 2000 sites (Italy-Hungary).

Actions:

(A1) Collection and examination of scientific documents and remaining natural forests. Elaboration of guidelines for ecological forest management based on the image of the natural forest.

(B1) Oak forests purchased for securing the biodiversity of the area.

(C1) Implementation of nature conservation forest management by creating different types of deadwood habitat, reconstructing the diverse, more habitat-rich forests structure, reducing game impact and suppressing invasive species according to the elaborated guidelines.

(A2, D1) The effect of forest management and interventions are monitored according to the developed monitoring protocol. I

(D2 & D3) Evaluation of the restoration of ecosystem functions and social economic impact.

(E2) Intensive awareness-raising activities for stakeholders and general public.

Project period: 01/07/2017 – 31/12/2026

The project is co-financed by the European Union's LIFE programme.

ID: 548

Ecological dynamics of the invasive species Erigeron annuus: impact on pollinator communities and resource availability

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Global rise in invasive species is contributing to habitat loss, posing ecological challenges. However, the impact of these species on biological interactions varies. They play crucial ecological roles by offering abundant resources, such as increased pollen and nectar production, making them more attractive than native plants. Conversely, they may draw pollinating insects, thereby encouraging visits to concurrently blooming native species.This study originated from the collaboration of researchers and projects (BeeNet, Life4Pollinators) from Italy and Lithuania, established within the European COST-Action 'Conserve Plants'.The research focuses on impact of the North American species Erigeron annuus, invasive in Europe, on pollinator communities, and

aims to explore how its presence influences food source availability for pollinators.Sampling activity was conducted in Italy and Lithuania, focused on individuals of E. annuus plants in morning and afternoon, to assess differences in pollinator visits captured on these plants. Results highlighted that E. annuus received significantly more visits during afternoon, suggesting a key role in supplying food throughout the entire day, addressing resource needs after the closure of other flower species.Pollen and pollinator community analyses have been done to deeply understand the role of E. annuus in agro-ecosystems and how it affects the pollination service.

ID: 550

Environmental and anthropogenic correlates of den-site selection by wolves in Scandinavia

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As habitat generalists, wolves are able to adapt to different environments. During their first weeks of life, however, wolf pups are highly vulnerable and susceptible to various forms of disturbance. It is therefore reasonable to hypothesize that breeding wolves are choosy when selecting the primary den, the site where the pups are born and spend the first weeks of life. In areas where human activities are increasingly encroaching formerly pristine environments, understanding wolf habitat needs when selecting den sites is critical to inform conservation.

From 2005 to 2023, we sampled 44 dens in 27 wolf packs in Scandinavia, detecting the locations through GPS positions of breeding wolves and surveying the sites in person. To assess habitat selection at den sites by wolves, we estimated a multi-grain resources selection function at the third order of selection, comparing the dens with random points inside the territories.

When locating dens, wolves selected for tree cover density and terrain roughness, while they avoided anthropogenic linear futures (paved and gravel roads). Especially with species in constant conflict with humans, spatially explicit models of delicate sites increase management and conservation effectiveness being useful for preventing persecution, mitigating livestock depredations, and improving monitoring programs.

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ID: 558

Midas touch - monitoring goldenrod invasion with remote sensing and machine learning

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Invasive species pose a significant threat to global biodiversity, impacting ecosystems’ health and agriculture systems. Among these invaders, goldenrod (Solidago spp.) stands out as a prolific colonizer with detrimental effects on native flora and fauna. This study investigates the integration of remote sensing technology and machine learning algorithms for the detection and monitoring of goldenrod invasion.

Goldenrod's pervasive nature and considerable negative impacts on pollinators, farmland birds, and ecosystem service providers emphasize the need for effective detection and management. Traditional methods face challenges in vast abandoned lands where goldenrod thrives. Machine learning-based automatic classification combined with remote sensing emerges as a promising tool, offering efficient, cost-effective, and scalable monitoring of extensive and challenging terrains.

In proposed approach, a customized Convolutional Neural Network classifies pixel data from Sentinel-2 satellites' multispectral imagery to detect goldenrod presence. The model is trained on field-inspected, goldenrod-infested plots in Lesser and Central Poland. Frequent satellite revisits enable monitoring changes over time, crucial for understanding the dynamic nature of goldenrod invasions and seasonal variations in growth patterns.

ID: 566

An unusual thing - a regional fire history in northern Sweden

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Fire is a common natural disturbance in the boreal forest landscape and give rise to a variety of dead wood quality, creating habitats that many threatened species depend on. To benefit these endangered species, prescribed fires are sometimes conducted. However, for these to be as effective as possible, knowledge of the areas' fire history is crucial. While there are several local fire histories available, this study presents a regional fire history in northern Sweden. By analyzing four datasets from southern Norrland in Sweden (Horten, Jämtgaveln, High Coast, and scattered key biotopes in Västernorrland County), it can be concluded that numerous fire years occurred in all areas. For instance, there were significant and numerous fires in the years 1693, 1729, and 1798. Results from analyses of tree ring sizes shows that these fire years have unusually small year rings. Also, there is a considerable geographical distance between the High Coast area and Horten/Jämtgaveln. Taken together, it can be assumed that these years experienced dry summers, resulting in fires occurring in many places simultaneously, similar to the significant fire year of 2018 in recent times. This overview of regional fire history can have great value for forestry and managers of protected forests.

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ID: 568

Advancing FAIR science to accelerate synthesis research: an agroecological case study in machine-reusable scientific knowledge

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Synthesizing scientific knowledge is critical for solving societal challenges like biodiversity loss. Yet, researchers struggle to share reproducible findings and are confronted with a flood of new publications. While most scientific articles are pseudo-digitalized as PDF publications that can be shared electronically, their unstructured format is unintelligible to computers (i.e., not machine reusable), limiting our use of computer support tools that accelerate knowledge synthesis.

The Open Research Knowledge Graph (ORKG) is an open-access online interface that digitalizes scientific knowledge using knowledge graphs that are human- and machine-reusable. Yet, a key barrier to scaling its use is that scientific results published in PDF format must be manually extracted by scientific experts, a time-consuming endeavor. Using an agroecological dataset, we showcase a novel technique allowing researchers to produce knowledge in machine-reusable format from the outset. Building from the original data analyses conducted in R, we developed an accompanying R script to produce machine-reusable descriptions of the original statistical models that can be automatically harvested by the ORKG, eliminating manual data entry.

Using programming languages like R to facilitate automated knowledge harvesting by the ORKG could be streamlined into existing FAIR (Findable, Accessible, Interoperable, Reusable) data sharing requirements, transforming knowledge sharing and synthesis.

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ID: 569

How can fisheries' operations contribute to the global nature positive goal?

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Successfully implementing the Global Biodiversity Framework (GBF) will require economic sectors to mitigate their negative impacts on biodiversity and increase positive impacts to contribute towards 'halting and reversing' net biodiversity loss. Net outcome policies are becoming widely used to support such goals and 'Nature Positive' is gaining traction as an ambitious goal that aligns with the GBF. Despite being a key sector in the global economy and concurrently a leading cause of biodiversity loss in the ocean, fisheries have received relatively little attention in terms of net outcome approaches. This research addresses this gap by exploring how the mitigation hierarchy could be applied to mitigate and compensate for the impact of fisheries operations on biodiversity to allow fisheries to contribute to the Nature Positive goal. This involves 1) developing a conceptual framework for how fisheries could contribute to the goal; 2) illustrating how the framework could be applied to real-world fisheries certified by the Marine Stewardship Council (MSC); and 3) exploring how MSC certified fisheries could take a broader view of their environmental impacts on their way to becoming Nature Positive. Based on the results, the implications for the MSC Fisheries Standard, fisheries, and global biodiversity goals, will be outlined.

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ID: 584

Sensitivity of REDD+ avoided deforestation estimates to matching specifications

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There is a substantial interest in the potential of carbon credits generated by Reducing Emissions from tropical Deforestation and Degradation (REDD+) and traded on the voluntary carbon market for generating the finance needed to slow forest loss. Recent global-scale analysis using a range of methods for estimating the counterfactual rate of deforestation ex post suggest that many REDD+ projects have overestimated their effectiveness at reducing deforestation and consequently issued more credits than can be justified. One study which has been widely cited in the debate (Guizar-Coutiño et al. 2022) estimated avoided deforestation using statistical matching of pixels and a single set of matching options. We estimated avoided deforestation from the same set of projects using 7-hectare plots rather than pixels to sample deforestation and explored the sensitivity of results to matching choices. There was a substantial correlation between our new estimates and those published in Guizar-Coutiño et al. 2022 and our headline estimate of 0.22% per yr (95% CI: 0.13-0.34) is essentially unchanged. At a time when confidence in the voluntary carbon markets is low, we hope these results provide reassurance that ex-post counterfactual estimates of avoided deforestation are consistent, helping accelerate their widespread adoption.

ID: 605

Phylogeography and landscape genetic analyses for the conservation of the threatened saproxylic beetle Rosalia alpina in Italy

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In the global scenario of genetic biodiversity loss, threatened umbrella species deserve a special attention in conservation. Rosalia alpina, a saproxylic longhorn beetle, perfectly fits in this category. In Italy, the species counts a not-yet well-defined number of evolutionary units. We here describe an ongoing project whose main aims are: 1) providing insights into the phylogeographic patterns of Rosalia alpina (mitogenomics/nWGS/RADSeq) to better delineate conservation units and compare the genetic diversity in Italy with that scored for other European populations and, 2) detecting at a landscape-level the genetic/genomic structure within Rosalia alpina (microsatellites and WGS techniques). In particular, population genetics/genomics results will be interpreted in light of the effects of different protection measures and landscape variables, allowing for the evaluation of the habitat fragmentation drivers worth to be considered in planning conservation actions. Then, by comparing neutral and non-neutral genetic variations, we expect to detect signatures of natural selection due to different management levels and anthropic activities. Finally, the demographic history of a set of populations from selected Protected Areas will be analysed on a decadal scale (2014–2023) to evaluate possible long-term environmental change effects on the diversity and evolutionary trajectory of Rosalia alpina at a narrower geographic scale.

ID: 608

Small structures for the promotion of stoats (Mustela erminea) within agricultural landscapes

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Installing small structures (SS) such as branch and stone piles in agricultural landscapes is encouraged by conservation experts to improve habitat conditions for biodiversity, in particular reptiles and small mammals. Although stoats (Mustela erminea) and weasels (Mustela nivalis) have been identified as the main target species when installing SS within regional biodiversity conservation projects (RBCPs), no study has quantitatively examined the effect of this measure on mustelids. We employed camera trap boxes and scat detection dogs to monitor stoats and weasels within 14 RBCPs and 14 paired pseudo-control regions located in Swiss farmland. Our objective was to investigate how SS and other landscape elements, influence the presence of these mustelids. While 281 sites with and 139 sites without SS were sampled, mustelid presence was detected only in 26 sites, all with SS, demonstrating an overall positive effect of RBCPs on stoat populations (but no effect on weasel populations). Furthermore, results indicate that stoat occurrence was higher on stone compared to branch piles, was positively affected by SS density, and negatively affected by forest cover on a 100-m radius. Findings provide evidence for the effectiveness of RBCPs in promoting farmland biodiversity and provides practical recommendations for the installation of SS.

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ID: 610

Effects of land-use on paleochannel grasslands in the argentinean dry chaco: a decade of change

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The study of the rapid agricultural expansion in drylands has primarily focused on forests, often overlooking neglected grasslands. These play -as any other ecosystem- a crucial role in maintaining biodiversity, ecosystem services, and socio-economic benefits. However, they are threatened by land-use changes. Our study focuses on the transformation of the paleochannel grasslands (PG) (i.e., grasslands in ancient riverbeds) of the Argentinean Dry Chaco by natural processes (e.g., shrub encroachment) and land-use changes (e.g., agriculture, cattle, fire, and infrastructure). We quantified the percentage of shrub and grass cover in each paleochannel unit, the average cattle stocking, the burnt area, and fire recurrence from 2010 to 2019. Our findings highlight the significance of combined traditional grazing and fire management in grassland conservation at low intensities since they prevent shrub encroachment of grasslands, thus maintaining the health and resilience of grassland systems. This approach guides conservation recommendations in dryland PGs while supporting traditional and sustainable socio-economic development, balancing conservation and socio-economic development aligned with the Sustainable Development Goals.

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ID: 630

Monitoring changes in carrying capacity through time: why and how?

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Conservation assessment of wild populations places a strong focus on monitoring trends in population size, but this approach has potential to mislead since a population can grow for a long time, even as carrying capacity falls. This is because population growth requires the population size to be lower than the carrying capacity but is agnostic to time trends in this carrying capacity. We thus developed a simple approach to estimate time-varying carrying capacity, a single integrative metric that can be used to monitor changes in all environmental variables relevant to a target population. We used an individual-based model to quantify this metric for a recovering population of spotted hyenas (Crocuta crocuta) and investigated how recent population growth could be explained by current or past environmental change. Growth in this population occurred despite no linear trend in time-varying carrying capacity, suggesting that the observed growth is likely the lingering effect of past environmental change rather than recent environmental improvements. This study illustrates that recovery can occur at different time scales for the environment and for a population. Taking account of this possible demographic lag is likely key to best manage the conservation of long-lived species.

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ID: 641

Effectiveness of forest restoration for the conservation of pollinators in agricultural landscapes

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Forests are critically important habitats for insect pollinators. Besides providing nesting and other non-floral resources, forests can host distinct pollinator species. However, in intensively managed agricultural landscapes such as temperate lowlands, forests are extremely scarce and often fragmented. Here, we focused on exploring the effectiveness of forest restoration as a conservation measure for forest-associated pollinators. We selected 17 mesophilic oak-hornbeam restored forests and compared their pollinating wild bee, hoverfly, and lepidopteran communities to those of 17 primary forest remnants in the lowlands of Northern Italy. Next, we investigated which local and landscape characteristics affect the diversity of pollinating insects within forests. We did not detect strong differences in pollinator communities between restored forests and remnants, suggesting that ecological restoration of forests in intensively managed agricultural landscapes can have the potential to conserve forest-associated pollinators. Furthermore, we showed how forest structural characteristics, local heterogeneity, and landscape connectivity between forest patches affect pollinating insects differently, based on the ecology and the dispersal ability of single pollinator taxa. Our research contributes to the knowledge of pollinating insects in forest interiors, provides evidence of the potential of forest restoration in supporting pollinators in agricultural landscapes, and highlights key temperate lowland forests' conservation issues.

ID: 652

Embracing Diversity: The Imperative of Multi-Taxon Approaches in Understanding and Safeguarding Biodiversity in a Changing Environment

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In contemporary biodiversity conservation literature, concepts such as biodiversity loss, mass extinction, and ecosystem collapse are prevalent. While many studies concentrate on the impact of land-use changes on a specific organism group, attempts are made to generalize findings to entire ecosystems. Our research spanning decades reveals that various organism groups respond distinctly to environmental changes. Exclusively focusing on a single organism group poses a substantial risk of overlooking inter-taxon variations, leading to divergent conclusions about the effects of environmental changes on biodiversity aspects. For instance, our studies show that removing understory spruce in commercial thinning benefits lichens but adversely affects birds. Another study demonstrates that mosses on lower stumps are more species-rich, while the opposite holds true for lichens. Singular taxonomic group studies, though valuable, can provide limited insights. Recognizing time constraints in acquiring knowledge for biodiversity conservation recommendations, we advocate for a comprehensive approach. Researchers should incorporate multiple organism groups in their studies to better understand and safeguard biological diversity.

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ID: 674

Can the microbiome help glacial springtails survive?

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The supraglacial ecosystem hosts different organisms among which viruses, bacteria, algae, fungi, plants and invertebrates.

Altogether they form simple trophic networks where springtails (Collembola) are the key organisms. Indeed, these arthropods feed mainly on bacteria and are preyed by ground-dwelling macro-arthropods (i.e. spiders and carabids), therefore they are a nodal point of connection between the microbial food web to that of macro-organisms. Springtails mostly inhabit the ice-sediment interface, and to date, little information is available regarding the strategies they use to survive in such extreme conditions. An open question is what their diet is and to what extent their microbiota can help them to proliferate on glaciers. For this aim, we characterized springtail microbiomes through 16S rRNA sequencing. These analyses were performed on springtails collected on Forni Glacier (Italian Alps). A group of springtails was immediately frozen after collection, while a second group was incubated in distilled water for a few weeks to empty their gut. These two groups will allow to distinguish bacteria present as part of their diet from their actual microbiome. Results will provide detailed information on springtail food sources, the most abundant bacteria inhabiting their gut and the metabolisms of the springtail microbiota.

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ID: 678

Evaluating climate change impact on three endemic plants at regional and sub-regional scale

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The climate crisis poses significant threats to ecosystems worldwide, causing local environmental unsuitability for species and forcing them to migrate, when possible, to more suitable areas.

Effective long-term conservation decisions must encompass thorough evaluations on how ecosystems are bound to mutate, involving robust predictions on the effects of climate change on habitats and species distribution. Multi-scale distribution models based on climate change velocity estimates can provide insights into the potential displacement of the environmental conditions and the species migration chances, thus supporting successful management strategies.

We evaluated the impact of climate change on distribution and migration likelihood of three endemic plants with different ecological requirements (Ajuga tenorei, Cardamine silana and Potentilla calabra) at two spatial scales.

Firstly, we investigated the differences in the ecological niches of the selected taxa, based on a local-scale analysis involving remote-sensed data.

Afterwards, we estimated patterns of climate change velocity, and the effects on the species distribution at two resolutions: 100 m for the whole Calabria region, and 30 m for the Sila National Park.

Overall, our work highlighted the importance of evaluating implications of climate change on ecologically diverse species, at spatial scales representing different critical levels of decision-making in nature conservation.

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ID: 684

Exploring the role of land abandonment within land sparing and sharing frameworks through ontology and advanced analysis

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Although the discourse on land use planning is frequently framed as a dichotomy between land sparing and land sharing, it is important to recognize the presence of numerous nuances. Understanding the role of land abandonment in land use strategies is crucial for optimizing its contribution to the conservation of biodiversity and ecosystem services. Given the evolving definitions of land sharing and land sparing over the past two decades, any ambiguity in these terms can affect environmental policy decisions. It is crucial to consider potential shifts in definitions and to examine where land abandonment falls within the framework of these concepts and how it is defined.Our systematic review explores the integration of land abandonment within land sparing and land sharing strategies. The study delves into the definitions used in articles and the context of the analyzed publications. To enhance precision and clarity, we employ ontology. Detailed analyses include, i.e., semantic evaluations, identification of high-frequency words, and radial categories. Quantitative studies using advanced LLM-based, word embedding techniques offered a comprehensive understanding of land sparing, sharing and land abandonment relationships. Knowledge graphs visually represent interconnections and ensure consistent definitions.The proposed approach enhances reproducibility and reliability, contributing to a universally applicable framework.

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ID: 694

Feral horses at the city gate: relationship with sympatric species and rewilding opportunity

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La Calvana massif is a protected area in central Italy characterized by forests patches interspersed with agricultural parcels and apical meadows of great ecological importance, now abandoned. The area hosts one of the few existing feral horse populations (Equus ferus caballus) in Italy, which originated nearly forty years ago from abandoned individuals and counts today 65 individuals. Their unplanned presence represents a unique rewilding opportunity, with potential for preserving grassland habitats important for biodiversity and limiting forest regeneration. Unfortunately, little is known about the horse distribution, their temporal activity, and relationship with co-occurring mammals. In 2022, we started a camera-trap study and sampled 40 sites to investigate the distribution of the horses and their activity in response to human disturbance, environmental characteristics, and other co-occurring mammals. We found 12 wild mammals, including the wolf and wild cat, and estimated occupancy probability of horses across the entire area. Moreover, despite the whole area was suitable for the horses, they used preferentially the upper-ridge grasslands. Horses were cathemeral but used closed-canopy areas during the hottest part of the day, likely increasing competition with wild ungulates. Horses appeared well integrated into the wild mammal community while contributing to keeping the apical meadow open.

ID: 695

Using dark diversity to disentangle the effects of protection and habitat quality on species diversity

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The effectiveness of protected areas in preserving species diversity is usually evaluated by comparison to control sites. Nevertheless, disparities between protected and control areas may also arise from hard-to-quantify gradients in habitat quality (i.e., its potential to harbor diversity). We suggest that dark diversity, the species that fit the site conditions but are locally absent, can be used to disentangle the confounding effects of protection and habitat quality on biodiversity. Using protected and control sites across the Mediterranean Sea, we show that fish dark diversity decreases with protection efforts but is independent of habitat quality and thus can assist in quantifying the effectiveness of protection while accounting for the habitat quality. Unlike species richness, which may be influenced by both protection measures and habitat quality, dark diversity offers a clearer estimate of a site's inherent capacity to support species diversity, offering a more refined understanding of the effectiveness of conservation efforts.

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ID: 696

GIS-based extraction of landscape units for pedodiversity, ecosystem analysis, monitoring and management

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Assessing and monitoring ecosystems are key steps in the path toward nature restoration, conservation, and management. Soil is a fundamental component of terrestrial ecosystems: in fact, it is considered one of the most diverse and complex natural systems at global scale. Despite its primary role in sustaining biodiversity and in providing ecosystem services, soil is often overlooked in ecological studies and when making policies for environmental protection.

Soil forms over time according to the combination of all environmental compartments like the atmosphere, hydrosphere, biosphere, and lithosphere. With geographic information systems (GIS), the soil forming factors are elaborated in homogeneous areas called landscape units. Thus, within each landscape unit, a characteristic set of soil types and habitats was detected. In this way, the landscape units are the basis for the soil survey campaign and subsequent mapping.

The resulting soil map and its derivatives for the evaluation of ecosystem services deliver a cartographic document useful for scientists, managers, and decision-makes alike. In this contribution, we describe this workflow up to the creation of the soil map of the Frignano Regional Park, in Northern Italy, and its potential in ecosystem assessment, monitoring and management.

ID: 705

Utilizing UAV technology to streamline monitoring for the conservation of segetal flora in arable land

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Intensification of agriculture is causing the decline of segetal flora species, with resulting negative ecological impacts. One way to promote the conservation of such species is through result-based payment schemes that reward farmers based on observed biodiversity outcomes in their fields, but cost and time required for the monitoring hampers a more widespread implementation of such schemes. Automated monitoring of segetal flora species is particularly challenging due to their small sizes and partly overlapping spectral signatures. Using the latest advances in deep learning, in this study we investigate the potential of UAVs for segetal flora species monitoring by focusing on an arable area in a UNESCO biosphere reserve in Saxony, Germany, and evaluate the usage of different UAV sensors to disentangle the different species. The presentation will focus on opportunities and challenges in species monitoring via UAV with particular emphasis on: i) species for which training data can easily be developed from RGB images, ii) sensor and flight height maximizing the classification accuracy, iii) difficult to map species, and iv) potential for result-based payment schemes for other species that were not observed in the study area, but that are of interest for the implementation of such schemes in Europe.

ID: 712

Wildfire severity drives plant diversity and biological invasion in Karst forest

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Wildfires are increasingly impacting ecosystems worldwide especially in temperate dry habitats, often interplaying with other global changes (e.g. biological invasion). Understanding the ecological consequences of wildfires is crucial for effective conservation and management strategies. The aim of this study is to investigate the impact of wildfire on plant community and non-native plant invasion.

We conducted an observational study in the protected Karst forests affected by wildfires in 2022. Fire severity was assessed using satellite imagery-derived indices, while plant communities were surveyed in 35 plots (200 m2). Plant cover was visually estimated while species functional traits were associated using existing trait database.

Results revealed significant shifts in plant community composition and diversity. High-fire severity areas exhibited higher species richness compared to low-severity or unburned areas. Total non-native plan cover increased with fire severity while native cover remained constant. We also found shifts in species and functional composition, particularly for traits related to germination potential and growth strategy.

This study contributes to the understanding of ecological processes after wildfires in temperate protected forests, emphasizing the need for conservation strategies aimed at limiting fire damages while increasing prevention.

ID: 735

Assessing the impact of planned linear infrastructure on ecological connectivity: an example from Uganda and South Sudan

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In an increasingly interconnected world, where human activities and infrastructure development continue to reshape landscapes, environmental fragmentation is one of the main threats to biodiversity and ecosystems. Fragmentation and its consequences for biodiversity and ecosystems are increasingly pronounced in developing countries, where the drive for economic growth and rapid infrastructure development is often associated with devastating impacts on habitats and species. This study aims at creating a macro-regional ecological network across South Sudan and Uganda by identifying priority conservation areas and the key corridors connecting them. The macro-regional ecological network was then used to investigate how the construction of proposed linear infrastructure could affect ecological connectivity at a finer scale. The priority conservation areas were selected through the integration of data derived from global open-access datasets encompassing information on species ranges, protected areas, land cover, topography, human population, and the density of linear infrastructure. Least cost path approach was used to identify corridors connecting the designated priority conservation areas. Impacts on corridors were assessed by quantifying the reduction in connectivity due to the development of proposed infrastructure. Our study can be a valuable conservation tool for planners, aiding ecological decision-making by promoting the inclusion of landscape-level connectivity alongside environmental impacts.

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ID: 757

Effects of drought on plant-pollinator interactions in a multi-factorial grassland experiment

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Droughts and heatwaves are predicted to increase in both frequency and severity in the coming years. These events have been shown to potentially affect plant-pollinator networks via multiple pathways, including changes in the amount of available nectar as well as in plant phenology. At the same time, pollinator declines are further affecting plant-pollinator interactions in our current environment. We are only beginning to understand how these effects co-occur and influence each other under field-realistic conditions. We conducted a three-factorial mesocosm experiment in an artificially sown homogenous grassland containing multiple plant- and two pollinator species. We present methodology and first results of an experimental drought treatment under the presence or absence of pollinators. We recorded floral phenology, plant reproductive traits and seed production in our system, focusing on species-specific differences in plant responses and their potential consequences on an ecosystem level. Our results will contribute to a deeper understanding of the effects of drought on plant reproduction in grassland ecosystems. Anticipating future dynamics is important for our ability to proactively apply suitable conservation measures to maintain biodiversity in grassland ecosystems.

ID: 768

Adapting to the heat: Insights into wild boar's thermoregulatory strategies using biologging data

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Climate change poses threats to both livestock and wildlife species. Yet, some species might benefit from warmer temperatures. For example, wild boar populations have shown an upward trend, potentially influenced by milder winters. At the same time, domestic pigs show heat stress reactivity – manifested through altered behaviour, reduced food intake, and decreased reproduction. We used multisensory collars to test the heat stress reactivity in wild boars to monitor their activity and behaviour during summer. Data from 23 wild boars over three years revealed that they mitigate higher temperatures by reducing overall activity without specific changes during their active phase. Notably, habitat type, precipitation, and movement patterns emerged as more influential factors than ambient temperature, demonstrating their coping capability.

This research showcases the potential of remote-sensing technologies to quantify wildlife stress reactions, particularly in challenging observational scenarios. With growing concerns about climate change, understanding how wildlife copes with environmental shifts and their impact on fitness is vital. This study underscores the importance of proactive monitoring to assess and address climate-induced stress in diverse ecosystems, offering valuable insights into the adaptive strategies of wildlife in the face of a changing climate.

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ID: 778

Bridging the gap between climate and conservation: "climate-proofing" lion conservation through time

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Climate change is a threat to biodiversity. Alongside direct impacts, climate change can exacerbate the impacts of anthropogenic activity. There is uncertainty surrounding how species will respond to future change. The lion, Panthera leo, is an endangered species under threat from changing landscapes. Lions currently live in highly fragmented landscapes, and alongside predicted population growth and land-use change, Africa is projected to experience a rising temperatures, changing precipitation systems and increases in the frequency and intensity of weather extremes. On continental scales, lions rely on broad areas of shrubby or woody savanna in close proximity to water for hunting and raising cubs. Future climate change is likely to change these landscapes and the availability of water. Lions are a charismatic indicator species and global ambassadors for conservation, but have experienced a 75% decline in abundance since the 1970s. Climate change may lead to further declines in the future. I am combining high-resolution climate data with ecological models to estimate which areas of lion range are under threat from becoming climatically unsuitable, and whether there are areas which could become suitable for lions to disperse to. These estimates have potential to be used to support conservation efforts in the future.

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ID: 794

A Genomics approach to the study of Formica wood ants (Hymenoptera: Formicidae) biodiversity in Italy

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Ants are worldwide distributed and play a pivotal role in ecosystem functioning by providing essential services (seed dispersal, decomposition, nutrient cycling) affecting ecosystem stability and community dynamics. The Holarctic genus Formica is known for its challenging taxonomy, mainly because of recurrent hybridization. In Italy, Formica species are distributed across the Alpine range and on the Apennines. Moreover, some of these species are labelled as Near Threatened in the IUCN Red list. To get a clearer picture on Italian Formica spp. biodiversity, we set a genome skimming protocol to draw genomic data useful for lineage definition and analysis. We collected data for 10 Italian species, assembling whole mitochondrial genomes and about 100/200 BUSCO genes. In addition, we applied a population genomics approach on Formica paralugubris, an Alpine species which includes populations introduced in the central Apennine 60 years ago. We got a high-quality genome sequence, and we will start the genome resequencing for both native and introduced population to get an insights into population divergence and, possibly, adaptation to a new environment. Overall, the genomic approach will provide valuable insights into patterns of hybridization and introgression, also providing a deeper understanding of their ecological and evolutionary dynamics.

ID: 797

Functional traits linked to germination behaviour in the steno-endemic Saxifraga berica.

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Species with narrow distributions are highly sensitive to extinction due to phenomena such as population bottlenecks, isolation, and inbreeding depression. A better comprehension of the interaction between environmental parameters and functional traits linked to germination success is required to understand the seed germination spectrum of such plants (1,2). In this study we measured morphophysiological traits (plant cover, leaf area, leaf weight, leaf dry matter content, seed mass) and eco-physiological traits (pigment content, photosynthetic efficiency) traits in-situ and correlated them with germination performances in Saxifraga berica (Bég.) D.A.Webb, a vulnerable (VU) steno-endemic chasmophyte of the Berici Hills, north-east Italy with extremely small population size (N < 1.000 individuals). Functional traits and seeds have been collected in 12 populations for a total of over 60 individuals. This study provides key novel, quantitative insights into the germination ecology of a threatened endemic species and represents a first step towards the development of an ad-hoc conservation program aimed at increasing its population size and adaptability.

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ID: 799

Virus distributions in wild bees (Andrena spp.) and managed honey bees are associated with floral communities at local and landscape scales

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Viruses infect a wide range of bee species, and can be transmitted interspecifically through shared floral resources. We investigate local and landscape-scale characteristics of the floral community that may be associated with viruses spread in populations of Apis mellifera (honeybees) and Andrena, a dominant, solitary wild bee. We surveyed 14 sites in a Mediterranean agroecosystem with varying local densities of honeybee foragers and diversity of flowering species, and assessed the prevalence of four common hymenopteran viruses [deformed wing virus (DWV), black queen cell virus (BQCV), sacbrood virus (SBV), Lake Sinai virus-2 (LSV2)] in honeybee and Andrena foragers. Prevalence of virus-carrying bees was associated with the diversity and composition of the local floral species, and with floral resource availability at the landscape scale. We found that SBV and DWV prevalence in Andrena are positively related to the density of honeybee foragers in the site. Honeybees and Andrena demonstrated different associations between local and landscape factors and virus prevalence. These findings confirm the focal role that the floral community at various spatial scales may have on pollinator health and highlight the potential differences in patterns of virus spread between pollinator species that are distinctively different in their foraging habits and functional traits.

ID: 801

The benefits to nature conservation and human health and wellbeing from particiapting in citizen science initiatives.

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Engagement in biodiversity citizen science initiatives can confer health and wellbeing benefits to individuals and communities. Yet, few biodiversity citizen science initiatives consider health and wellbeing as a project goal, leading to missed opportunities to integrate health-focused approaches into initiatives towards benefiting both biodiversity conservation and human health. Here, we investigate how engagement in 5 biodiversity citizen science initiatives (from Germany and Australia) fostered health and wellbeing, social and conservation benefits. We found that biodiversity citizen science initiatives varied in the duration, frequency and intensity of nature exposure, and therefore vary in their potential to confer a wide variety of benefits to both people and nature. We conclude with considerations on how to enhance the benefits from citizen science initiatives to people and nature, and to assess synergies and trade-offs.

ID: 810.

Enhancing conservation strategies through refined species distribution modeling: a case study with the endangered Cantabrian brown bear.

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Species distribution models (SDMs) are powerful tools in ecology and conservation. The accurate selection of environmental drivers and careful consideration of biases in species' occurrences are key for effective modeling, especially when applied to management and conservation. This study focuses on addressing five common challenges encountered in input data selection for presence-only SDMs, using the endangered Cantabrian brown bear as a case study—a generalist species of significant conservation concern. Addressing five common challenges in selecting input data for SDMs, this research emphasizes the importance of choosing adequate environmental drivers and considering biases in species occurrences at different spatial resolutions (500m, 1km, and 5km). Despite minor performance differences among models with varying input data, the study highlights the impact of spatial analysis grain on model precision. Our findings also reveal that limited data availability and suboptimal environmental variable selection can lead to inaccurate predictions. Specifically, for exploring Cantabrian brown bear's habitat suitability, we recommend excluding climatic variables, prioritizing recent data during population expansion, disregarding dispersing bear occurrences, and independently modeling subpopulations. In summary, SDMs prove valuable for generalist species, but expert evaluation considering data suitability and biases can be essential, especially when results are intended for local management and conservation.

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ID: 815

Spatial distribution across Europe of alien plant species impacts to biodiversity

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Biological invasions are one of the major drivers of biodiversity loss. Efficient conservation efforts require knowing where negative impacts on biodiversity and ecosystem functioning are likely to occur. The Environmental Impact Classification for Alien Taxa (EICAT) is a well-known standardized system adopted by IUCN to score and compare these impacts and can be potentially used to predict the spatial distribution of threats to biodiversity. We selected 100 terrestrial alien plant species known for their high potential to cause impacts. For each of them, we (i) assessed the EICAT impact score using available literature, and (ii) by fitting ensemble Species Distribution Models, we (iii) projected its potential distribution in Europe. We matched impact scores and geographical distributions across species to obtain maps of potential impact intensity across Europe. Preliminary results showed that chemical impact on ecosystems, competition with native species in invaded communities, and indirect impact on other species were the most common mechanisms and contributed most to the spatial distribution of impacts by alien plants. Most species have a potential for moderate impacts (i.e., reducing populations in the habitats they invade). However, several species with major impacts, inducing local extinctions of native species, have the potential to spread widely throughout Europe.

ID: 829

Hidden effects of the invasive bracken fern: unravelling soil invertebrate community responses

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Native yet invasive bracken fern (Pteridium aquilinum (L.) Kuhn) proliferates rapidly in abandoned or ungrazed grasslands in Croatia. While its tendency to outcompete native vegetation, thereby altering ecosystems and affecting soils, is well-documented, there is a scarcity of data on its impact on soil invertebrate communities. We studied carabid beetles and orthopterans in two focal habitat types – dense bracken stands and grasslands (control) using pitfall trapping and sweep-netting. We recorded changes in both taxonomical and functional metrics of both invertebrate groups. Carabid beetle and orthopteran abundances (pitfall) were two times higher in the bracken stands than in the grasslands, with a single generalist (Poecilus koyi and Decticus verrucivorus) outcompeting all other species. Accordingly, carabid beetle (pitfall) and orthopteran (sweep net) diversity was significantly lower in the bracken stands than in the grasslands, while the opposite pattern was documented for orthopterans (pitfall). Carabid beetle Red List species were recorded in low abundance, and associated either with grasslands (open habitat) or bracken stands (forest species), while orthopteran Arcyptera brevipennis flourished in bracken stands. The spread of bracken caused changes in grassland invertebrate communities, enabling the pronounced dominance of a single species, reducing beta diversity, and impacting species associated with open habitats.

ID: 833

Global decoupling of functional and phylogenetic diversity in plant communities

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Plant communities are composed of species that differ both in functional traits and evolutionary histories. Understanding how species' traits and histories interact with environmental conditions of a site to drive the assembly of ecological communities is the basis for predicting the impacts of climate change on biodiversity and ecosystem functioning. As species' functional traits partly result from their individual evolutionary history, the functional diversity (FD) of communities is expected, on average, to covary positively with their phylogenetic diversity (PD). However, this expectation has only been tested at local scales, for specific growth forms or specific habitat types, e.g. grasslands. Here, using the global sPlot database, we compared the standardized effect sizes of FD and PD across 1,782,777 vegetation plots. In contrast to our expectations, the correlation between FD and PD was weak, not positive but negative, and these two facets of diversity were more often decoupled than coupled. While PD reflected recent climatic conditions and vegetation type, being higher in forests, FD depended on recent and past climatic conditions. The independent nature of functional and phylogenetic diversity makes it crucial to consider both aspects of diversity when analyzing ecosystem functioning or prioritizing conservation efforts.

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ID: 862

Improved ecological criteria for the design and assessment of marine area-based management tools

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Effective ocean conservation and restoration strategies must ensure that species remain not just extant but maintain their key roles in the ecosystems. Conservation efforts have often prioritised structural over functional aspects when considering ecological criteria. To bridge the gap between ecosystem functioning research and policy, promoting the design of area-based management tools (ABMTs) based on the best available ecological knowledge, we analysed existing global, European, and regional conservation and restoration initiatives. We categorised initiatives criteria based on their ecological, abiotic, anthropogenic, climatic, and socio-economic implications. In addition, we conducted a systematic literature review of ecological criteria related to functional aspects. We observed

that life traits, functional diversity, trophic ecology, and connectivity have been suggested or are already considered as broad criteria categories for prioritising, designating, and managing ABMTs and networks of marine protected areas. However, these criteria have not yet been fully integrated into conservation and restoration strategies. We have harmonised, integrated and synthesised both currently used and proposed criteria to create a framework to assist managers in designing and implementing effective area-based conservation measures. We also propose methods, metrics and potential applications for incorporating ecological functioning into the planning and management of marine protected areas networks.

ID: 872

Improving the cost efficiency and precision of mountain ungulates' population counts

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Population total counts have a key role in conservation but their use in the field is limited by imperfect detection, that reduces the precision of abundance estimates, and by high logistic costs.

Using as a case study the population of Alpine ibex (Capra ibex) in the Gran Paradiso National Park (GPNP, Italy), we investigated more cost-effective census methods which take into account imperfect detection. First, using simulations, we tested if counts performed in only a portion of the total area (sample counts) were able to correctly detect population trends. We found that sampling at most half of the total area could still reliably monitor the population trend, except when variability in population parameters is so high that even counting the entire area is ineffective.

Secondly, we developed a new census framework, the Double Observer Adjusted Survey (DOAS). DOAS is a modification of the traditional Double Observer method conducted in only a portion of the sample sites. The detection probability estimates obtained from the Double Observer counts are then used to adjust the abundance estimates obtained from total counts in the total area. We showed that DOAS can estimate abundance with precision and a lower effort compared to the conventional Double Observer method.

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ID: 883

Visual identification of Eurasian lynx (Lynx lynx) individuals from camera trap images

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Obtaining abundance or density estimates is important for conservation and management of wildlife. For species with patterned fur or other recognizable features, methods relying on identification of individual from camera trap images is often used (e.g. different kind of capture-recapture models). However, these approaches often assume that the individuals have unique patterns and that humans can identify them. We tested if humans could identify Eurasian lynx (Lynx lynx) individuals based on camera trap images. We photographed 40 lynx in zoos and created a survey which we sent to both experienced and inexperienced participant. The lynx was classified into two different fur type; patterned and uniform. The final analysis is not conducted yet, but preliminary analysis indicate that experienced participants had a higher probability of answering correct and answered correct in more than 95 % of the times. Comparisons of two uniform lynx had higher error rates compared to comparisons with at least one patterned lynx. Comparisons of two daytime images had higher probability of being correct compared to two comparisons of black and white images. Close to half of the comparisons of uniform lynx were considered unidentifiable by the participants. We will discuss the implications of these results.

ID: 899

A new synthesis of global evidence for the conservation of inland aquatic vegetation

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A comprehensive and accessible scientific evidence base supports effective conservation. Conservation Evidence (www.conservationevidence.com) provides open-access evidence syntheses on the effects of conservation interventions. This presentation will give an overview of our recent addition to the Conservation Evidence project: a synthesis of global evidence for the effects of interventions to conserve vegetation in inland aquatic habitats.

Aquatic vegetation contributes to good water quality, stabilises substrates, provides habitat and plays a key role in nutrient cycling. Major threats to aquatic vegetation include pollution, invasive species, deliberate removal, water management and climate change.

With an international advisory board, we listed over 180 interventions that could be used to conserve aquatic vegetation. Based on systematic literature searches and recommendations from the board, we collated and summarised over 300 publications quantifying the effects of these interventions. Most evidence came from Europe or North America and concerned interventions to manage pollution, manage problematic species or generally restore/create habitats.

We found limited evidence from Africa and Latin America, and for the effects of interventions addressing threats such as climate change and human intrusions. Many interventions have context-dependent effects; our synthesis provides details, including locations and implementation methods, to help readers judge the likely effects in their situation.

ID: 911

Surprising widespread Cymodocea nodosa occurrence along Israel's Mediterranean coast and

Implications for Seagrass Conservation in a hot spot of clim

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Cymodocea nodosa is a temperate seagrass species that grows in the shallow and sheltered waters of the Mediterranean Sea. Despite being widespread, it was assumed to be absent along the Israeli warm and salty coastline. We conducted methodical underwater surveys along the Israeli Mediterranean coast, incorporating depth, latitude, season, and habitat features, and revealed extensive C. nodosa population at depths of 8-21m (peak occurrence at 14m) in exposed habitats. Using general additive models, we illustrated how depth, latitude, and season influence local meadow distribution. We conduct a systematic literature review to compare the habitat affinity of the Israeli meadows with other populations in the Eastern Mediterranean Sea. By incorporating Species Distribution Models, we confirmed the increase in the geographical range also reflects an increase in realized niche breadth into higher values of temperatures, salinity and current velocity. Considering that the eastern tip of the Mediterranean is a hotspot for climate change, finding C. nodosa populations surviving these harsh conditions holds implications for seagrass conservation and restoration in the entire Mediterranean. However, the low density of observed meadows suggests that these populations require careful monitoring to prevent local extirpation.

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ID: 915

Soil arthropod assemblages as indicators of advanced vegetation succession in a highly endangered Croatian peat bog

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Peatland habitats at the edges of their European distribution are under high risk of disappearance due to vegetation succession facilitated by changes in land use and climate. In this study, we aimed to assess the ecological condition of Trstenik peat bog (5 ha) in Croatia using soil arthropod assemblages (Carabidae, Formicidae, Isopoda) as indicators of successional change. Our main objective was to test for differences in assemblage metrics and species composition among three habitat types, i.e. bog centre, the surrounding Molinia stands and the forest edge. Pitfall trapping and environmental measurements were performed once a month from June to October 2021. No statistically significant differences in arthropod assemblage metrics were recorded between the central and successional parts of the bog. This finding indicates advanced vegetation succession in the bog centre, promoting its colonization by generalists and open grassland species. Nevertheless, peatland indicator carabids Pterostichus diligens and P. rhaeticus still exhibited a clear preference towards the wet central part of the bog. Our results show that active conservation measures, including hydrological restoration and regular vegetation removal, are urgently needed to ensure long-term persistence of this biologically invaluable habitat and the associated fauna.

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ID: 924

Challenges in establishing biodiversity conservation programme in Pannonian part of Serbia

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In the Pannonian part of Serbia, a trend towards intensive changes in natural landscapes can be observed from the beginning of the 19th century. As a result, landscape has been fragmented, altered, or destroyed. With the aim of developing sustainable measures in the nature conservation programmes, in 2020 we started biodiversity studies at different habitat types, to test and further develop various field-research and mathematical models in order to improve the conservation of priority habitats and corresponding species. Habitats that are recognised as important for protection in the lowland part of Serbia are: grasslands (steppes, saline areas, wet meadows) and lowland floodplain forests. For the study selected sites are at Subotica Sand (steppe grassland), Slano Kopovo (continental saline area) and Obedska bara (lowland floodplain forest and wet meadow). According to the preliminary results, a positive response to measures has been detected, i.e. introduction of active habitat conservation measures, such as grazing by various livestock, has a positive effect on the restoration of natural habitats. However, it is important to recognize and define the habitat types and all their specific floristic and faunistic characteristics, as the success of the programme depends on this.

ID: 931

Impacts of Free-Ranging Dogs on Native Wildlife in a Human-Dominated Desert

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The coexistence of free-ranging domestic dogs with diverse wildlife in the anthropogenically influenced Thar Desert necessitates an in-depth exploration of ecological interactions in order to develop effective conservation strategies. This study, conducted in the Desert National park, employs methodologies, including radio-telemetry and direct observations, to elucidate the spatial behavior of free-ranging dogs and their implications on native species. Our findings reveal that these dogs exhibit concentrated ranging around human settlements and protected grasslands, influencing native wildlife, including critically endangered Great Indian Bustard. The study estimates a high rate of negative interactions with competitor species, particularly raptors, and wild prey, such as Chinkara.

Radio-tracking revealed an extensive ranging pattern of free-ranging dogs covering 20.89 ± 1.84 (SE) km2, with a predation attempt rate of 29.18 ± 11.91 predation attempts/year, constituting substantial stress on already scarcely populated Chinkaras. Ancillary surveys underscore the socio-economic impact, with 70.25% of villagers experiencing economic losses due to livestock depredation and 83.3% reporting dog attacks.

This holistic investigation emphasizes the urgency of implementing comprehensive dog population control measures, advocating sterilization and targeted removals. Tailored conservation strategies are imperative to mitigate these challenges, and in the preservation of unique socio-ecological dynamics of the Thar Desert.

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Landscape fragmentation affects polypore diversity on multiple spatial scales

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Forestry practices in boreal Sweden have significantly impacted landscape structure and saproxylic biodiversity by converting old-growth forests into short rotation managed stands. While local species loss is mainly linked to depleted deadwood, emerging evidence suggests that landscape quality and quantity across time and space, plays a pivotal role for saproxylic fungi occurrence. Hence, effective conservation strategies require understanding how species respond to landscape alterations.

This study examined the repercussions of landscape fragmentation on red-listed saproxylic polypore species and on overall community composition in 26 woodland key habitats in central Sweden, focusing on non-clearcut forest proportions over time, forested areas at different scales, and forest naturalness.

The results show no discernible impact of fragmentation over time on any of the studied species. The absence of temporal effects is attributed to a relatively uniform fragmentation history, underscoring the need to consider landscape-specific nuances. By contrast, the study reveals landscape effects on the occurrence of polypore species within mid-range scales (4-15 kilometres), emphasizing the importance of intermediate spatial scales in conservation planning. Findings highlight the need for a detailed understanding of landscape dynamics, emphasizing potential conservation benefits by maintaining connectivity through enhanced forest quantity and quality within specific spatial ranges.

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ID: 934

The role of ancient burial mounds in conserving medical plant diversity in fragmented agricultural landscape

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Agricultural landscapes are often characterized by extensive cultivated fields, which can lead to habitat fragmentation and loss of biodiversity affecting medicinal plants as well. In such landscapes, habitat islands such as kurgans (ancient burial mounds) have a crucial conservation role by providing safe haven for grassland vegetation. We studied how kurgans take part in the conservation of medicinal plants in transformed landscapes. We used vegetation data collected from 178 kurgans covered by grasslands and oldfields in Hungary. Our objective was to reveal how grassland age, kurgan area, and cropland percentage in the landscape could influence diversity and coverage of medicinal plants on kurgans. We documented 164 medicinal plants, with 42 grassland specialized species. The number of medicinal plants on kurgans ranged from 5 to 34. Species richness of perennial medicinal plants increased with grassland age. High percentage of cultivated land in the landscape supported the species richness of short-lived medicinal plants. Based on our findings the area of mounds did not influence the total cover and composition of medicinal plants. Our findings indicate that kurgans can act as hotspots and reservoirs of medicinal plants, although their composition depends on the grassland age and land use intensity.

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ID: 938

Assisted evolution techniques: a proof of concept for plant conservation under Global Change.

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Global change is the main threat for biodiversity. Several species will be extinct at their natural distributions, so disruptive measures are necessary, implementing new conservation tools. Assisted-migration and assisted-evolution could be used to improve the dispersion or increase the adaptative potential of natural populations. With this aim, our purpose was to compare the potential use of artificial selection and assisted gene-flow to advance flowering onset, using as a case study the widespread mediterranean species Lupinus angustifolius. Sowing seeds from four populations, different lines were created and established in a common garden. Intra-population (artificial selection) and inter-population (assisted gene-flow) crosses were performed by manually and self-pollination was allowed as control. The performance of artificial selection and assisted gene-flow was evaluated considering the advance of flowering onset, reproductive and vegetative traits, and changes in the genomics imprints. Furthermore, the evaluation was completed with an experimental reintroduction near a native population. Our experiments showed that the use of assisted-evolution approaches are promising measures in theory, but complex to implement, due to the polygenic regulation of most traits, trade-offs, correlations, and other interactions. Their implementation must be evaluated case-by-case, according to population origin and under different environmental conditions to ensure its success.

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ID: 962

Long-term monitoring design for mammals in urban contexts

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Urbanization is a type of human-driven land modification that is often linked with detrimental impacts on native and endangered species. Thus, with urban areas expanding globally, understanding urban biodiversity dynamics and patterns is crucial to both safeguarding native wildlife and informing conservation practitioners. This knowledge is required to tailor efficient conservation and urban planning for healthier and more liveable cities for both wildlife and people. We designed a multi-species, multi-city sampling approach for long-term monitoring of urban medium- and large-sized mammals in Italy and for the detection of drivers of their distribution and resilience. We employed a grid-based (1km2 cells) framework built on fragmentation and green cover gradients in five urban areas (Milan, Rome, Florence, Naples, and Campobasso). Specifically, we used a combination of camera trapping and bimonthly transect sign surveys in native forested areas, also collecting a set of environmental variables from field and remote sensing data measured at different scales. By delineating both local and regional scale trends of urban mammals' response to human-induced stressors, the study contributes to establish a resilient and interconnected network of metapopulations in urban ecosystems. The research is part of the EU funded project National Biodiversity Future Centre's Urban Spoke (Code: CN_00000033).

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ID: 967

Novel low-costs GPS trackers to evaluate placement of marine protected areas used by sea turtles in a biodiversity hotspot.

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Understanding the movement of species is crucial for the effective management of protected areas. Across ontogeny, marine vertebrates face threats that vary with time, such as bycatch, habitat degradation and climate change. To test whether protected areas remain effective over time, regularly monitoring animal movement is critical. Yet, the lack of affordable, fine-scale tracking technology limits tagging deployments. Here, we deployed 57 novel, low-cost, GSM-relayed GPS trackers on endangered loggerhead sea turtles (Caretta caretta), from three islands (Sal, Boa Vista and São Vicente) of the Cabo Verde nesting aggregation, across the 2021 and 2022 nesting seasons. We monitored their movements and tested the use of existing protected areas. We show that both in-water and land-based movements (false crawls and nesting) occur more frequently within protected areas than outside. Similarly, kernel density estimates revealed that six highly used areas fell within the boundaries of coastal protected areas. Notably, several individuals performed extensive oceanic excursions outside of protected areas, revealing connecting corridors between nesting islands. As human development exacerbates the threats on marine megafauna, our results, in addition to their policy implications, also demonstrate the utility of low-cost tracking tags for evaluating the placement of protected areas.

ID: 978

Towards a more equitable future: advancing inclusive global biodiversity research through collective action

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Biodiversity research requires diverse global participation and perspectives to understand and address the global biodiversity crisis. However, the current state of biodiversity research highlights significant issues concerning inclusivity, representation, and equitable collaboration. Local expertise from biodiversity-rich countries and regions is often underrepresented, with researchers and institutions from traditionally overrepresented regions, such as the United States and Western Europe, dominating the field. This imbalance undermines efforts to leverage localized knowledge essential for effective conservation globally. While these issues are gaining attention, proposed solutions are often fragmented and reactionary. However, representation gaps do not stem from isolated factors but from subtle, systemic biases ingrained within research norms, structures, and practices over time. Addressing these pervasive issues requires a holistic unified framework of collective responsibility where all members of this interdependent global system acknowledge their role in either promoting inclusion or perpetuating barriers. Researchers across all career levels, institutions, funders, and publishers must work collaboratively to dismantle systemic barriers and promote inclusive and equitable practices. Here, we go beyond reactionary blame and convenient binaries to propose a unified framework by incorporating general strategies from diverse sources to create a comprehensive set of approaches that embrace diversity, remove barriers, and foster collaboration.

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ID: 979

Navigating through murky waters: decision analysis provides a clear path forward for complex sturgeon reintroduction considerations

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Reintroductions are a critical tool for conservation, yet uncertainty and perceived risk about their outcomes can inhibit stakeholder engagement and decision-making. Recovering UK's native sturgeons is a relatively new endeavour, and we have little understanding of how sturgeons once used UK habitats. Both native species, European (Acipenser sturio) and Atlantic sturgeon (A. oxyrinchus), are close to disappearing from European waters and need immediate conservation action. In response, reintroduction has been proposed to support European populations and restore UK sturgeon. However, stakeholders hold differing opinions about establishment success from reintroduction, given the present state of freshwater habitats, and early stages of other sturgeon reintroductions. We used structured decision-making to help stakeholders decide whether reintroduction should be considered. By breaking down the problem and providing a safe space to deliberate, structured decision making fostered an environment that allowed stakeholders to engage in the proposal and articulate perceptions of risk that had until now been hindering progress. Then, we could estimate outcomes with uncertainty in a meaningful way for several alternative management options. This clarified whether pilot studies should take place, where, and what further evidence was needed to progress. We illustrate how decision analysis is highly effective in supporting complex reintroduction considerations.

ID: 999 /

Early warning, rapid eradication, and recovery in a high mountain lake with a recent alien fish introduction

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Fish introduction in high mountain lakes is an increasing threat to native biodiversity and their natural ecological functioning, as they prey on and decimate native populations of amphibians, crustaceans and macroinvertebrates. Timmelsjochsee, a small lake in the Austrian Alps, (elevation: 2512 m a.s.l.; area: 0.76 ha; maximum depth; 3.4 m) was naturally fishless until recently, but the presence of alien fish was first noted during a visual survey in the summer of 2022. Therefore, in agreement with the lake owners, we decided to eradicate the fish. We deployed six multi-mesh gill-nets over 18 months. Most fish (N=11; 6 brook trout Salvelinus alpinus and 5 rainbow trout Oncorhynchus mykiss) were captured within one day on the 4th October, 2022, one more brook trout was removed one month later during the following net survey, and the last fish, another brook trout, in August 2023. During the eradication, we observed a recovery on the abundance of Rana temporaria through visual surveys. This work highlights the need to monitor fish introductions into high mountain lakes and provides an example of an effective restoration action using easy and cost-effective early warning and rapid eradication protocols.

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ID: 1000

Assessing and balancing the impacts of railways on biodiversity and carbon stocks

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The major cause of biodiversity loss in recent times is associated with habitat destruction and degradation. Land use change due to infrastructures and transportation is one of the major causes of habitat loss, creating barriers for wildlife and increasing the fragmentation of ecosystems.

This study starts from the assumption that railways are the most sustainable option in transportation and it is fundamental to ensure the mobility of people and goods is directed towards transport systems with a reduced impact also on biodiversity and ecosystem functions.

We focused on implications of railway infrastructures and linear developments on ecosystem fragmentation and alterations in land use and cover. Through a national-level assessment, this study quantifies the extent of land area affected by the passage of railway infrastructures, categorizes the impacted types of land cover.

Furthermore, the research explores the potential for carbon stock enhancement by converting degraded areas adjacent to railways into biodiverse zones to increased carbon sequestration and species conservation. This will require the implementation of strategic tree and shrub planting initiatives. The findings of this study could provide valuable insights into sustainable land management practices related to railways also in other countries, offering a pathway to mitigate carbon and biodiversity loss.

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ID: 1009

Prevalence of Red List DD species limits the application of the EDGE approach for fungi

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With only 781 published assessments, fungi remain severely underrepresented on the IUCN Red List of Threatened Species. The dataset is also biased, not least because priority was given to species suspected to be threatened. Thus, the list includes a high proportion of threatened species, which may not be representative of the global state of fungal biodiversity. In an initiative to help mitigate this bias, we analysed the extinction risk of 94 fungal species in monotypic families and genera, 84 assessed in this study. Through our focus on monotypic taxa, species from different geographical regions, taxonomic groups, ecological guilds and likely threat categories were covered. Results may inform a future list of Evolutionarily Distinct and Globally Endangered (EDGE) fungi, species whose extinction would represent a significant loss of evolutionary history and potential. We found a prevalence of Data Deficient species, followed by Least Concern and a small proportion in threatened categories – smaller than in the current published list. We discuss challenges underlying the high proportion of Data Deficient evaluations and conclude that more basic mycological knowledge and taxonomic research are crucial, especially if we want to consider phylogenetic diversity in the establishment of conservation priorities.

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ID: 1010

Coral trophic strategy and growth mode affect tissue recovery response to ocean warming and acidification at a shallow CO2 vent

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Human activities primarily drive significant changes in ocean waters, causing warming and acidification. Climate change has a profound impact on marine communities leading to diverse physiological responses in various organisms, including corals. Here we examined the combined effects of increasing seawater acidification and warming on the tissue regeneration rate of three Mediterranean scleractinian coral species with distinct trophic strategies and growth modes. Specifically, the solitary zooxanthellate Balanophyllia europaea, the solitary non-zooxanthellate Leptopsammia pruvoti and the colonial non-zooxanthellate Astroides calycularis were transplanted along a natural pH gradient generated by continuous and localized CO2 emissions from a volcanic vent off Panarea Island (Mediterranean Sea, Italy). While we did observe a generalized decrease in tissue regeneration rate with increasing seawater temperature and acidification in all species, the zooxanthellate coral showed the highest declines, possibly as a result of re-allocation of available resources to processes such as reproduction and calcification at the expense of tissue maintenance. These findings contribute to growing evidence indicating that the projected combination of warming and acidifying conditions in the forthcoming decades could prove harmful to crucial aspects of shallow-water benthic ecosystems. This, in turn, may impede the ability of Mediterranean stony corals to recover from physical damage.

ID: 1012

Headline indicators to assess the status and trends of biodiversity in Austria

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We developed a set of headline indicators to assess the status and trends of habitats, species, and genetic diversity, as well as pressures and responses to biodiversity. The indicators should also describe the achievement of the 100 targets specified in the Austrian National Biodiversity Strategy and Action Plan "Biodiversitäts-Strategie Österreich 2030+". We adapted and significantly reduced the original 100 indicators using seven criteria, i.e. (1) relation to biodiversity, (2) significance for measuring the achievement of a national biodiversity target, (3) data availability, (4) availability of baseline values, (5) opportunity for Citizen Science, (6) congruence with international indicators; (7) costs.

This way and based on stakeholder consultations, a set of 43 biodiversity indicators was defined, which was divided into headline indicators and complementary indicators based on expert judjement. Of the 22 headline biodiversity indicators, 13 are status indicators, five are pressure indicators and four are response indicators. In many cases, the indicators are already monitored based on EU law or other obligations (CBD). For other indicators, the methodology for monitoring sometimes still needs to be developed. Values of 16 headline indicators and 11 supplementary indicators can be presented as data are available for 2023.

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ID: 1013

Examining disturbance and environmental factors acting on true flies (Diptera, Brachycera) of Italian coastal sand dunes

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Coastal sand dunes play a crucial role as habitats for diverse insect species, but their conservation is threatened by environmental challenges and human activities. This pioneering study investigates the factors acting on communities of the megadiverse group of Diptera Brachycera (Arhtropoda, Insecta) in Italian coastal sand dunes, filling a critical knowledge gap. Three extensive sampling rounds in 2022, spanning ten study sites, explored the effects of habitat complexity, landscape structure, and human impact on species diversity and community composition. Key questions addressed species richness and the influence of human activities on taxonomic diversity, with a focus on coastal habitat types (shifting dunes, fixed dunes, retrodunal wetland, retrodunal forest). We recorded comprehensive data on plant communities and environmental variables (i.e. temperature, landscape use). Employing yellow pan-traps and net capturing, we collected 14k true flies, and utilized Next-Generation Sequencing for voucher-based DNA megabarcoding (Chua et al. 2023). Results covered various "dark taxa" (Hartop et al. 2022), enhancing understanding of less-studied groups. This research sheds light on overlooked communities in endangered

habitats, contributing to local fauna understanding and aiding conservation efforts in tourism-affected neglected areas. The importance of establishing protected areas is emphasized to ensure the sustainability of these ecosystems.

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ID: 1020

A case study on the impact of coppicing for small mammal conservation in Italy

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Several studies have shown that small mammals react to habitat disturbances, including those resulting from woodland harvesting management. Understanding the implication of woodland management practices becomes an imperative for preserving the composition of animal species within woodlands, especially for those that play crucial roles in maintaining ecological balance, such as small mammals. Coppicing is one of the most widely adopted sylvicultural systems in Europe. Since coppicing seems to have a species-specific impact on small mammals, our study aimed at preliminary assessing the effect of different woodland stages on community richness, focusing on forest small mammal species. We identified three different coppice age classes and we selected a total of 15 coppice-with-standards forest stands. Additionally, we collected data about understory shrubs richness and structure. Samples were collected using the hair tube sampling method. Our results highlight how more mature woodlands provide a more favourable environment for the entire forest small mammal community, recording the highest species richness. Conversely, coppice stands in their initial regrow phase negatively affected community richness. Furthermore, we found a differential response between glirid and murid families, with glirids being significantly affected by both the stand stages and the understory abundance.

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ID: 1030

Ground-dwelling arthropods as biodiversity indicators in maize agroecosystems of Northern Italy

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Reliable monitoring of arthropod diversity in a given agroecosystem is essential for the conservation of the related ecosystem services, such as biological control. The often daunting complexity of arthropod collection and identification, however, highlights the need for surrogate taxa that can be easily sampled and be representative of a number of other taxa in term of diversity, general community features and specific composition.

In this study, we used pitfall traps to sample three ground-dwelling arthropod taxa important as biocontrol agents (ground beetles, rove beetles and spiders) in 9 conventionally managed maize agroecosystems of Northern Italy over the course of two years, with the goal of characterizing their assemblages and evaluating their reciprocal potential as indicators of activity density, species richness, community turnover and species co-occurrence.

Ground beetles as a group were confirmed as promising indicators for the species richness and community composition turnover of rove beetles and spiders. While the co-occurrence of individual arthropod species was limited for the studied taxa, a few species such as the ground beetle Parophonus maculicornis (Duftschmid) did show promise as species-specific bioindicators. Our results could be useful in improving the monitoring and management of these important natural enemies in maize-growing regions.

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ID: 1038

Temporal changes in plant use and plant-pollinator networks revealed using pollen DNA metabarcoding

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Loss of flower-rich habitat for foraging is a key resource limitation for pollinating insects. Here, we use pollen DNA metabarcoding to understand plant-use and plant-pollinator networks at different temporal scales. First, we analysed honey samples from honeybee colonies throughout the UK in 2017 and compared these to a survey from 1952. We show how changes in agricultural intensification, crop use and the spread of invasive species have altered the nectar and pollen sources available in the UK. Next, we investigated changes in the diet of honeybee colonies through the flowering season. We found that honeybees visit a wide range of plants, but there is monthly variation in their degree of diet specialisation that relates to periods of floral resource limitation. We conclude that it is important to track floral resource use through the year to fully understand network stability in the face of ecological change. Finally, we tracked the foraging preferences of bumblebees, honeybees, non-corbiculate bees and hoverflies through the flowering season. We show differences in plant use by the different groups of pollinators and use these results to provide recommendations to gardeners on the best plants for pollinators through the year.

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Identification of roadless areas and their significance for nature protection and restoration in the European Union

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The identification of remote and unfragmented areas is an emerging tool for spatial planning in the context of international commitments to nature conservation and restoration. Yet, most studies so far have been carried out at national scales or considering individual target ecosystems (e.g., forests or abandoned agricultural areas). Here, we identified roadless, infrastructure-free areas for the whole European Union and assessed their ecological value, environmental representativeness, and current protection level. First, we developed a reproducible R workflow for roadless areas' extraction based on data from OpenStreetMap. Then, we analysed their distribution across biogeographic regions, ecosystems and land use classes, and determined their abiotic envelope considering different environmental variables. The ecological value of identified roadless areas was evaluated in terms of area size and the presence of habitats and species of conservation interest. Finally, we assessed how much roadless area is currently under protection, with a focus on strictly protected areas. This research sheds light on the potential contribution of roadless areas within the European Union toward fulfilling international conservation and restoration objectives.

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ID: 1047

Towards a checklist of floras of Mediterranean islands

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Access to large datasets is fundamental for studying biogeographical and macroecological patterns, and for planning conservation actions. The Mediterranean basin hosts 2212 islands larger than 10,000 m2, with endemic species and peculiar plant communities of great conservation value. Despite the intense study of their flora, a comprehensive and accessible catalog is still lacking.

With this study we tested the coverage of 3 databases concerning plant data on Mediterranean islands, to start building up a first open floristic checklist at the basin scale. We retrieved vascular plant occurrences from EVA, GIFT, and GBIF; we investigated the overlap of data among the three harmonized sources and looked for potential data gaps.

We found that GBIF has the largest coverage (633 islands), but often limited to few occurrences on smaller islands; GIFT checklists, instead, are generally more complete than EVA and GBIF ones. We noticed that referring to GBIF data only biases the definition of the island species pool composition, while the combined use of the three sources significantly improves it.

This contribution is a step towards a floristic catalog of Mediterranean islands and can represent a useful tool for defining conservation plans for island biodiversity at the basin scale.

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ID: 1068

Conservation actions for endangered plant Eryngium alpinum L. in Eastern Alps: genotype and germination study

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Eryngium alpinum L. is an endemic plant growing in alpine tall forbs communities. In the Eastern Alps occurs in small and fragmented populations, and its risk of extinction is mainly due to climate and land-use changes. PNRR National Biodiversity Future Center and Life Seedforce projects, targeted this species with the aim of the complete genotyping and restoring its threatened Eastern Alps populations, respectively. In order to improve the conservation actions, we used a multidisciplinary approach. To assess genotypic variability, samples from Friuli and Slovenia populations were subjected to ddRAD sequencing; while to study the effect of snow on germination success, an experiment based on different levels of snow cover was designed. Our results highlighted the isolation between the populations of Slovenia, Friuli Prealps and Carnic Alps and the snow cover-dependency of the seed germination. In the light of these outcomes, the rise of the snow limit and the progressive fragmentation of E. alpinum populations represent an imminent risk for the survival of this species in the Eastern Alps. Future conservation actions need to aim for an enhancement of the population genetic variability, reintroducing tailored genotype mix in areas where snow cover is ensured also in the future thanks to microclimate.

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ID: 1073

Biodiversity conservation in viticulture through fungicide reduction and landscape diversification

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The reduction of pesticides and the diversification of agricultural landscapes are major strategies to protect and restore biodiversity. Viticultural landscapes have a high potential for biodiversity conservation and for the reduction of pesticides through the cultivation of new, fungus-resistant grape varieties. We studied effects of these factors in a series of projects, focussing on arthropods, birds and bats as conservation targets. The response was group-specific, with arthropods of the grapevine canopy mostly responding to local management. In contrast, the diversity of flying insects, birds and bats depended strongly on the cover of woody semi-natural habitats in the landscape. Also bat foraging success was strongly concentrated along hedgerows. We conclude that growing fungus-resistant varieties and landscape diversification have a high potential for biodiversity conservation and should be supported with adequate policies.

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ID: 1090

Application of nature-based and nature-made solutions in water retention: human-nature conflicts and possible ways to move forward

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Landscape-level water retention plays an undoubtably important role in climate mitigation, biodiversity protection, and enhancement of agricultural productivity. The implementation is a common goal of nature protection and local communities; however, it usually fails because of legal difficulties and the counter-interest of a few landowners. Inadequate land-use (especially intensive cultivation) in the former floodplains of regulated watercourses led to the situation that today even the enabling of the nature-made solutions offered by the reintroduced beavers is a challenging task. Beaver dams reconstruct former wetland habitats (marshes and wet meadows), but landowners often regard this as a nuisance, as it can mean a loss of income or forces them to change their land-use practices. Thus, beaver dams are frequently demolished. At the same time, the application of nature-based solutions (leaky dams, beaver dam analogues, rock weirs) is hindered by the absence of landowners' financial motivation to return areas to nature. In our presentation, we will explore how the Common Agricultural Policy and the Nature Restoration Law could help change this situation. In addition, we will provide a case study about the beavers' actual and potential habitat restoration ability along Hungarian small watercourses based on field surveys and citizen science (BeaverMap) data.

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ID: 1095

The acceptability of urban rewilding initiatives among local communities and the significance of user experiences

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Restoring wild nature in cities is increasingly recognised as an important agenda in urban greenspace planning and management for safeguarding urban biodiversity and reconnecting urban residents with nature. While a broad spectrum of 'urban rewilding' projects have been proposed, little is known about the acceptability of urban rewilding among local communities. To gain a comprehensive understanding of the conditions under which rewilding is accepted by local communities, we conducted a questionnaire survey with a representative sample of Viennese citizens (n=800) and examined their reactions to different urban rewilding scenarios varying in terms of location, restoration practices, and goals. Our results show a consistently high level of acceptability for all scenarios, with highest levels found for transitions to 'urban forests' and 'urban wildflower meadows'. Furthermore, acceptability levels depend significantly on how residents use existing wild spaces. Residents who visit wild spaces more frequently and for a wider range of activities show a greater support for urban rewilding initiatives in their neighbourhood. To conclude, we discuss the opportunities and challenges of facilitating access to and multifunctional use of rewilded areas, including potential social-ecological trade-offs and the human-nature relationships that can be created.

ID: 1130

Are insects declining also in Sweden? Analysis of 35 years of suction trap samples

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The reported declines in insects are concerning, to say the least. Recent estimates suggest that overall insect abundance and biomass has decreased at an average rate of 1-2% per year, but with faster declines in intensively managed areas. The declines are especially strong for common taxa, and this is particularly alarming since common species contribute disproportionally to ecosystem functioning. The number of studies assessing changes in the insect fauna has grown steadily in recent years, but knowledge gaps are still huge due to a lack of monitoring data. This knowledge gap is particularly large for the tropics, but also well studied regions in the northern hemisphere are poorly covered. A long-term (35 years) collection of insects in Sweden, has made it possible to examine changes of invertebrate communities over time in this region. Censuses have been carried out using geographically dispersed 12 m high suction traps in the agricultural landscape. In these traps a wide variety of insects moving through the air has been caught and are currently analysed. Results on changes in taxa, biomass and abundance over time will be presented at the conference.

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ID: 1137

The RiPartyAmo Project: Restoring and preserving nature through active collaborations

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The EU's 2023 approval of the Nature Restoration Law signifies a substantial step in regulating and promoting ecosystem restoration, much-needed in coastal areas facing heightened anthropogenic impacts. Restoration ecology transcends technical skills, involving economic, political, and social aspects, fostering collaboration between science and local entities for actionable outcomes. Unfortunately, given the empirical nature of this science, finding information about methodologies and criteria is challenging. Thus, this abstract aims to outline the methodologies and criteria used during the restoration initiatives — led by WWF Italia — in Fermo's three coastal areas: Baia dei Gabbiani, Lido di Fermo, and Marina Palmense. Successes include a biogenetic reserve, protective measures for the Kentish plover and rarefied plants, and pioneering alien species control using custom-made machinery. Ongoing monitoring, comprising 27 permanent plots that track alien species abundance trajectories, is complemented by continuous bird monitoring to protect the Kentish plover and support nesting. Marina Palmense's nature

experience was enhanced, discovering a previously unrecorded species. Didactic panels in all areas facilitate a connection between people and nature. In conclusion, the Ripartyamo may serve as a guideline for future restoration ecology initiatives, fostering actions in line with the EU's Nature Restoration objectives.

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ID: 1138

Gut microbial functions are impacted by habitat: implications for the conservation of non-human primates

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We investigate the effect of forest fragmentation on gut microbiota functions and dietary adaptations of two non-human primate species in the Udzungwa Mountains of Tanzania using whole-genome shotgun sequencing. The Udzungwa red colobus (Procolobus gordonorum) is an endangered species with a restricted folivorous (leaf-eating) diet, while the yellow baboon (Papio cynocephalus) is a species of least concern with a highly diverse omnivorous diet. We identified several microbial pathways that were enriched or decreased in a fragmented forest patch compared to an intact forest, indicating functional adaptations of gut bacteria. The gut microbiota of the Udzungwa red colobus, in particular, shows a high sensitivity to habitat changes, which may be linked to its strictly folivorous feeding strategy. By contrast, the yellow baboon displays greater tolerance to habitat changes by showing a lower impact on their gut microbes, which is likely caused by its more varied diet. To investigate habitat-associated diet in detail, in an ongoing analysis, we aim to reconstruct dietary composition from the same shotgun sequencing samples. We will also present novel results showing the potential and the limits of identifying diet and host characteristics from faecal samples, and hence, the usefulness of this shotgun approach to conservation issues.

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ID: 1142

The Aquarium of Pisa University and its contribution in enhancing biodiversity conservation's awareness

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The Natural History Museum of the University of Pisa is one of the most visited museums in the province of Pisa and hosts the biggest freshwater Aquarium of Italy. The Museum and the Aquarium actively contribute to the University third mission for scientific dissemination and to enhance the awareness of its visitors about the issues of nature preservation. Indeed, it has been widely demonstrated that the possibility of having direct experience with living animals or habitats greatly improves the public engagement in the topics of biodiversity conservation and, consequently, their motivation to corrisponding actions.

The Aquarium allows visitors to view several species of conservation interest from different continents, such as the critically endangered Paretroplus menarambo and Ambystoma mexicanum. Moreover, since 2021 it includes one special room dedicated to torrential and riverine Italian species, menaced by IAS, genetic hybridization and habitat loss. These threatened species and the issues of biodiversity conservation are the focus of dedicated guided visits for schools, and of temporary exhibitions associated to the Aquarium.

As such, we believe that the Aquarium significantly contributes to conservation education by allowing the public to get directly in touch with endangered species, increasing their involvement in biodiversity loss issues and conservation science.

ID: 1165

Who is using Tree-related Microhabitats?

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Tree-related microhabitats (TreMs) are well-delineated structures occurring on living or standing dead trees that provide important resources and refuge for many species. TreMs have been recommended as indirect biodiversity indicators to promote integrative forest management. However, it is unclear as to which taxonomic groups are most frequently associated with which kind of TreM. Through a review of literature of TREM-species interactions, we found that cavities were the most frequently studied TreM. Cavities, crown deadwood and fruiting fungal bodies, and tree injuries are most frequently associated with bats and saproxylic beetles. Since cavities were well-represented in our review, we closely evaluated the TreM-taxa association of different types of cavities. We recommend future studies to evaluate poorly studied TreMs and the evaluation of multiple taxonomic groups when possible.

ID: 1167

Designated juvenile surveys identify cobble beds as important nursery habitats of coral reef fishes

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Juvenile fish often use different habitats than their adult-phase habitats, i.e., nursery habitats. For coral reef fish, several habitats have been established as nurseries, mainly seagrass meadows and mangrove forests. Since nursery research is currently largely focused on these habitats, other, less charismatic habitats, such as cobble beds are overlooked, limiting our understanding of the mosaic of habitats necessary throughout ontogeny. Here, we use paired underwater visual census of designated juvenile surveys and across-life-stage surveys conducted along the Israeli coast of the Gulf of Aqaba, to unveil potential nursery habitats. We find that cobble beds consist of high juvenile densities and species richness compared to seagrass meadows. Moreover, several species are obligatory to cobble beds as juveniles. Finally, designated juvenile surveys in cobble beds reveal higher juvenile densities, smaller sizes, and distinct species compared to across-life-stage surveys, emphasizing that surveys which are not juvenile-designated may be non-inclusive. Taken together, our results demonstrate that cobble beds may serve as important nursery habitats for coral reef fish, and that designated juvenile surveys may be required to identify nursery habitats. At times when coastal development is increasing, protecting cobble beds habitats may be crucial to conserve coral reef fish communities.

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ID: 1176

To safeguard pollinators' food resources you need to calculate them

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Protection/enhancement of habitats that are rich in nectariferous and polleniferous flora is one of the strategies to mitigate spatial and seasonal gaps in pollinator food resources. However, to recognize the habitats that can safeguard nectar and pollen availability to pollinators a well-established method is required. Here we propose a step by step method that, in brief, includes assessment of flora composition, recording nectariferous and polleniferous species' flowering phenology and abundance, quantification of nectar and/or pollen production and calculations necessary to scale the results up. This approach enables to calculate the mass of available pollinator food resources at species, habitat and landscape scale and their seasonal distribution. To illustrate the method, a case study from south-eastern Poland was used.

The study was a part of the project no. PPN/IWA/2018/1/00103/U/0001 funded by the Polish National Agency for Academic Exchange.

ID: 1188

More than meets the eye: unraveling anthropic land use impacts on skin microbiota of an opportunistic amphibian species

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As amphibians continue to register population declines worldwide due to human-driven habitat modifications and emerging diseases, their skin microbiota has attracted major interest as both a possible means of adaptation to the changing environment and a barrier against pathogens.

Here we focussed on Bombina variegata, a small anuran colonizing both natural and artificial water bodies, to investigate differences in skin microbiota composition between individuals living in different habitats across the Province of Trento, Italy. Fourteen populations were sampled, including those of natural ponds, seasonal ponds on agricultural land, water tanks, and farm ponds. Skin and water microbiota were investigated using metataxonomics by targeting the bacterial V3-V4 16S rRNA gene and fungal ITS1 loci.

Our results highlight a significant association between skin and water microbiota across all investigated habitats. Composition and diversity of skin microbiota changed between habitats, with the skin microbiota of animals collected from natural ponds being characterized by lower alpha diversity and distinct bacterial and fungal composition. Furthermore, observed variation in skin microbial diversity could be partially explained by the water parameters: pH, dissolved oxygen, and temperature. Implication of human-driven habitat modifications and water composition on B. variegata skin microbiota for the conservation of this species are discussed.

ID: 1191

Successful reintroduction of the Northern Bald Ibis (Geronticus eremita) to Central Europe challenged by climate change and human made mortality

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The project to reintroduce a migratory Northern Bald Ibis (Geronticus eremita) population to Europe is ongoing since over 20 years now. The population has grown to over 250 individuals. A European LIFE-project (LIFE20 NAT/AT/000049 – LIFE NBI) is aiming for 350 individuals by the end of 2028. The migratory population is breeding in four breeding colonies north and south of the Alps and migrate to a wintering area in Tuscany (Italy).

Probably due to climate change, the ibises are starting their autumn migration later every year. The lack of thermals later in the year prevents them from successfully crossing the Alps. Therefore, last year the project team led a group of young ibises to Andalusia (Spain) for the first time. This new migration route bypasses the Alps and the new wintering area can be reached also late in the year.

The LIFE project also includes measures against human made mortality. Measures against illegal hunting are focused on Italy and include information campaigns, support of criminal prosecution and cooperation with local and international stakeholders. In cooperation with local electric grid operators more than 150 high risk power poles in in Austria will be secured against electrocution of all large birds.

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ID: 1194

An experience of twenty years of ex-situ and in situ collective conservation efforts to save species from the extinction: The European bison project

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At the end of the last ice age, more than 11 thousand years ago, the European Bison appeared in Europe, gaining territories from France to Ukraine with some evidence even in Siberia. However, the European's largest herbivore started to disappear from its territories in France at the end of the XVIII century and its extinction continued throughout the centuries since 1927 when the last wild population was exterminated in the Caucasus.

Parco Natura Viva received its first European bison in 1982, one male and two females. Throughout the years, the bison bred several times and joining the ex-situ Conservation Programme for the reproduction and breeding of this species, to keep a high genetic variability of the population across European EAZA Institutions.

Since 2004, 11 animals have been reintroduced. The project has been carried out first in Slovakia and later in Romania. The park built important collaborations with institutions that deal with the protection of wildlife: the Large Herbivore Foundation, Rewilding Europe, WWF Romania, Romanian Wilderness Society and recently Carpathia Foundation.

This is an effective example of how zoological gardens in collaboration with NGOs can be successful in saving species from the extinction with the EU-cofounded projects.

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ID: 1206

Impact of climate and land use change on the distribution of orchids in Estonia

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Terrestrial orchids are declining worldwide, due to habitat loss and climate change. In Europe, northward shifts in orchid distributions were observed, suggesting northern countries as future refugia. As an orchid-rich country in northern Europe, Estonia may represent an indicator of climate change impact on orchid distributions. We used species distribution modeling (SDM) to predict the distribution of 34 orchid species in Estonia. We selected both bioclimatic and land use variables as environmental predictors, considering climate predictions under fossil-fueled development pathways and land use urban and agricultural expansion scenarios from present to 2100. Our results indicate western Estonian islands and coasts as the most suitable areas for orchids, yielding the highest predicted species diversity. However, western territories might be highly impacted by several orchid species range losses. Wide expansions eastwards for calcicole species are predicted. However, due to a lack of calcareous soils in eastern Estonia and to dispersal limitations these shifts are unlikely to occur in a few decades. As a result, western islands and coasts – currently the hotspot for calcicolous orchids in Estonia – might progressively become less suitable for several species. Northern countries' role as orchid refuges might not be straightforward, therefore further conservation strategies are recommended.

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ID: 1211

Don't shock the monkey! A non-invasive multidisciplinary approach to the study of conservation issues for Macaca maura in South Sulawesi, Indonesia

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The moor macaque (Macaca maura) is an endangered species endemic to the Wallacea region, a global biodiversity hotspot characterized by alarming deforestation rates, particularly in the southern arm of the K-shaped Sulawesi Island that corresponds to the geographic range of this species. Lack of knowledge about the current conservation status underscores the need of a non-invasive multidisciplinary research project. First, a habitat suitability assessment using presence data collected in the Bantimurung Bulusaraung National Park (TNBabul), the most important South Sulawesi's protected area, identified karst forests as a fundamental ecosystem for the conservation of moor macaques. Furthermore, from non-invasively collected faecal samples, we developed a SNP panel and implemented a portable and cost-effective approach for in situ DNA metabarcoding using the Oxford Nanopore Technologies plc. MinION sequencer. This allowed both the study of moor macaque genetic diversity in the TNBabul and variations in diet and gut microbiome in response to different anthropogenic pressures. Results suggested a higher genetic structure and lower genetic variability in individuals from the northern region of TNBabul and significant diet and gut microbiome alterations in heavily anthropized areas. Overall, this research project lays the foundations for a comprehensive moor macaque conservation program through a non-invasive multidisciplinary approach.

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ID: 1235

Spectral Rarity: a signal from the hidden elements of biodiversity

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Rarity is a complex phenomenon in nature, and it is not only correlated to "organisms limited in number", but also to uncommon features, e.g. a disturbance factor on a landscape scale. Introducing the concept of spectral species, clustered pixels with similar spectral signals, we propose a new concept “spectral rarity”, a unique spectral signal of a rare entity in the landscape. Remote sensing helped ecological studies: non-intrusive and efficient identifiers for rare features. Satellite-based metrics offer consistent monitoring over large areas, providing spatiotemporal information about vegetation changes. Using GEE, we retrieved Sentinel2 images and bioclimatic data to identify spectral species and their climatic space. Clustering similar pixels based on spectral signatures, we calculated three rarity indicators: local abundance, geographical range, and habitat breadth. Testing on various forest areas across Italy, we were able to track isolated drought stress in summer as spectral rarity in the landscape. Identifying unique spectral signatures over space and time and applying these spectral rarity metrics, offers an innovative method to explore rarity at the landscape level. Leveraging remote sensing advancements and spectral rarity metrics, we shed light on the hidden diversity dimensions, as a guide towards a comprehensive understanding of biodiversity changes.

Abstracts of posters

ID: 181

Altitudinal shifting of major forest tree species in Italian mountains under climate change

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Climate change profoundly affects global ecosystems, especially in sensitive mountainous regions where species distribution is impacted. Understanding climate change's effects on native forest species is crucial for effective conservation. This study addresses a knowledge gap by examining potential shifts in altitudinal range and suitability for Italy's mountainous forest species. Using species distribution models, we identify divergent impacts among species, with most facing altitudinal range contractions, while others may extend beyond the current tree line. The Northern and North-Eastern Apennines show widespread impacts, emphasizing vulnerability. While most species contract, the European larch and Turkey oak in the Apennines show potential gains. The tree line is expected to shift upward, negatively impacting the European beech in the Alpine arc and Northern Apennines but showing future suitability in the Central and Southern Apennines above 1,500 meters. The Maritime pine is promising for the Southern Apennines. Projected impacts on mountain biodiversity suggest the need for comprehensive conservation strategies. The study highlights the importance of high-resolution climate data and considering multiple factors when assessing species vulnerability. Findings have implications at local, regional, and national levels, emphasizing the ongoing need for reliable datasets to inform targeted conservation and adaptive management in the face of climate change.

ID: 202

The importance of forest components as landscape structure in maintaining high biodiversity in oil palm plantations

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Oil palm plantations (OPP) have been associated with deforestation and threat to biodiversity worldwide. Understanding the landscape factors contributing to biodiversity is crucial in planning a sustainable and biodiversity-friendly plantation. This project aims to distinguish the diversity of different biodiversity taxa inhabiting OPP with a focus on landscape structure, which includes OPP; with no forest, with forest patches, next to forest reserves. Sampling methods vary across taxa within 1km radius at each landscape type. A preliminary study in Felda Lepar Utara, Pahang recorded 18 mammal, 40 bird, 3 reptile, 5 amphibian, and 24 insect species. OPP next to forest exhibited the highest species richness across a majority of taxa (94% mammals, 70% birds, 92% insects) followed by OPP with forest patch, and lowest in OPP with no forest. A similar pattern was observed on the highly concerned species (endangered, vulnerable and near-threatened) which were particularly higher in OPP next to forest reserve. This indicates that forest is an important component of landscape structure in oil palm plantations to buffer against biodiversity loss and provide refuge for these organisms. Therefore, a strategic action to reserve a green patch in the OPP landscape should be considered to ensure a sustainable plantation practice.

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ID: 207

Indigenous-Wildlife Conflict and Coexistence in the Altiplano

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Understanding the drivers of conflict and coexistence in human-wildlife relations are critical to conservation. This study sought to understand varying attitudes of local indigenous people towards wildlife by focusing on the Titicaca Grebe (Rollandia microptera), an endangered endemic species found in Lake Titicaca in Peru and Bolivia. We used an ethnobiological approach to understand which demographic, sociocultural, and economic factors influenced 1.) attitudes and LEK towards the grebe, and 2.) their effects on Indigenous-wildlife conflict or coexistence. Participants consisted of locals from the Aymara, Quecha, and Uro Indigenous groups. Our findings produced quantitative and qualitative results, where we found that most individuals expressed apathy towards the grebe, with a significant minority being hostile to it. Hostility was mainly concentrated amongst fishers and was primarily driven by economic concerns. Knowledge of the grebe was low in the general population, but higher amongst fishers. There was, however, widespread willingness to conserve the grebe amongst the general population, particularly when they learned that the grebe is endemic to the Altiplano. Non-homogenous perspectives towards the grebe were held within and between indigenous groups, suggesting the need for future research into intra-indigenous group dynamics in indigenous-wildlife relations.

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ID: 219

TetraDENSITY 2.0 – A database of population density estimates in tetrapods

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Population density is a critical piece of information for conservation, as it provides insights on species' spatial requirements, their relative abundance in a community, and, ultimately, their extinction risk. Yet, obtaining absolute population densities can be both costly and time-consuming, and such estimates have limited temporal validity for management purposes. To address this challenge, ecologists and conservationists need to leverage the vast amounts of density estimates available in the literature to make generalizations and predictions.

Here we present TetraDENSITY 2.0, an extensive database with ~50,000 population density estimates for >3,500 species of marine and terrestrial tetrapods, to foster and facilitate new research on this topic. The database includes estimates collected between 1926 to 2022 across all continents and using different methodological approaches.

TetraDENSITY 2.0 has a wide range of potential conservation applications, including parametrizing and validating ecological simulations, or developing predictive models for conservation analyses such as protected area assessment and planning.

Despite geographic, temporal and taxonomic biases, the database collates previously dispersed estimates and can help identify gaps in the data, guiding future collection efforts.

Ultimately, TetraDENSITY 2.0 has the potential to enhance our understanding of species abundance patterns and support more effective conservation strategies.

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ID: 221

Widespread wind energy development conflicts with biodiversity hotspots in Sardinia

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The Sardinia region hosts several birds and bats species protected by the Birds and the Habitats Directive. However, this region is also undergoing the rapid and massive expansion of wind farms that could affect the behaviour and ecology and conservation of these species.

We assessed the spatial overlap between wind farms and the potential distribution of endangered bird and bat species and potentially affected by wind turbines.

We downloaded presence points for 53 birds and 6 bats species from GBIF (https://www.gbif.org/). Then we used 2023 aerial pictures from Google Earth Pro to map 2020-2023 changes in wind turbines.

In Sardinia there are areas of overlap between the distribution of the sensitive birds and bats and wind turbines. It is therefore necessary to develop effective tools for zonation, to balance energy infrastructure development and the conservation of protected species.

Species distribution models and wind farm density estimation can identify overlaps between biodiversity hotspots and wind energy development sites.

ID: 222

Mapping breeding seabird and coastal waterbird sensitivity to offshore wind farms in the central Mediterranean

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The Mediterranean region is a hotspot for multiple climate risks. To reduce climate change effects, it is crucial to implement renewable resource use and there is a need for careful examination of potential impacts to biodiversity.

We present a sensitivity map regarding the offshore wind farms development in the central Mediterranean Sea for the most relevant breeding seabirds and coastal waterbirds.

GPS tracking data were used to identify the most important breeding areas for 4 seabird species based on three key steps: (a) identifying individual core areas, (b) assessing colony-level representativeness of the sample and (c) quantifying spatial overlap among individuals and scaling up to the colony.

A second layer was developed based on a 10-km buffer around each Italian breeding colony of 10 seabird and coastal waterbird species.

The two data layers were combined into a gridded map with the scores equated to 5 categories of sensitivity, based on the conservation status and vulnerability to collision of the species.

Our map is designed to be used to inform about areas suitable for future offshore wind farms development in the central Mediterranean with the aim of minimising risk of a negative impact on populations by avoiding areas of highest sensitivity.

ID: 234

Conservation of calcareous fens with Cladium mariscus (habitat 7210*) in northern Italy

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The conservation project was carried out at the “Torbiere del Sebino” Nature Reserve, SAC, SPA and Ramsar site, in the southern portion of Lake Iseo (Lombardy).

Habitat 7210, which has a conservation status at national level for the continental region of “Unfavourable – Inadequate” (EEA, 2013-2018 Conservation Status of Habitats), is present within the Nature Reserve but is affected by a progressive decline mainly due to: eutrophication, landfills and climate change.

The conservation interventions were divided into monitoring activities and restoration actions. Habitat monitoring was conducted both through phytosociological investigations and through the use of drones (UAV). The restoration interventions were carried out in 2022 and 2024 in 2 suitable areas, involving the removal of surface soil and subsequent planting of approximately 3,000 plants, obtained in the nursery from seeds collected by volunteers from local communities. The invasive plant species were subsequently removed.

The action carried out in 2022 was successful, leading to the development of a new population of Cladium mariscus, enriched by the presence of a species of conservation value such as Thelipteris palustris.

In conclusion, the project led to a Net Positive Impact on wetland biodiversity and improved awareness of the local population.

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ID: 239

Functional diversity of birds in response to Forest Management Intensity: a review across Europe

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The majority of European forests undergo some form of management, with only 1.5% excluded from production. Birds, commonly habitat indicators, display diverse responses to forest management. This review explores the influence of various forest management intensities on European bird functional diversity. Examining local-scale studies comparing bird diversity in managed versus unmanaged forests, we classified management into five intensities: no intervention, low, medium, high, and intensive. The analysis indicates higher species diversity at intermediate management levels, supporting the intermediate disturbance hypothesis. Functional richness peaks at low management, suggesting diverse traits due to coexisting species. No and high management forests exhibit lower functional diversity, implying potential homogeneity from lack of intervention or excessive disturbance. For instance, low management show a combination of high functional diversity and slightly higher functional dispersion, indicating diverse functional traits in the bird community. The pattern reveals that intermediate and low management maintains higher richness and diversity. Mild management practices alone do not threaten avian functional diversity, while aggressive practices negatively impact it, irrespective of forest location and type. The study underscores a consistent pattern in bird functional diversity across a forest management intensities gradient in European forests, serving as a valuable tool for future conservation decisions.

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ID: 264

Integrating ecological corridors connecting protected areas for conservation planning

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According to to 30x30 target of the EU Biodiversity Strategy, Member States are called to create Ecological Corridors (ECs) between Protected Areas (PAs) to conserve marine biodiversity and ecosystem services. At the same time, Maritime Spatial Planning (MSP) aims to determining spatial priorities for the conservation through ecological connectivity. However, integration of connectivity into PA network planning is rare. To maximize marine conservation effectiveness , the upcoming extension of PAs needs systematic conservation planning methodologies that take into account connectivity and ECs.

Here Ecological Corridors (ECs) were identified among PAs in Sardinian territorial waters (Italy) for the endemic Seagrass Posidonia oceanica. Existing data on P. oceanica occurrence (3170 points) were collected to model suitable habitats using an ensemble modeling approach. A resistance map was generated starting from the habitat suitability to identify ECs with a Least Cost Path analysis and were obtained 9 ECs were obtained covering a surface of about 430 km2.

These first results will lay new basis for the identification in the next future of new marine and coastal areas to protect in Sardinia as required by the EU Biodiversity Strategy for 2030.

ID: 269

The Integrated Management Plan for the Conservation of Emys orbicularis

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An Integrated Management Plan was developed as part of the LIFE21-NAT-IT-LIFE URCA PROEMYS project for the conservation of the European pond turtle Emys orbicularis. The main goal of the initiative is to improve the conservation status of natural populations in Italy and Slovenia. The Management Plan outlines a number of conservation and management strategies and includes veterinary protocols, genetic procedures to maintain current populations diversity, operating protocols to be adopted by breeding centers, containment of alien freshwater turtles, training and community information programs. The project aims at promoting parallel conservation actions to be implemented by the authorities of protected areas and breeding facilities for E. orbicularis. All project partners involved in the protection of the European pond turtle are networked through the Management Plan for effective conservation of autochthonous turtles and the maintenance of intraspecific genetic diversity. The Plan complies with European regulations on nature conservation and control of invasive alien species.

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ID: 287

Filling knowledge gaps in insect conservation by leveraging genetic data from public archives

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In recent years, the decline of insect populations has raised concerns, prompting studies that reveal alarming decreases in various taxa. Despite this, our understanding of genetic spatial patterns and evolutionary history of insects remains incomplete, hindering effective conservation efforts. Genetic data offer crucial insights into the diversity and evolutionary relationships of insect species and populations. Public repositories like GenBank and BOLD store extensive genetic data with associated metadata, serving as valuable resources for researchers investigating species diversity, population structure, and evolutionary connections. However, challenges arise due to scattered data, incomplete metadata and potential inaccuracies from inconsistent sampling protocols. This study introduces a curated georeferenced database of genetic data from GenBank and BOLD for insects listed in the IUCN Italian Red Lists, including dragonflies, bees, saproxylic beetles, and butterflies. After querying and conducting quality control, we assembled a dataset with around 34,000 mitochondrial sequences and metadata on taxonomy, collection localities, coordinates, and IUCN status for 1,466 species. This study outlines the current state of spatial metadata, highlighting data gaps that impede conservation prioritization. The curated dataset, available for analysis, encourages comparative studies and underscores the importance of addressing knowledge gaps in insect diversity, supporting research in phylogeography, macrogenetics, and conservation strategies.

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ID: 292

Standardization protocols for microsatellites analysis in wildlife conservation and forensic genetics

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Microsatellites are extensively employed in animal conservation and forensic genetics.

Despite their widespread use, the lack of standardization systems makes routinary use and interoperability difficult. Drawing inspiration from human genetics, we are developing protocols for animals such as Aquila chrysaetos.

Identifying 10 informative markers from the literature, we designed a multiplex PCR, ensuring non-overlapping fragment lengths and primer specificity. Primers combination, fragment labeling, and capillary electrophoresis analysis verified the robustness of the PCR. Subsequent optimization focused on the allelic ladder, crucial for accurate electropherogram interpretation.

Three protocols were tested for allelic ladder development: (1) successive PCR amplifications with enzymatic purifications, (2) agarose gel-based isolation with reamplification, and (3) plasmid-based allelic collection.

The first performs well in terms of development time and cost but may lose alleles, the second performs less well in terms of time and cost but may isolate rare alleles. The third performs well in terms of time and includes all alleles but it is more expensive.

While the first two protocols require more optimization, the third method is promising for its efficiency in obtaining rare alleles. Future research will focus on refining these protocols and testing allelic ladders across different laboratories and instruments to validate standardization.

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ID: 294

Environmental DNA for direct, non-invasive assessment (eDNA) of fish species in the marine sanctuary of Dalipuga, Iligan City, Philippines

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Environmental DNA (eDNA) metabarcoding is a non-invasive tool for biomonitoring marine species. This investigation specifically assessed the utility of eDNA in detecting and identifying crucial marine fishes within the marine sanctuary of Dalipuga, Iligan City, Philippines. The outcomes derived from the eDNA approach offer valuable insights into the identification of significant fish species. Noteworthy is the detection of Hippocampus kuda (yellow seahorse) and Hippocampus comes (tiger-tail seahorse), both classified as vulnerable and threatened species by the IUCN. An exceptional highlight of this research involves the identification of the new Indo-Pacific atherinomorine fish species Doboatherina magnidentata, representing the first record in Philippine marine waters to the best of our knowledge. A comprehensive survey based on eDNA revealed a total of 44 fish species in the marine sanctuary of Dalipuga, Iligan City, spanning 19 families: Pomacentridae, Sillaginidae, Zanclidae, Atherinidae, Clupeidae, Scaridae, Labridae, Lutjanidae, Mugilidae, Lethrinidae, Mullidae, Syngnathidae, Balistidae, Acanthuridae, Holocentridae, Apogonidae, Serranidae, Triglidae and Scombridae. This study underscores the efficacy of eDNA metabarcoding as an effective and non-invasive method for monitoring marine fish species, with specific emphasis on detecting rare and endangered taxa.

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ID: 316

Vegetation dynamics in the Gran Paradiso National Park through a remote sensing-based approach

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Climate change and human activities are widely recognized as the main driving forces behind vegetation dynamics, which also affect associated ecosystem services. In this context, alpine areas are facing profound changes as a result of the abandonment of traditional agro-sylvo-pastoral practices, further exacerbated by climate change. Gran Paradiso National Park represents a peculiar observatory because of the wide availability of studies and data collected over time, although not continuous in time and space. Some questions remain unanswered, such as the changes that have occurred and their timing at the landscape scale. The availability of long-term, high-resolution satellite remote sensing data has made it easier to obtain accurate information that can be used to study the dynamics and role of vegetation, with high temporal and spatial resolution. This study addresses this gap through the analysis of time series maps of vegetation distribution, extracted from Landsat data by means of a land cover classification algorithm, which aims to exploit all the information that can be extracted from satellite imagery and available ancillary data related to the distribution of plant communities. The change maps will reveal the mechanisms of ecosystem trends, predicting future vegetation growth and, thus, informing environmental management and policies.

ID: 319

Protecting endangered Siberian flying squirrel in urban environment in Espoo, Finland - methods, experience and lessons learned

Laura Lundgren, **Aino Kostiainen**
City of Espoo, Finland

The Siberian flying squirrel (Pteromys volans) lives within European Union only in Finland and Estonia. It is strictly protected under the EU's Habitats Directive and classified as Vulnerable in Finland and Critically Endangered in Estonia. The flying squirrel lives in mixed tree forests but in Finland it has also adapted to urban environment. The city of Espoo in Finland was one of the first cities to find flying squirrels in urban forests around ten years ago. Today, flying squirrels in Espoo have a fragmented, mosaic type of habitat network, that spreads around the city even to most urban areas. At the same time, Espoo is growing rapidly and conflicting interests in land use and protection of the flying squirrel need to be balanced carefully. In our presentation, we will show how Espoo has been able to solve this dilemma: we can protect flying squirrels even though the city is growing. Espoo has made several studies on urban flying squirrels and developed methods to protect the species and to take it into account in city planning. In 2019-2025 Espoo has also improved ecological corridors for flying squirrels as part of a large EU-funded Flying Squirrel LIFE project.

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ID: 348

Where do semi-natural habitats remain? Examination of factors related to the presence of semi-natural meadows and woody landscape features in farmland

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Semi-natural habitats are of crucial importance for biodiversity in agricultural landscapes, yet continue to disappear from European agricultural landscapes. Little is known about the factors that affect individual farmer's decisions to retain semi-natural habitats. In this study, we focus on two key types of semi-natural habitats: woody landscape features (hedgerows, woodlands, scrubland and solitary trees); and late-mown, unfertilised semi-natural grasslands. By interviewing 506 farms in two Slovenian lowland regions, we gathered data on spatial location of woody landscape features and semi-natural grasslands on farms, along with farmers' attitudes towards these habitats and various socio-economic and production-related data. We merged our dataset with spatial data on hydrology, soil types, land use and Natura 2000 sites. To determine what affects the likelihood of a semi-natural meadow or woody landscape features being present at a specific location, we use a mixed logistic regression with conditional autocorrelation that accounts for potential spatial effects. We discover that attitudes and physical factors affect the presence of selected semi-natural habitats, while only some of the socio-economic and production-related variables have any effect. Our results can help improve the design and targeting of agricultural policy measures for the conservation and restoration of semi-natural habitats in the European farmland.

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ID: 352

Do brown bears visit dens during periods other than hibernation?

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Hibernation is essential for the individual well-being of brown bears. In Bulgaria, Ursus arctos hibernate from December to March, but this period can vary depending on winter conditions from year to year. They hibernate in dens mainly in rock cavities, but there was no evidence that they visit these dens apart from the hibernation period. For two consecutive years - 2022 and 2023, we monitored 17 bear dens in the Stara Planina Mountains year-round using camera traps. We observed that dens were visited between March and October. In 2022, the highest frequency of visits was registered from May to July, followed by September and October, while in 2023 the highest frequency was in May and June. Several male and female bears visited the dens, as well as females with cubs, and young individuals. Males visited dens often soon after females. The bears carefully sniffed the entrance to the dens, and some came in or looked in briefly. Some of these den visits probably are associated with the breeding season. Another reason could be looking for a potential den for the next hibernation. These findings may contribute to the conservation of this species in the country.

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ID: 354

Emerging problem of the nutria (Myocastor coypus) in Central Europe: reproductive potential in the wild

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The nutria (Myocastor coypus) is a semi-aquatic rodent becoming invasive in Central Europe. The species is causing damage in flood protection structures and in wetland and agricultural vegetation.

Our purpose was to study this rodent for its adequate management in Hungary, and to answer the questions: 1) Are the wild male and female individuals sufficiently developed and in good condition for their reproduction?; 2) How intensively does the species reproduce?

In Slovakia 53 individuals were shot and trapped throughout a year. The carcasses were investigated in the laboratory, by measuring the body sizes and observing the reproductive organs.

Our results showed that most of the animals were in good general condition. The males were bigger than the females. The body weight for males could reach 10.1 kg. We confirmed that the nutria can be highly reproductive, the average number of embryos in pregnant females was 6.6±2.1. From March to October 70% of females were pregnant, and even during October we could find 10 embryos for a specimen.

The nutria is able to reproduce and spread quickly leading to its different adverse environmental or economic effects, therefore an urgent intervention is required to eradicate the population and stop their range expansion.

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ID: 358

First evidence on the ecological impact of raccoons (Procyon lotor) in Hungary

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The raccoon (Procyon lotor) is an invasive carnivore species that is increasingly being observed in Hungary. We aimed to prove the nest predation of raccoons. We supposed that the raccoon can predate the nests of birds on every forest layer. In a forested area, we placed artificial nests on the ground, shrubs, and nest boxes on trees with hen eggs. We monitored the nests continuously for a week with wildlife cameras. Twenty repetitions were in each group by changing the placement locations in four consecutive periods during the May-June nesting period. Strong raccoon activity was detected. Raccoons appeared at six observation sites. The animals visited at all three nest types and we took both day and night pictures of it. The raccoon predated the ground and bush nests, and returned to them several times. In addition to the raccoon, the wild boar and the pine marten were also frequent egg predators, but woodpeckers and mice were also found in the nests. In Hungary, our study is the first evidence of the raccoon's nest predation behavior and its obvious impact on natural communities. Control of the raccoon population is a fundamental task to prevent the further expansion of the species.

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ID: 362

The effect of boreal forest integrity on wildlife in Finland

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Boreal forests face significant threats from human activities, including the degradation of ecological integrity. In Finland, despite extensive forest cover, the forest landscape integrity index is low, especially in southern regions because of intensive forestry.

The ecological integrity of forests is a crucial factor for biodiversity protection, but the connection between forest degradation indices and the biotic community is still poorly studied. To bridge this gap, we analysed the relationship between the global Forest Landscape Integrity Index and the abundance of 17 mammal species observed in more than 1000 wildlife triangles, the main method for monitoring wildlife populations in Finland.

Our findings represent a pioneering effort in showcasing how the Forest Landscape Integrity Index can effectively assess the impact of forest ecological integrity on mammal species abundance. Notably, our analysis reveals a distinct trend: native species exhibit a preference for more pristine forests, while invasive and synanthropic species inhabit forest areas characterised by more degraded ecological integrity.

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ID: 366

Conserving Pannonian grassland habitats: a historical overview and protected areas assessment

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Salt-tolerant habitats and steppe in the Pannonian biogeographic region fragile and threatened sites hosting specialized plants, animals, and other organisms, demonstrating strong resistance to invasions. Their conservation status remains unevaluated in the Serbian region. This study addresses this gap by assessing the changes in grasslands and 13 halophytes and steppe species in Pannonian Serbia since the late 19th century. We also evaluate how well protected areas cover the distribution of investigated species, especially those of conservation concern. Data on species distribution were collected from Herbarium of the Department of Biology and Ecology, University of Novi Sad - BUNS, a large amount of published data from period 1896 until the present days as well as on personal field observations. To gauge the effectiveness of protected areas, site data were overlapped with their boundaries. Beckmannia eruciformis, Prunus tenella, and Suaeda marittima subsp. pannonica had the highest number of localities within protected areas, while Senecio doria, Sternbergia colchiciflora, Suaeda marittima subsp. marittima, and Tripolium pannonicum had the lowest. For species with numerous localities outside protection, strategic measures like forming new protected areas or expanding existing ones are needed.

ID: 372

Competition between domestic and wild bees (Hymenoptera: Apoidea: Anthophila) in sown flower strips

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Honeybees are an important economic source for humans. Still, recently, interaction and overlap of trophic resources between honeybees and non-managed pollinators such as wild bees have been studied, and concerns about possible competition have been raised in environments where the number of hives is very high. Apis mellifera L. is a social species, with large colonies and can communicate to choose foraging sites that are very remunerative. Moreover, they may show territorial behaviour that can depress wild pollinator species. For those reasons, actions that focus on solutions to pollinator decline shall also consider the competition that can occur between honeybees and wild species. Our study aimed at seeding and managing entomophilous plant mixtures in marginal areas of river belt basins for the support of pollinators. During a two-year experimental period, it was noted that plots with greater flower coverage were subject to a major presence of honeybees and a decrease in wild bee populations. These were concentrated in the plots with low flower density and therefore less attractive to honeybees. Our results can be useful when designing the mixtures to be used in improvement actions for pollinators. Creating oligotrophic flowering areas can support wild pollinators and decrease interspecific competition.

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ID: 376

Forest orchids under future climate scenarios: habitat suitability modelling as a conservation strategy

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Orchidaceae is one of the largest and most diverse families of flowering plants in the world but also one of the most threatened. Climate change is a global driver of plant distribution and may be the cause of their disappearance in some regions. Forest orchids are associated with specific biotic and abiotic environmental factors, that influence their local presence/absence. Changes in these conditions can lead to significant differences in species distribution. We studied three forest orchids belonging to different genera for their potential current and future distribution in a protected area of the Central Apennines. A Habitat Suitability Model was constructed for each species based on presence-only data and the Maximum Entropy algorithm (MaxEnt) was used for the modelling. Climatic, edaphic, topographic, anthropogenic and land cover variables were used as environmental predictors and processed in the model. The aim is to identify the environmental factors that most influence the current species distribution and the areas that are likely to contain habitats suitable for providing refuge for forest orchids and ensuring their survival under future scenarios. This will allow protected area authorities to decide whether to invest more resources in conserving areas that are potential refuges for threatened species.

ID: 379

A step-by-step approach to select climatic variable for ecological modeling

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Species distribution models (SDMs) are widely used to estimate species distribution and predict future responses to climate change. Multiple studies have shown how the selection of predictor variables for model training can have crucial implications on the models’ predictions, while it can have slight effects on the estimated predictive performance through cross-validation. An increasing number of studies have proposed statistical approaches to automatically select variables in SDMs. These approaches often overlook the ecology of the studied species fully relying on model fit and complexity (e.g. via Information Criteria), and collinearity. Fully automatic approaches risk to exclude key variables while retaining spurious predictors, with important implications in predictions under novel conditions. Here, we present an informed expert based step-by-step approach to guide researchers in the identification of ecologically and biogeographically meaningful variables. The approach consists of three filters based on taxonomy, biomes and adaptation, which can help identifying relevant variables while excluding potentially spurious ones, depending on the aim of the study (e.g. explanatory vs. predictive).

ID: 384

Establishing a Marine Protected Area network using a Marine Spatial Planning approach in São Tomé and Príncipe

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Integrative social-ecological approaches are crucial for addressing sustainability challenges in coastal and marine systems. Among these, Marine Spatial Planning (MSP) emerges as a pivotal approach for integrated management. Often, the establishment of Marine Protected Areas (MPAs) and the application of MSP occur in parallel. Given the potential synergies, there is a need to better understand and address barriers to the adoption of MSP approaches for integrative conservation mechanisms. Using São Tomé and Príncipe as a case study, we illustrate how MSP was employed as an operational framework for establishing an MPA network. Drawing on the experiences of people directly involved in this co-design process, we reflect on main challenges and opportunities in achieving social-ecological integration, and highlight recommendations for conservation practitioners and planners. Applying MSP was perceived to contribute substantially to multiple project goals, with some (e.g. incorporating perspectives and needs of vulnerable groups) more challenging to achieve. While MSP enhanced conceptual, disciplinary, methodological and functional integration, practical challenges in implementation hindered the extent to which each of these was achieved. Given international commitments to Blue Growth, high fisheries dependence and current patterns of change, developing effective integrative MSP approaches is essential for social-ecological resilience.

ID: 388

Integrated Conservation and Restoration Planning within a Central-European Cross-border Region

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Effective conservation and restoration actions, if carefully and strategically implemented, can help to bend the curve of biodiversity loss. Yet, conflicting societal objectives and climate change can constraint such actions, and there is a need for context-specific and integrated solutions that work for biodiversity and people.

We investigate conservation and restoration options within the Neusiedl lake and surrounding cross-border region, situated in Austria and Hungary. This region contains the largest central-European endorheic lake, rare ecosystems such as steppe salt ponds and provides a habitat for many species. Critically it is cultural landscape with a complex governance system and the competing demands give rise to a series of land-use and resource conflicts with biodiversity.

We apply a systematic conservation planning framework customized for cross-realm and integrated conservation problems. It is integrated as it critically considers not only biodiversity, but also other perspectives towards sustainable land and water management discussed together with stakeholders in the region. Further a range of state-of-the-art remote sensing, machine learning, socio-ecological valuation techniques will be applied to identify where and how biodiversity can be preserved. Our holistic framework has the potential to provide actionable insights for stakeholders and entry points towards implementing nature-positive policies.

ID: 407

What is the Tole of Geodiversity in Protecting Current and Future Biodiversity?

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Ecological connectivity is widely acknowledged as a climate-wise conservation strategy, fostering species movements and gene flow amid changing environmental conditions. While protected areas act as refuges for species, their effectiveness is compromised by not only climate change but also surrounding land use that causes habitat loss and fragmentation leading to scattered terrestrial protected areas, resembling habitat islands in a landscape dominated by intensive land use. Understanding which landscape elements facilitate and impede species movements is pivotal for planning connectivity, thus protecting the efficacy of protected area networks.

Geodiversity sets the stage for biological diversity. It introduces landscape variations, creating microclimate heterogeneity that fosters species and their interactions. While the complementary role of geodiversity and biodiversirty is evident, the integration of geodiversity into connectivity modeling and conservation remains limited. This research seeks to bridge this gap by investigating the significance of geodiversity in biodiversity conservation, emphasizing its role in enhancing connectivity and contributing to the resilience of landscapes in the face of climate change. I will present preliminary results from a literature review that aims to prune the thicket of geodiversity and connectivity conservation terminology and explore how incorporating nature's abiotic stage into connectivity conservation modeling affects the performance of biodiversity.

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ID: 413

Climate change adaptation strategies across the Natura 2000 network of protected areas

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Anthropogenic climate change requires a conservation paradigm shift to ensure long-term biodiversity conservation. Indeed, climate change makes it almost unfeasible to maintain historical baselines of an ecosystem, challenging management of protected areas (PA). The RAD (resist-accept-direct) framework suggests that management actions can address climate change effects by resisting, accepting, or directing the ecosystem changes. Yet, species-specific actions to implement the RAD framework are scarce and would require standardized collection of management activities enforced in protected areas. The aim of this study is to investigate to which extent climate change is considered as a threat in the management of the Natura 2000 network of PA (n>27 800). To achieve this, we developed an interactive questionnaire using R shiny, dedicated to collect management information from all PA managers across the EU. The purpose of this questionnaire was to collect site-level info on: 1) implemented management actions; 2) species and habitats targeted; 3) threats, including which aspects of climate change are perceived as a threat; 4) management actions implemented to resist, accept or direct the effect of climate change. From questionnaire answers, we created a novel, publicly accessible database with associated guidelines available for conservation practitioners and policy makers.

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ID: 416

The effect of climate and agriculture on farmland biodiversity in Finland

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Demand for cheap, readily available food has increased, pressuring agriculture to increase productivity. Yet, intensive agriculture has led to biodiversity declines, impacting ecosystems and their functions necessary for food production. On top of this, agriculture, as well as the entire planet, face challenges with the changing climate, where adverse weather conditions compromise crop production. A dire need for solutions regarding fair transformation towards ecological farming are needed.

My poster summarizes the aims of my PhD, which are to determine the direct and indirect effects of anthropogenic and climatic pressures on farmland biodiversity. I will determine whether local farmland bird abundance changes are impacted stronger by local farming practices or climate change, allowing us to understand immediate threats and target conservation measures locally. Secondly, I aim to determine if farmland indicator species (birds and butterflies) experience similar pressures in similar areas, indicating that the changes are driven by shared factors. Lastly, I will explore how farmers perceive biodiversity changes in their lands and what they consider just transformations within the agricultural field. Therefore, the findings of my interdisciplinary project aim to provide guidelines and solutions for ecological food production, securing food demand and a sustainable future hand in hand.

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ID: 419

Determining favourable reference areas of ten EU-importance forest habitat types in Latvia

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To assess the biodiversity conservation success in forests, it is necessary to determine favourable reference areas (FRAs). Earlier, in Latvia the minimum dynamic area (MDA) for forests was determined by using GAP analysis and setting a threshold of 20% of the remaining initial area of each forest group to ensure long-term survival of specialist species. However, forests were divided into groups by natural disturbances; but there haven't been studies to determine FRAs of forest habitat types of European Union importance (EU Habitats Directive, Annex I).

To determine FRAs at habitat level for 10 EU-importance forest habitat types in Latvia, we used forest inventory data by the Latvian State Forest Service from 2012 and 2023 and habitat distribution models to calculate potential past and present forest habitat areas, then compared them with data from country-scale habitat inventory (2017–2023). Usually, data on population viability are used to calculate MDA, however, here a different approach was used, as there was a lack of data about habitat specialist species. Ecological niche analysis and species distribution models for owls and saproxylic beetles were applied to select threshold values for gap analysis.

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ID: 427

Predicting maximum dispersal distances and quantifying energetic costs of dispersal from species traits

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Dispersal is a fundamental process driving biodiversity patterns and is crucial for species survival. It is complex and occurs over different phases (departure, transfer and settlement), with a range of costs associated with movement (energetic, time, risk and opportunity). During transfer, species often make large-scale displacements resulting in significant energetic losses that are assumed and not directly tested. We developed a mechanistic model to predict maximum dispersal distances and quantify energetic costs of dispersal for realised distances. Our bioenergetic model balances between energy stored (e.g. fat reserves) and energy loss (e.g. metabolic costs) during dispersal, which are dependent on a species body mass and movement mode (i.e. running, flying, swimming). We used our model to predict the allometric scaling of maximum distance and energetic costs of dispersal across movement modes, further comparing our model to an empirical dataset (n = 3362) to test our predictions. This model allows us to quantitatively predict the dispersal ability of animals from species traits, enabling generalisability across taxa, predictions under unobserved conditions and can be integrated into consumption and meta-community models. Overall, this approach will improve our understanding of how animal movement affects landscape connectivity, species distributions, and ultimately biodiversity patterns in a changing world.

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ID: 445

Plant–pollinator interactions vary following glacier retreat

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Plants and pollinators have longstanding interactions which are generally complex and reflect the functioning and health of ecosystems. However, plant–pollinator interaction networks are very sensitive to changing of environmental conditions, like retreating glaciers. Yet, the impact of glacier retreat on plant–pollinator interactions remain poorly understood. Here, we address how glacier retreat affects the frequency, complexity, and diversity of plant–pollinator interactions. We surveyed plants visitors and analyzed visitation networks along the foreland of the Mont Miné glacier (Valais, Switzerland). We observed sharpe changes in the diversity of plant–pollinator interactions and the structure of pollination networks. We found an increase in the frequency of interactions following glacier retreat, but an ultimate decrease with glacier extinction. After controlling for the effects of floral diversity, interaction frequency showed a regular pattern. Accordingly, the complexity of pollination networks and interaction diversity tend to change at constant rates with glacier retreat. Our results indicate that glacier retreat decreases biodiversity and influences the stability of ecological networks. Besides, increasing floral diversity counteracts these impacts by increasing interaction diversity and supporting complexity. These results may therefore be developed to provide solutions for halting the erosion of ecological networks while increasing biodiversity and ecosystem functioning.

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ID: 451

The climate exposure of European protected areas: temporal trends and biodiversity implications

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Protected areas (PAs) are vulnerable to climate change impacts, just like any other area, but this aspect is often neglected in conservation policy and planning. Almost 70% of European terrestrial PAs are smaller than 1 km2 , and their limited extension and lack of temporal climate connectivity could put at risk their ability to retain the species they currently host. This generates a risk for the many species of European interest that depend (in part or in full) on this areas for survival.Here, we measured the values of multiple climate metrics for each vertebrate species threatened by climate change according to the IUCN threats classification scheme; we measure such metrics within Natura 2000 network under different SSP-RCP scenarios, using the latest climatic model available from CMIP6. Our results show an incresing trend of climate risk across all scenarios within the Natura2000 network. The highest climate velocity values are reported for amphibians and birds, while amphibians and reptiles face the highest magnitude of change. Policy makers should account for these risks,especially dramatic for amphibians, while designing new PAs to reach targets set by the EU Biodiversity Strategy for 2030.

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ID: 456

Know to conserve hoverfly communities: the case study of Dolomiti Bellunesi National Park

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In 2020, the Dolomiti Bellunesi National Park (PNDB) started a project to study the role of hoverflies (Diptera: Syrphidae), as bioindicators and pollinators. The preliminary results of the project are presented and discussed. A total of 203 species were recorded, corresponding to 38% of Italian fauna, thus confirming the very high hoverfly biodiversity of PNDB. The hoverfly communities in thirteen sites, characterized by different habitats, were sampled using Malaise traps. The percentage of habitats, in particular unimproved grasslands, pasture, pine forests and screes, in a 500 m radius resulted the best predictor of hoverfly community. The list of hoverfly species and the type of habitats in the PNDB were used as input data to apply Syrph the Net, a standard protocol developed to evaluate habitat conservation. All habitats, except scree and running water edges, resulted to have more than 50% of the expected species, showing a general good conservation status. In 2024, a Citizen Science project, focused on saproxylic species, has been promoted. The hoverfly project in the PNDB is an interesting example of long-term monitoring aimed to create a baseline of the hoverfly fauna, crucial for future research and to obtain important information on the conservation status of habitats.

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ID: 464

Are urban forests connected for viable vertebrate populations? A case-study in Helsinki, Finland

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Connectivity is a crucial element for species long-term persistence. Nevertheless, a better understanding is needed on how connected urban forests should be from a multispecies perspective to support biodiversity, in particular from the point of view of city planning.

We compared the connectivity of urban forests habitats for three vertebrate species: Siberian flying squirrel (Pteromys volans), common lizard (Zootoca vivipara) and crested tit (Lophophanes cristatus). We used Graphab and Circuitscape with literature- and expert opinion-based parameters to model the dispersal potential of the species. We compared the output with current and planned forest network maps of the city of Helsinki. We also assessed the sensitivity of the models to a range of plausible parametrizations.

Our preliminary results indicate that despite the relatively high number of green areas in Helsinki, urban forests are latitudinally disconnected for all the three species. Roads were major barriers for the common lizard, whereas the distances between habitats were main reasons for habitat isolation in the two other species.

The results may be applied in city planning to identify critical spots for connectivity and where more connectivity would be beneficial. In particular, we suggest that current longitudinal green infrastructure needs to be complemented with latitudinal structures.

ID: 467

Coupling species distribution and connectivity modelling at the population level in a dynamic industrial environment for conservation planning

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Artificialization of habitats and soils is one of the principal causes of biodiversity loss (IPBES, 2019). A major regulatory tool to limit artificialization impacts is the mitigation hierarchy sequence used in environmental assessment studies. However, several weaknesses have been identified concerning mitigation hierarchy processes: avoidance of impacts is neglected to privilege overuse of offsetting and mostly applied in a project-by-project approach without scaling up (Bigard et al., 2017). As such, a comprehensive vision of land-use changes should be considered at scales relevant to population functional ecology and should integrate cumulative anthropogenic pressures.

Here we investigate the potential impacts of alternate schemes of development of an industrial site on a population of the endangered ocellated lizard (Timon lepidus). The industrial site, which covers 900 ha, is frequently under building and land management projects, and at the same time intertwined with natural habitats favorable to the ocellated lizard. We used species distribution modelling (SDM) to identify at a very fine resolution (5 meters) the urban and natural features affecting species occurrence. Subsequently, we used an individual-based spatially explicit model based on a stochastic movement simulator (Moulherat et al. 2020) to modelled landscape connectivity and population dynamics under different land management scenarios.

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ID: 479

Using present data to track temporal changes in the functioning of coastal dune ecosystems

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Protected areas are generally designed to conserve biodiversity. However, how well they also contribute to maintaining ecosystem functions and services that plant diversity supports has been rarely explicitly tested. Here, we examined changes in ecosystem functions over the last 15 years in protected and unprotected coastal dune ecosystems, which are among the most threatened ecosystems in Europe.

First, we resurveyed vegetation in quasi-permanent plots and collected several ecosystem function variables related to erosion control, productivity, carbon, water, and nutrient cycling, across six coastal dune sites in Central Italy. Second, using these data, we assessed Biodiversity-Ecosystem Function (BEF) relationships and employed them to hindcast past ecosystem functioning based on historical vegetation surveys. Finally, we assessed temporal changes in ecosystem functioning under three protection regimes: protected areas, Natura 2000 sites, and non-protected areas.

Productivity, carbon, and water cycling increased in non-protected areas, likely due to an expansion of productive and non-native species. Within Natura 2000 sites communities showed a decrease in erosion control potential, due to the loss of important dune-building species. Only within protected areas functions did not undergo significant temporal changes. These results suggest that on coastal dunes only high levels of protection effectively maintain ecosystem functioning stable over time.

ID: 487

Habitat adaptation strategies of a protected species: diet assessment of the mountain hare in Scotland

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Land use and climate change will have profound and widespread effects on the distribution of plant communities. Understanding how these changes will affect wild herbivore populations is vital if we are to predict their responses and develop evidence-based management and conservation measures for both herbivores and plant communities.

The Mountain hare (Lepus timidus) is found in upland areas of Scotland where it is strongly associated with heather moorland habitats and is also found in woodlands and other habitats. Mountain hares have an intermediate feeding strategy, with a high-quality grass-dominated diet in summer and switching to a low-quality bulk browse-dominated diet in winter. This diet adaptation, along with their wide distribution and presence in different habitat types, makes mountain hares an ideal model species to study how small herbivores may adapt to habitat change.

This interdisciplinary research project will combine genomics, ecology and spatial analyses to assess seasonal changes in diet and gut microbiome composition of mountain hares in different habitats in Scotland. The results from this research project will provide novel insights into the adaptation of intermediate feeders to changing habitats and help to inform land use policy and the conservation and management of this protected species in Scotland.

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ID: 488

Festina lente: a case study of multi-taxon diversity in Italian forests

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Researchers working on biodiversity and conservation face two main options for when retrieving data for their research: either relying on existing databases (the 'fast' option) or actual field collection (the 'slow' one). However, researchers working on biodiversity and conservation of certain taxa (e.g., insects) can only choose the 'slow' option, due to inner constraints of the selected target species. In this context, the present research aims at investigating how forest structure affects multi-taxon diversity (both taxonomic and functional) and abundance in Italian forests, focusing on saproxylic beetles, lichens, bryophytes, vascular plants, soil arthropods and molluscs. Multi-taxonomic data are matched with forest structure attributes such as dead wood typology and abundance, canopy cover and tree-related microhabitats, all collected at plot level. Areas selected for sampling are in Tuscany region (Italy), namely: the State Reserve "Belagaio", mainly characterised by a holm oak and an abyssal beech forest (350-270 meters a.s.l.), and "Alpe di Catenaia", dominated by beech forest stands. The first site has not been managed since 1980 while the second one is still managed with different silvicultural treatments. Preliminary results will focus mainly on sessile organisms (lichens, bryophytes, vascular plants).

ID: 492

Areas of high risk for mammalian biodiversity and Nature's Contributions to People under global warming

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Climate change is leading to more frequent and extreme events, such as droughts and megafires. The coaction of climate and land-use change has already impacted biodiversity and Nature's Contributions to People (NCP), leading to an increase of species extinction rate and deteriorating ecosystem functions. To determine synergies between biodiversity conservation and NCP preservation, we developed a comparative extinction risk model for mammal species sensitive to fire, drought, and extreme temperatures, and used it to predict their probability of being threatened under different socio-economic development scenarios. The highest increase in species threat risk was observed in Malaysia, Western Indonesia and in Madagascar, both under scenarios SSP1-2.6 and SSP5-8.5 followed by Australian east coast and South Africa. These same regions also represent areas of high risk for several NCP namely the regulation of freshwater, air quality, and extreme events, thereby representing high-risk areas for both biodiversity and NCP. Preserving these high-risk regions could reduce habitat loss and human-induced extinctions, safeguarding ecosystems that provide essential contributions to humanity such as water regulation and mitigation of extreme fires. These regions could represent priority areas for policy and management intervention, including sustainable land-use policy and climate adaptation actions, which would benefit people and biodiversity.

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ID: 493

Dependency of people on land influences invasive plant cover in rural Galapagos

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The Galapagos Islands, known for their unique biodiversity, are facing a significant threat to their ecosystems from invasive plants, particularly in the highlands. The impact of invasive plant cover is expected to be influenced by rural socio-economic factors, but research on this interaction has been limited. Through stakeholder surveys, spatial and statistical analyses, we identified socio-economic groups and factors that explain invasive plant cover variation in the rural areas of two islands. A conceptual framework was developed to outline the expected relationship between socio-economic factors and invasive plant control. Four distinct actor groups were identified based on economic capacity and potential interest in controlling invasive plants. We confirmed that higher-income groups, potentially more interested in controlling, had the lowest invasive plant cover on their lands. Factors influencing invasive plant cover variation were ranked, revealing that the economic sector of the landowner and the type of benefit obtained from the land played crucial roles. Farms dependent on agriculture or retirement payments had lower invasive plant cover, whereas higher cover was found in those dependent on tourism or the public sector. The study suggests that invasive plant cover in rural Galapagos is linked to livelihood dependence on the land.

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ID: 500

Ecologically-Informed Precision Conservation: A framework for increasing biodiversity in intensively managed agricultural landscapes

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Conservation actions are urgently needed to tackle biodiversity loss in agricultural landscapes. Production lands are usually heterogeneous and contain low-yield areas that can be set aside for biodiversity conservation without serious yield losses. Here, we introduce Ecologically-Informed Precision Conservation, a framework that integrates yield mapping and ecological theory to select the best areas to create new set-asides while ensuring high crop yields at the farm/landscape level. Long-term yield maps can be generated using globally available satellite data and basic information on field/farm crop yield from farmers. Ecological principles are then used to select the subset of areas with the highest potential for biodiversity conservation by prioritising those that increase connectivity, maximise habitat heterogeneity and decrease landscape grain size. The created non-crop habitats can be permanent and thus ensure biodiversity support over time. In addition, agricultural management efficiency can be enhanced by improving field shapes. The framework provides the basis for a practical, user-friendly tool that informs all interested stakeholders on how to rationalise existing agricultural landscapes using already-existing farming systems and available technologies. High cost-effectiveness from an economic and conservation perspective, along with the creation of heterogeneous non-crop habitats, make our framework a promising solution to re-design agricultural landscapes.

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ID: 513

Bridging genetics and behaviour: A southern white rhinoceros conservation project

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The southern white rhinoceros is a flagship species in conservation. Their genetic diversity is the lowest compared to other rhinoceros species. Further inbreeding may lead to reproductive problems and loss of adaptive flexibility, emphasizing the need for conservation efforts. However, deficient data on rhinoceros' reproductive behaviour and population genetics hinders putting the preservation of genetic variation into practice. The deficiency extends to understanding whether dispersal or kin recognition exists in this species and functions to prevent inbreeding. Dispersal involves moving and breeding away from the birth territory. In mammals, the males rather than females disperse. The second mechanism, kin recognition, increases the inclusive fitness of an individual if they adjust their behaviour toward close kin (i.e., favouring kin in social interactions, but avoiding mating with them). Recognizing kin requires cues encoding identity, such as acoustic signals. Here, we assess the genetic diversity of contemporary rhinoceros using whole genomes. We further predict how kinship affects dispersal and social structure in a wild population through social network analysis. Finally, we explore the potential of rhinoceros' calls for kin recognition, assessing their distinctiveness. The insights of our study can inform effective conservation strategies for the long-term survival of this threatened flagship species.

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ID: 518

Rediscovery of Paracoenia beckeri in the Acque Albule plain, Italy: implications for conservation and ecosystem restoration

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Recent surveys have led to the rediscovery of Paracoenia beckeri (Diptera, Ephydridae) in the Acque Albule plain, an important Italian travertine basin known for its active carbonate deposition. This discovery comes nearly six decades after the last record by Giordani Soika in 1956. The exclusive existence of Paracoenia beckeri in this unique carbonate-depositing habitat, despite its potential dispersal ability, underlines the ecological uniqueness of the Acque Albule plain. The ecological value of this area led to its designation as a Special Area of Conservation in 2019. However, the plain is under serious threat from travertine quarrying, thermal water exploitation and uncontrolled urbanisation, which have led to the destruction of suitable habitats for this and other peculiar species. Interestingly, the study finds that the flooded travertine quarries could play a crucial role in conservation, in fact they could be the key to restoring the ecosystem since they are undergoing rapid renaturation. This approach offers a novel and promising way of restoring ecosystems and highlights the importance of sustainable management practices. The study highlights the need for a balance between conservation and human activities, and provides a blueprint for similar ecosystems worldwide.

ID: 533

Few data, big questions. The challenge of wildlife research in a conflict-affected region of Venezuela

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Effective monitoring of biodiversity in human conflict-affected areas requires diverse analytical approaches to overcome data biases and incompleteness. In Venezuela's upland Amazon region, within Canaima National Park, our biodiversity monitoring initiated in 2015 faced interruption due to ongoing socio-economic crisis and a large-scale mining development plan in 2016, compromising both temporal and geographical monitoring extents and researcher security. Using a resource selection function model, we considered imperfect detectability, supplementing sub-optimal camera trap surveys with opportunistic off-camera records (animal tracks, direct sightings). Our approach aimed to (1) assess the value of additional occurrence records for accurately predicting wildlife resource use in perturbed areas and (2) provide recommendations to navigate security and budget constraints. Despite mixed results for restricted distribution species, adding data from poorly sampled areas improved inference and predictions for widespread species. Camera trap records together with other field observations allowed us to estimate responses of 17 species to deforestation, 15 to fire, and 13 to swidden agriculture. For researchers working in high-biodiversity sites in conflict-affected areas, we recommend detailed documentation of sampling effort, use of every possible source of occurrence records, diverse analytical methods and adherence to security protocols.

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ID: 534

A population model of European tree frog (hyla arborea) for management planning

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The European Tree Frog Hyla arborea is a Vulnerable to Critically Endangered species in Switzerland. The Swiss population of H. arborea has suffered from severe decline due to human-induced pollution and destruction of its habitat. Targeted conservation management, including habitat restoration and reintroduction, can help the recovery of the species, but planning requires specific knowledge about population dynamics. We constructed a stage-structured population model of H. arborea for management planning, and used it to simulate different release and harvesting strategies to allow (1) the foundation of a new viable population and (2) the persistence of the source population. Our results confirm that H. arborea is an r-strategist species, with the larval stage being the most populated age class and 2- and 3-year-old individuals having the highest reproductive value in a population. Our simulations show that the optimal strategy to meet our goals is to harvest and release 35 adult (3 year old) individuals form one source population or 15 adult individuals from multiple source populations. More research of the existing populations in nature must be done as well as restoration of the chosen reintroduction sites to ensure success of the planned conservation actions.

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ID: 542

Innovative management of grasslands by insect-friendly grazing for plants, insects and birds: the LIFEforBUGSandBIRDS project

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Agricultural intensification and land abandonment threaten farmland biodiversity long adapted to low-intensity agriculture in Europe. Newly emerging threats in grasslands also include the use of anti-worm veterinary drugs such as ivermectin, which can seriously damage grassland arthropod populations. The LIFEforBUGSandBIRDS project addresses these threats by re-establishing insect-friendly livestock grazing in a partly abandoned natural alkali and loess grassland complex in Kiskunság National Park (Hungary). The most important conservation actions are the restoration of grazing infrastructure, the implementation of insect-friendly (no ivermectin) grazing by sheep and cattle, the pre-management by cattle grazing, controlled burning and stalk crushing, the installment of artificial habitats for insects in conventionally grazed areas, and the control of invasive shrubs and non-desired game species. The project also carries out extensive monitoring and dissemination activities. We expect that insect-friendly grazing will be extended to 1,600 hectares, new drinking wells, summer folds and shepherd accommodations will be established, and a winter farm will be purchased and renovated. The dung insect community will re-establish, the nesting population of previously extinct bird species increases, the conservation status of protected species is improving, invasive shrubs and reeds are shrinking, and the population of non-desired game species is decreasing.

ID: 562

Recognizing the importance of near-home contact with nature for mental well-being based on the COVID-19 lockdown experience

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Urban landscape planning globally seeks a harmonious blend of urban development, biodiversity preservation, and human well-being. Our concise review, coupled with global Google Trends data analysis, underscores the pivotal role of daily nature interaction for mental health during the COVID-19 pandemic. Home-based activities like observing nature, gardening, and citizen science projects gained popularity during lockdowns, offering a pleasant distraction and preserving mental well-being. Examining 37 articles from 28 countries with a sample size of 114,466 individuals, our findings highlight the significance of accessible nature engagement. Google Trends reveals a surge in interest during lockdowns compared to the preceding five years. Recognizing the challenges faced by those confined to homes due to illness, childcare, or elderly care responsibilities, we propose that urban landscapes fostering easy access to small natural areas prove more beneficial for mental health than occasional visits to expansive nature parks. This perspective advocates for urban planning solutions that prioritize regular, effortless contact with nature for the well-being of individuals facing constraints on travel and outdoor activities.

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ID: 564

Protecting nest sites of European Pond Turtle (Emys orbicularis) in Ljubljana Moor in 2022 and 2023

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The European Pond Turtle (Emys orbicularis Linnaeus, 1785) is predominantly observed in marshes, ponds, and slow-flowing streams with rich vegetation. With an IUCN status of Near Threatened (NT), its population trend across Europe is exhibiting a decline. In Slovenia, it is classified as Endangered (EN). Within the northern part of Ljubljana Moor is a well-known population of this species, mostly found in man-made water canals among agricultural land. Because Ljubljana Moor is under the influence of agricultural intensification, this population is threatened mostly due to the destruction of nests which the turtles dig in the soil of agricultural fields to ensure optimal sun exposure. Since 2015, the Herpetological Society – Societas herpetologica slovenica has been monitoring gravid females and protecting nesting sites. Here, we focus on the outcomes of the last two annual projects. In 2022 we marked five gravid females with radiotelemetry transmitters and later discovered and protected five nesting sites. However, the 2023 project encountered challenges related to transmitters, weather conditions and nutrias. Only four gravid females large enough were successfully captured, and no nesting sites were located. The summer of 2023 was characterized by excessive rainfall and storms, leading to widespread flooding throughout Slovenia.

ID: 567

Multi-taxon biodiversity and ecological indicators in urban and peri-urban forests. A preliminary approach in central Italy

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Cities accommodate most of the global population making urban environment one of the most impacted by anthropogenic activities. The monitoring of biodiversity indicators in urban areas is therefore a sensible topic that generates significant interest. Even in an urban environment the approach the multi-taxon approach is frequently applied to correlate specific forest characteristics useful for management and conservation practices.

The aim of this work was to examine interrelated biodiversity indicators in urban environments in three Italian cities, differing in spatial, environmental, and social dimensions (Campobasso, Florence, and Rome).

In each city, four forest sites were selected were selected along an urban to rural gradient. In each area, field works were carried out into 15 circular plots with a radius of 13 m. In each plot, we collected data to derive biodiversity indicators related to stand structure, deadwood, tree-related microhabitats, beetles, and birds.

We analyzed the stand structural indicators, the amount and types of deadwood components, and the microhabitat occurrence, evaluating their impact on the abundance, distribution, and diversification of beetles, and the bird fauna.

The study was carried out within the Project “National Biodiversity Future Center - NBFC”.

ID: 574

Monitoring and managing bat communities in forest ecosystems: an overview of the LIFE SPAN project

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The LIFE SPAN project in the Cansiglio forest aims to promote forest ecosystem resilience and biodiversity conservation by mitigating the negative effects of traditional forest management. Through different silvicultural practices such as pollarding, basal slits creation, girdling, uprooting, tree cavity creation, thinning and gaps creations, is encouraged the presence of target species sensitive to anthropogenic pressure, like saproxylic taxa, birds, and bats.

Despite bats' role as providers of important ecosystem services, few studies exist on their conservation in forest environments, many of these focused on individual threatened species. To detect differences in bat communities in relation to forest management, passive acoustic sampling is being conducted by using a song meter mini bat detector.

Currently, 29 bat species belonging to four distinct families have been detected. The highest species richness was found in gap areas, followed by thinning areas and tree cavity creation areas. In addition, individuals of endangered species were detected, including the barbastelle bat (Barbastella barbastellus) and the lesser horseshoe bat (Rhinolophus hipposideros). Furthermore, the ongoing LIFE SPAN project is verifying the trade off between different forest ecosystem services and forest biodiversity conservation.

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ID: 577

Monitoring the effects of anthropogenic pressures on biodiversity: a multitaxonomic approach

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The combined pressures of anthropogenic activities request rapid assessments of environmental impacts to develop strategies for sustainable management and biodiversity conservation. This study specifically addresses the imperative to investigate the potential consequences of anthropogenic impacts in the upper Agri Valley (Basilicata, Italy) by employing a multi-taxonomic analysis to understand spatial dynamics and species responses to these pressures. We assessed the relationship between the presence of the industrial hub, the primary sector, and taxa diversity. Additionally, we used biological traits to discern the degree of species specialisation and determine common characteristics among taxa to disentangle the potential association of these traits with an extremely anthropized environment characterised by high levels of anthropogenic disturbance resulting from extraction activities. We catalogued 153 diverse species, forming a valuable baseline for local biodiversity understanding. Statistical analyses identified industrial hub proximity as the most important variable influencing species richness, revealing a proportional relationship between industrial activities and biodiversity. Road infrastructures showed a slighter influence on species richness. Biological traits analysis indicates a prevalence of generalist species in the proximity of anthropogenically disturbed areas. In light of our findings, we recommend including in-depth investigations, consideration of additional variables, and long-term monitoring for effective biodiversity conservation measures.

ID: 597

Delineating species-specific targets to extend the network of protected areas in Europe using favourable reference ranges (FRRs) as benchmarks

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The 2030 EU Biodiversity Strategy aims to safeguard 30% of land and establish a transnational nature network. The focus extends beyond reducing the extent of human domination on landscapes; it also emphasizes the strategic placement of protected areas. Crucially, EU member states are mandated to routinely update on the Favorable Reference Range (FRR), a target range extent to ensure ecological variations across a species' distribution within a bioregion thereby promoting species long-term survival. A key conservation objective in the EU for this decade thus involves projecting the network of protected areas to maximize the protection of species distribution in reference to the estimated FRRs. However, FRRs are still missing for many species and no general framework for their estimation is in place.

In this study, as part of the NaturaConnect Consortium, we propose a framework to standardize the estimation of FRRs based on the available information to date. To present the data, we calculate targets of protected areas extension per member state in reference to the current species range, the species distribution according to IUCN, and the estimated FRRs. We focused on >300 species of mammals, birds, reptiles, and amphibians listed in the Habitats (92/43/EEC) and Birds Directives (79/409/EEC).

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ID: 601

Sexual dimorphism in mitochondrial aerobic respiration during breeding fasts in king penguins

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The Southern Ocean is threatened by the impacts of climate change, including sea ice retreat and changes in prey distribution, both impacting seabirds foraging trips: shifting southwards with an increase in foraging costs. For many seabirds, the breeding cycle encompasses an alternation of foraging periods at sea and fasting periods on land, and the success and coordination of both stages influences parental, but also the offspring's survival and fitness. Because of their extended fasts, king penguins have been largely studied when it comes to studying fasting. Yet, the ability and efficiency to convert metabolic substrates into energy at a cellular-level remain poorly studied, while this knowledge would help understanding how biochemical constraints at a cellular-level shape the individual performance across fasting. Here, we investigate how mitochondrial metabolism varies in response to fasting in male and female king penguins. We collected blood samples and measured mitochondrial metabolism in the beginning (3-days) and at the end (10-days) of their natural egg-incubation fast. Mitochondrial metabolism was higher in female king penguins at any stage of fasting, while the efficiency of mitochondrial metabolism decreased in males across fasting. These results provide a novel insight for this species, for which females are underrepresented in ecophysiology.

ID: 604

Parent-offspring interactions and development of Eurasian Hoopoes (Upupa Epops) during the post-fledging period

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The post-fledging period is a critical stage in avian life history as survival rates are particularly low. However, investigations looking at how young birds develop and how they interact with their parents have so far mainly focused on the nestling period, and the behavioral development of fledglings has thus been neglected. Here, we use radio-tracking combined with observational assays to study the interactions and development of N = 15 fledgling Eurasian Hoopoes, Upupa epops, during 1-3 weeks after leaving the nest. Our results reveal that foraging rate increases ($\beta = 0.6368$, p-value < 0.01) and parental provisioning rate decreases ($\beta = -0.0004615$, p-value < 0.01) with fledgling age. Furthermore, we found evidence for the prevalent importance of semi-open habitats for the development of the foraging skills in the young birds. While our results provide information about how parental care may influence the development of the skills of the young, they do not provide any information about how it may influence survival. Future work will thus be needed to link survival with behavioral development, and to understand whether behavioral development of the young is driven by the intensity of interactions with their parents.

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ID: 607

Insect-friendly grazing to counter the negative impacts of ivermectin on grassland biodiversity and ecosystem services

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The decline of arthropods, and insects in particular, is an emerging global concern. Among the many reasons discussed and studied, anthelmintic (anti-worm) veterinary drugs, and ivermectins in particular, are rarely mentioned. First, we review the evidence on the negative impacts of ivermectins on grassland arthropod diversity. So far dozens of studies have found such negative effects on dung beetles and other arthropods in laboratory and field experiments. Recent field studies also found that prolonged exposure to ivermectins reduces the number of arthropod species and individuals and undermines ecosystem services, such as dung decomposition, that are central in grassland ecosystem functioning. Second, we describe insect-friendly grazing as a potential solution to avoid the negative effects of ivermectins in grasslands. We also present a recently launched conservation project that aims to develop, implement and replicate insect-friendly grazing as a solution to the ivermectin problem in grasslands grazed by cattle and sheep. The project applies ivermectin-free grazing, works with farmers to co-manage land, experiments with artificial installations for insects in conventionally grazed areas and conducts various activities to draw attention to the problem and its solutions. Knowledge from the project will be essential in improving the conservation status of imperiled grasslands in Europe.

ID: 609

Species of the Habitats Directive - how dependent they are on the protection of forest habitats of European Union importance

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The efficient use of forest land and its distribution for production, social and nature conservation purposes are being discussed more and more often. Relatively little has been discussed about the effective use of the areas set aside for nature conservation for the conservation of biological diversity. In practical nature conservation in Latvia, it is emphasized that the habitats of the European Union (hereinafter - EU) also ensure the conservation of species.

The aim of the study is to assess to what extent species conservation can be ensured by the conservation of habitats of EU importance and to assess whether the rapid assessment method used in the study provides sufficiently accurate information. Species with a relatively wide distribution and a relatively large number of localities were selected for the study.

Pulsatilla patens. In EU habitats, 42% of registrations were found in five habitats of EU significance, most often 9060 Coniferous forests on, or connected to, glaciofluvial eskers and 9010* Western Taiga. Data on Cypripedium calceolus, Dianthus arenarius, Diphasiastrum spp. and Osmoderma barnabita were also analyzed.

The results of the study show that species have different relationships with EU habitats, however, in general, a relatively large number of registrations are outside them.

ID: 616

From the sky to the ground: exploring the stray dog issue in Puerto Deseado, Argentina

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Domestic dogs rank among the top five invasive animal species due to their adaptability and broad ecological niche. The study was conducted in Puerto Deseado, a city in Santa Cruz province, Argentina, where a surge in human population during the '80s, driven by the fishing industry's growth, coupled with dogs being the country's most popular pet, resulted in an escalation of conflicts between dogs and local wildlife. The 2023 dog census in Puerto Deseado utilized CyberTracker on car transects and two drones, totaling 106 flights with 16 hours of manual flights. Drones collected 7,000 images, aiding in dog counting through orthomosaic processing. CyberTracker identified 923 stray dogs, while drones analysis reported 887 dogs (408 stray and 479 confined). The aerial perspective of drones, while limited by obstacles like trees and rooftops, uniquely captured confined dogs in yards. This, combined with ground methods, enhanced the collected information totaling 1402 dogs in an area of 451 ha. The synergy of ground-based and aerial methods not only enriches the data but also facilitates the understanding of the interactions between urban settlements, dog populations and wildlife.

ID: 618

Woody plant diversity on urban woodlands of an inner town of southern Italy (Campobasso)

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Urbanization, significantly alters plant diversity and ecosystem functioning inside built-up areas and also promotes the introduction and spread of non-native species [1]. In the context of the National Biodiversity Future Centre (NBFC) and the working group "Urban Biodiversity" (Spoke 5) we sampled and analyzed urban woodlands in a small-medium inland town taking Campobasso as a representative study case.

We sampled woody plants on 74 (10x10 m2) plots distributed following a random stratified protocol being the strata: a) a coarse forest fragmentation classification (1 km2 cells classified by cover and aggregation of green areas - national approach of NBFC) and, b) the main EUNIS forests classes mapped at 1:5000 by Carta della Natura [2]. For each strata we analyzed plant diversity and ecological indicators (moisture and nitrogen) [3] and soil disturbance indicators [4] and compared them by CWM (Community Weighted Mean) values.

Results highlighted that native species richness decreased from woodlands dominated by common native tree species (Quercus cerris, Q. pubescens, Q. frainetto) to ones dominated by alien tree species, and CWM soil ecological indicators of nitrogen and disturbance resulted signifincatively higher on alien-dominated woods.

The increased knowledge on urban plant diversity may support conservation efforts and enhance management planning.

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ID: 623

The role of agroecological intensification in meeting food production, sustainable livelihood, and conservation objectives in SE India

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Creating agricultural systems that meet human needs at minimal environmental cost is essential to achieving Nature Positive by 2030. 'Agroecological intensification' may be a key strategy, because it aims to deliver high yields by improving ecosystem services, creating agricultural landscapes less hostile to biodiversity but able to meet food demand in smaller areas, freeing space for natural habitat. In India, an example may be Zero-Budget Natural Farming (ZBNF). Using quasi-experimental designs, we investigate food production, livelihood, and conservation outcomes of the region-wide transition to ZBNF in Andhra Pradesh. ZBNF did not reduce yields but boosted economic profit by 214% on average. We also examine the impacts of small-scale native vegetation patches, showing that they have no net effect on yield at field or landscape scale. We survey wild bird communities in ZBNF, agrichemical, and forest landscapes, and present the impacts of ZBNF and native vegetation cover, at varying levels of landscape-scale agricultural productivity, on bird community integrity in relation to forests, and densities of individual bird species. Our study demonstrates the effectiveness of the world's largest agroecological transition in delivering high productivity with considerable livelihood benefits and potential for additional conservation benefits; information crucial to devising Nature Positive agricultural strategies.

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ID: 629

The role of species Red List assessment to set the conservation priorities at national level

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From 2021 till 2023 within the project LIFE FOR SPECIES "Threatened species in Latvia: improved knowledge, capacity, data, and awareness" (LIFE19 GIE/LV/000857) for the first time in Latvia extinction risk assessments were made for species of all taxonomic groups by the IUCN Red-List methodology. Of the 1607 assessed species more than 46 % (747) were classified as threatened. Simultaneously criteria were developed to update the national list of protected species. Each of the developed 11 criteria were weighted considering their importance for species conservation, species were evaluated against all criteria, and legal protection recommended only for species exceeding a certain threshold. For animals besides the international commitments, the national threat category was the most important criterion for inclusion in the list of protected species. For plants, lichens, and fungi the most important criteria were the national threat category and species connection with habitats in unfavorable conservation status. Such criteria as population conservation status, the regional threat category, the importance of the species local population at the European level, and the environmental services provided were less significant. In total 1020 species were selected for inclusion in the list of protected species.

ID: 634

Nesting behaviour of Steppe Birds in Catalonia

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Agricultural intensification and land use changes are the main threats to steppe birds causing habitat fragmentation or even a complete habitat loss. Spain is a hotspot for steppe birds relying on open landscapes and grasslands that are characteristic for steppe ecosystems. Understanding the factors that impact nest success and predation rates is essential for the conservation and management of these bird species. We investigated the nesting dynamics and predation outcomes of two steppe specialist birds, the Thekla's lark (Galerida theklae) and the Mediterranean short-toed lark (Alaudala rufescens) in Lleida, NW Spain. We monitored 13 nests over a seven-week period. 4 out of 5 (80%) nests of A. rufescens and 2 out of 8 (25%) nests of G. theklae hatched successfully. Five nests were predated by five different reptile, bird and mammal predators. The observed predation rate is in line with previous studies for similar species, showing the challenges faced by these steppe specialist birds. This study highlights the need for sustainable land management and careful planning, especially for expanding renewable energy infrastructure, to avoid further degrading the precarious reproductive success of these species.

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ID: 642

Fingerprinting snow tracks of three large carnivore species: individual genotyping from eDNA to enhance wildlife non-invasive genetics

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Continued advancements in environmental DNA (eDNA) research have made it possible to access intraspecific variation from eDNA, opening new opportunities to expand non-invasive genetic studies of wildlife populations. We will present successful individual genotyping of eDNA obtained from snow tracks of three large carnivores: brown bear (Ursus arctos), Eurorasian lynx (Lynx lynx) and wolf (Canis lupus). We extracted DNA using a protocol for isolating water eDNA and genotyped it using high-throughput sequencing (HTS) of newly developed short tandem repeats (STR) and, for brown bear a sex marker. The sequence data were analyzed using a bioinformatics pipeline. While individual genotypes were obtained for all species (44-71% success rate), genotyping performance differed among samples and species, and was higher for the brown bear (88% locus genotyping success). We will outline the workflow for snow track eDNA sampling and analysis, including guidelines for optimal STR marker development for HTS genotyping. We will then discuss our results in relation to field sampling and laboratory protocols, as well as the ecology of eDNA of the three species. Finally, we will provide

recommendations for application of the method in non-invasive wildlife genetics and more broadly to advance eDNA–based individual and population level studies.

Bibliography

molecular ecology, conservation genetics, wildlife ecology, large carnivores

ID: 643

Oral presentation

Select the symposium to which you were invited, if any: None

Keywords: biodiversity, conservation, policy, landscape ecology

Assessing the role of drivers behind the decline of biodiversity to inform management

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The significant loss of biodiversity caused by human activity leads us to look deeper into the causality of this decline to guide concrete measures to halt it. The decline of species may be related to the impact of the drivers of change on their key requirements.

The aim of this work is to unravel the relationship between changes in species distribution and the drivers impacting on species requirements to provide valuable information to improve management plans.

We compared changes in species distributions with changes in key requirements of the species using three methodological approaches using sensitivity information in an increasing gradient of complexity. First, using only information on changes their key requirements. Second, by incorporating information on the impacts of drivers of change on these requirements. Third, by weighting these impacts according to the function of those requirements (reproduction, shelter, and food). We hypothesize that species specificity will define the gradient of complexity of sensitivity information. We focused on changes in 11 open-area bird species between 2000 and 2020.

The methodology developed will allow us to make concrete attributions of the specific drivers that cause changes in the distribution of species considering their ecological specialisation to inform management.

ID: 645

Spatial ecology and habitat selection of translocated European bison in the Romanian Carpathians.

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European bison (Bison bonasus) are keystone species that have been reintroduced in the Romanian Carpathian Mountains. Understanding space use and habitat selection is key to the success and assessment of translocation projects and can inform similar initiatives in the future. We evaluated habitat selection and movement ecology of nine European bison translocated to Fagaras Mountains, Romania and fitted with GPS collars recording locations every 4 hours between April 2020 and September 2022 using Step-Selection Functions. We found that European bison habitat selection was influenced positively by topographical ruggedness, and negatively by ecosystem productivity during Winter, elevation, slope and distance to release sites. Terrain ruggedness was the most influential variable, suggesting that terrain heterogeneity is a key determinant of space use, with a preference for more fragmented landscapes. The interaction between terrain ruggedness and mixed forest cover also influenced selection, whereby mixed forest was selected for in areas with high topographic heterogeneity, but avoided when heterogeneity was low, such as in open pastures. Overall, our study is the first to assess the spatial ecology and habitat selection in a new European bison population (>50 animals introduced between 2020 and 2023) and provides guidelines for future rewilding translocations of an iconic species.

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ID: 646

A Communication Tool on the Reintroduced Mexican Wolves (Canis lupus baileyi).

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The intense campaigns to eradicate rabies and reduce livestock losses led Mexican Wolves to extinction in the wild by the late 1970s. For the recovery of the subspecies, a binational captive reproduction program was initiated with the only seven surviving specimens. The first wolves were reintroduced into the wild in the United States in 1998, and in Mexico until 2011. While wild populations have been growing, effectively managing Human-Wolf conflicts remains a significant challenge. Based on the protocols, specimens born in captivity that are candidates for release are vaccinated against various diseases and have a device for satellite monitoring of their location and movements. However, there are specimens born in the wild that have not received medication and whose distribution is not controlled. A proposal for a communication tool was developed that consists of a scale that provides key information on knowledge of the birth, vaccination, and location of wild specimens. The proposed scale, in addition to optimizing access to information about wild wolves, is also useful for the development of studies on social acceptance and perceptions, and for redesigning of management strategies.

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Research Project: Study and Management of the Human-Wolf Conflict in Mexico.

ID: 650

Restoration potential and vertical distribution of soil seed bank in wet meadows

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Habitat transformation and loss is considered the main driver of biodiversity loss worldwide. Soil seed bank, as one of the seed-based approaches in habitat restoration, can play an important role in re-establishing the native vegetation composition and structure of degraded ecosystems. The aim of our study was to examine the restoration potential of the soil seed bank in wetlands in Central Hungary. We studied the soil seed bank of wet meadows at four depths (0-10 cm, 10-30 cm, 30-50 cm, 50-70 cm). Seedling emergence method was used to detect germinable seed densities. We found that the seed bank of wet meadows had relatively high species richness and seed density. A large number of viable seeds was also found in deeper soil layers. Species with passive dispersal, less water requirement and larger seeds occurred in large abundance in the lower soil layers. The dominance of species without specialized spatial dispersal in the seed bank suggest that they invest more in temporal dispersal by soil seed bank. These characteristics of the soil seed bank can support vegetation recruitment. Our research suggests that the soil seed bank of the studied wet meadows can serve as a useful propagule pool for restoration projects.

ID: 666

Development of peat rehabilitation model for Sarawak Region

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Unsustainable management of peatlands could lead to serious environmental problems and managing the area is very challenging. This project aimed to convert the 50ha out of 400ha of unproductive ex-oil palm with a total of 30,000 seedlings cultivated on peatlands to its original ecosystem services in Bintulu, Sarawak. A holistic approach being carried out to ensure the success of the project including of peat survey investigation, research activities and tree planting programme. Soil investigation shows that the tropical peatland at the area appears flat on the ground, but elevation measurement reveals its uneven surfaces. A preliminary biodiversity assessment has been performed from local university, using various method such as life trap, mist netting, catch & release and visual observation. The assessment recorded 2 species of small mammal such as Maxomys rajah and fruit bats, 24 bird's species, box turtle represent reptile, 5 species amphibian, 31 insect species, 8 spiders and 8 species of freshwater fish. Whilst for flora assessment, only the adult trees with 5cm diameter at breast height (dbh) were measured. A total of 79 species of tree species were recorded at the estate and area close to the river buffer zone.

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ID: 668

Keywords: biodiversity, community ecology, population ecology

The role of tri-trophic interactions on resource diversity at the patch and landscape level: studies on a predator-rodent-seed system

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Greater diversity of resource species increases ecosystem stability. Although this pattern is recognised in ecology, it is important to further our understanding of the processes that maintain resource diversity. In this study we investigated how tri-trophic interactions affect local and regional diversity of a resource over time, using a tritrophic predator - rodent (consumer) – seed (resources) system. Using an experimental semi-wild system, we assessed how consumer density and behaviour influenced diversity at the resource level, using the novel DivGUD approach (Eccard et al. 2022), which measures diversity of resources on different landscape levels, after a consumer quits harvesting. We found that diversity at the resource level was affected by an indirect tri-trophic effect of predation on consumer behaviour. Resource communities in risky foraging microhabitats had higher local (alpha) diversity compared to those in safe foraging microhabitats. Regional diversity (gamma) remained independent of consumer density. Our results show that consumer decisions, that are affected by predation risk and/or consumer competition, can act as a mechanism determining species diversity on the resource level.

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ID: 669

Small-mammals community analysis to guide nature-based solutions (NBS) in functional urban ecosystems

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This study is part of Task 5.2 (Activity 5) of the National Biodiversity Future Center (funded by the National Recovery and Resilience Plan, EU) which aims to assess urban animal biodiversity at a national scale. In this study we focused on small mammals, an effective indicator taxon of environmental quality. We placed 436 hair-tubes within 52 1-km2 cells located along a green areas' fragmentation gradient in three Italian cities: Milan, Florence, Rome. The hair-tubes had different diameters and were placed both on the ground and on tree branches to sample species with different size and ecology. Plots were checked five times (June-November 2023) and multiple habitat variables were collected. Sampled hairs were analyzed under a microscope for species identification. Overall, we detected 13 species (Milan: 9, Florence: 10, Rome: 8), a number significantly higher than originally expected, of which one listed in Annex IV of the Habitats Directive. Advanced modeling techniques will be employed to identify key environmental and management factors of urban green-areas that influence the diversity and composition of small mammals' communities. The final output of the research will be the development of guidelines for the implementation/management of NBS to enhance and maintain biodiversity in functional urban ecosystems.

ID: 679

Temporal fluctuations in fish and phytoplankton assemblages in the coastal water of Busan, Korea: An eDNA metabarcoding approach

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The coastal waters of Busan, Korea exhibit complex oceanographic features, shaped by factors such as the variability of seasonal currents, thermal effluents from nuclear power facilities, and the influx of freshwater from inland sources, as well as other human-related activities. These factors contribute to the significant seasonal fluctuations observed in the regional fish populations, necessitating ongoing and methodical research. We conducted from June 2020 to November 2022, employed environmental DNA (eDNA) metabarcoding with MiFish and 23S rRNA gene primers, and successfully generated 499 fish ASVs and 194 species, in conjunction with 702 phytoplankton ASVs across 18 phyla and 73 taxa. Results revealed the formation of three primary fish assemblages corresponding to the winter, spring-summer, and autumn seasons. The phytoplankton populations underwent discernible seasonal shifts, with species like Micromonas bravo and Eunotia sp. Spearman correlation analysis was employed to evaluate the temperature sensitivity of fish and phytoplankton species exhibiting statistically significant correlations with water temperature. Despite this assessment, establishing a clear connection between the seasonal variations of fish and phytoplankton remains challenging. Nevertheless, this research emphasizes the efficacy of eDNA metabarcoding as an invasive and highly sensitive technique for monitoring biodiversity and marine ecosystems.

ID: 683

Satellite imagery machine learning-based analysis reveals a decadal expansion of seagrass meadows in protected lagoons.

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Seagrass meadows play a vital role for lagoon ecosystems, sustaining multiple ecosystem services. Their distribution are showing rapid shifts in relation to the ongoing global changes. Long term monitoring of species is, hence, important to understand the response to past and future scenarios. The availability of long term open-access satellite data together with the power of machine learning algorithms offers a unique perspective for studying seagrass community dynamics in shallow waters. In this study, multispectral seasonal images were used with a Random Forest algorithm to map over two decade the trends of seagrass meadows and individual species in the vast protected site of Grado and Marano lagoon (Northern Adriatic). The models were built using a large training dataset collected in 2010 (n = 426, accuracy of 92%) together with Landsat 5TM and 8OLI imagery and then applied from 1999 to 2019 images. Change detection analysis revealed a 14.16 km2 expansion (+ 39 %) of the seagrass community at a rate of 1.59 km2*year-1, shedding light on relative species movements over time. The observed expansion could suggest that conservation strategies have improved the habitat suitability, highlighting also an increasing seawater influence that is radically modifying Adriatic lagoons.

ID: 686

New genomic approaches for ex-situ conservation and management of the Asiatic lion (Panthera leo persica)

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The Asiatic lion (Panthera leo persica) is one of the most endangered large feline species on a global scale. Historically this subspecies was widespread over a wide geographic area, ranging from the Near East to the Indian subcontinent, but today the only population in the wild is confined around the Gir forest in the Indian state of Gujarat. Therefore, the Asiatic lion is ranked as Endangered in the IUCN Red List of Threatened Species. Ex-situ conservation plans have started to secure its survival and future. The main strategy adopted by the EAZA ex-situ conservation programme is to maintain a population of Asiatic lions in captivity, but currently, this approach is facing major reproductive issues. This project performed a population genomics analysis using whole genome sequencing (WGS), data obtained from 16 Asiatic lions from different European zoos. Moreover, these newly obtained sequences have been compared with other lion species (living and extinct) to determine genetic diversity. With these new sequences we were able to generate new genomic resources to contribute to the understanding of the evolutionary history of the lion species and produce a new tool useful for improving conservation efforts to protect the species in its full diversity.

ID: 697

Maternal effect reduces interspecific trait variability in Festuca vaginata, used for ecological restoration

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Seed transfer is regulated during restoration to avoid maladaptation of non-local genotypes. In the absence of genetic variation, plant traits can be proxies of measuring local adaptation. However, maternal effect that can be studied in the next generation might be responsible for inter-site trait differences. We previously investigated population traits of plants grown in common garden from seeds collected directly from the field and found significant differences among localities. In this study, we used a subset of the seeds produced by these plants to grow the second generation. The test species was Festuca vaginata from 19 locations in Hungary. We measured the emergence rate, above ground dry biomass and length of the longest leaf of the seedlings. We analyzed the effect of location on the traits for the first-generation plants and the offspring. We found significant differences of seedling emergence across locations in the first-generation but none in the offspring.

These results, together with the lack of pronounced genetic structure demonstrated by our RADseq-based genomic analysis, suggest an important maternal effect that faded in the second generation. We conclude that there is no need to restrict seed sourcing when using F. vaginata for species introduction in restoration projects in Hungary.

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ID: 700

Assessing invasion risks using EICAT-based expert elicitation: application to a conservation translocation

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Conservation translocations are widely used to recover threatened species, but can involve risks to the recipient environments. Because of limited data and uncertainty, risk assessments for such projects must rely on expert opinion, complicating decision making.

We developed a risk assessment protocol combining formal expert elicitation and the IUCN-recommended Environmental Impact Classification for Alien Taxa (EICAT), and applied our protocol to an extinct-in-the-wild bird, the sihek (Guam kingfisher). We elicited estimates of risk from multiple experts across five different candidate release sites. We aggregated estimates using different simulation-based and Bayesian approaches, with and without accounting for expert confidence.

Experts generally agreed that sihek introduction might pose risks to the recipient ecosystem through potential predation, competition and disease introduction, although they disagreed about the likely impact magnitudes. They identified one site with lower overall risk, which was then selected for further detailed ecological assessments and risk mitigation efforts.

The EICAT framework, with its standardized definitions, helped reduce the linguistic uncertainty and subjectivity common to expert-based assessments. Expressing judgments as probabilities allowed us to evaluate uncertainty transparently and to assess the weight of expert confidence on the overall risk estimation. Formal quantitative elicitation and aggregation allowed better communication with stakeholders.

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ID: 714

Observing parental care behavior of the critically endangered Red-headed vulture (Sarcogyps calvus) for conservation purposes

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Sarcogyps calvus is a critically endangered vulture species that requires ex-situ conservation efforts for its survival. This study aims to observe the behavior of the only breeding pair in Europe housed at Parco Natura Viva, Italy, to enhance our understanding of the species for conservation purposes. Continuous recording with focal animal sampling was used to collect the duration of behaviors of both the male and the female during the breeding seasons 2020 and 2021. Observation of 20 days of incubation period during the 2021 breeding season found that both the male and the female contribute to incubation, with variations in time allocation. Additionally, the research compared the behaviors of the vulture pair during the first 19 days of incubation of an infertile and a fertile egg, respectively in 2020 and 2021. Differences between the two incubation periods could indicate potential recognition of non-fertile eggs. Eventually, the initial seven days of chick rearing in both years were observed, revealing asymmetries between male and female involvement in chick rearing. Despite the need for further research to help establish an insurance population to preserve S. calvus from extinction, this study improves our knowledge of the breeding ethology of this critically endangered vulture.

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ID: 719

Collecting and mapping livestock data in Central Apennines: a standardised protocol

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Central Apennines are rich in biodiversity and host many endangered wildlife populations. Extensive livestock farming has traditionally played a primary role in the livelihood of local communities in this region. Yet, livestock can compete with wild mammal grazers, can alter the composition of natural ecosystems, and can increase the probability of zoonotic disease transmission from wildlife. Grazing data are essential for research on human-wildlife coexistence in Central Apennines, but acquiring such data is often hindered by a fragmented governance of the zootechnical sector. Here we developed a standardised protocol to collect livestock data in Abruzzo (Central Apennines). For 15 municipalities within our study area, we determined the number of grazing animals (i.e., sheep, goats, bovines, and equines) by extracting data from the National Data Bank. Then, we validated these data with farmer interviews and information about "fida-pascolo" - i.e. municipal lands entrusted to farmers for grazing - obtained from municipalities. We finally mapped livestock densities of the study area on a fine scale. Building these maps could be crucial for future works that aim to assess the spatial interaction between grazing cattle and wildlife on a local scale, investigating conservation strategies that can find a balance between people and nature.

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ID: 724

Through gaps and biases: limits and usefulness of synergistic standardised biodiversity datasets

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Location and palaeoceanographic history of the Mediterranean Sea make it a biodiversity hotspot, prompting extensive studies in this region. However, despite Mediterranean marine biodiversity being one of the best known in the world, a vast amount of distributional data for Mediterranean taxa are still scattered across various sources and formats, causing severe limits to their potential re-use. Retrieval of these data through a process of harmonisation could potentially support biodiversity research and conservation. In this project, we designed a pipeline to build a dataset representative of local biodiversity by integrating data from literature, natural history collections and citizen science, aiming to assess which biases may affect these data. Our dataset comprises over 40000 standardised point-occurrence records of Italian marine mollusc species. We assessed the contribution of each data source in outlining species distribution, uncovering different features in terms of taxonomic, temporal and spatial coverage. Results point out the limits of malacological biodiversity data collected so far. The availability of such synergistic datasets may help highlighting actual knowledge gaps, providing insights on how to adjust future data collections.

ID: 727

Distribution and ecological requirements of the native pond turtles (Emys orbicularis, E. trinacris) in Italy

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European and Sicilian pond turtles serve as pivotal surrogate species in reptile conservation, representing roles as flagships, sentinels, and focal species due to their inherently charismatic traits. Conservation organizations increasingly showcase these turtles on reserve logos, magazine covers, and in advertisements to secure funding and attention. Beyond their symbolic value, these turtles significantly contribute to wetland management research programs. Despite efforts to utilize them as a tool for safeguarding freshwater fauna and habitats, a lack of clear information persists regarding the distribution of European and Sicilian pond turtles and their relationship with environmental data. Limited and methodologically varied data, often confined to local scales, pose challenges for comprehensive understanding, hindering effective conservation planning. This research employs Species Distribution Modelling (SDM) to investigate the potential distributions and ecological requirements of native pond turtles on a national level in Italy. Reliable distribution data were obtained by combining information from the literature and personal communications with field herpetologists from iNaturalist. Environmental data were analysed using bioclimatic models previously employed in the literature. Identifying broad-scale ecological requirements for these species offers prospects for enhancing conservation strategies and protecting Italian wetlands.

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ID: 736

Anything changing? Assessing the status of the saproxylic beetle community in Cabañeros National Park (Spain) 12 years later

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Considering the ongoing environmental changes and habitat loss, monitoring insect species and communities over time and at local level is becoming increasingly urgent, especially in critical areas, such as Mediterranean forests.

Saproxylic beetles are strictly related to deadwood and decaying wood for their development, inhabiting a large variety of microhabitats. Some species present very specific ecological requirements, resulting in being highly susceptible to even small changes.

This given, we present the results from a study aimed at assessing potential shift in abundance, morphology and phenology over time in a saproxylic beetle community in the Cabañeros National Park (Spain), by comparing data collected in two one-year sampling campaigns (2009-2010 and 2021-2022).

Results showed changes in species abundance and body size for less than 20%. Moreover, the phenology pattern of some species differs between the two sampling years. These results suggest a shift in several biological traits within the saproxylic beetle community and have produced important insight for estimating the impact of ongoing changes to the biological communities and planning mitigation actions.

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ID: 741

The impact of livestock and human disturbance on mammal species occupancy in the central Apennines

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Anthropogenic disturbance, such as habitat fragmentation or degradation, can represent a threat to conservation as it can interfere with the natural behavioral and movement patterns of wildlife, resulting in reduced fitness for individuals. In this sense, the identification of disturbance causes is a valuable tool when it comes to estimating the persistence of animal populations and their management. Among these, livestock presence in natural environments is often an underestimated factor that can have important repercussions on habitat use of many wild species. For instance, excessive livestock grazing might lead to the competitive exclusion of herbivore species and interfere with carnivores' natural function, resulting in significant ecological imbalances in ecosystems. We collected livestock and human presence data in two ecological corridors of the Apennines, and placed camera traps to collect meso- and macro-mammals presence data. We then generated single-season and multi-species occupancy models (Unmarked R package) in order to evaluate natural and human drivers of wild animals occupancy. Although not all species considered responded in the same way to human pressure, livestock presence represented a statistically significant factor for habitat selection in some of them, with a tendency to avoid more grazed areas.

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ID: 742

Mediterranean oak forests response to extreme drought in the face of climate change.

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Mediterranean oak forests (MOFs) present huge interest in southern regions in Europe due to its multifunctional nature, specifically in Andalusia (Spain) where MOFs occupy almost half of the surface. Climatic change effects impact this ecosystem reducing their health and productivity in the last decades. We investigate MOFs response and resilience to an extreme event of drought (2017-2018) at a regional scale (Andalusia). We also analyze if the tree density (Dense, Meadow and Mixed) makes MOFs have different responses to drought. We calculate satellite-based remote sensing vegetation indices and productivity (e.g. NDVI and NDWI) variables to assess the resistance and recovery after the extreme drought event in multiple National Forest Inventory plots. We used generalized additive models and multi-model inference to understand which factors best explained drought responses. We anticipate a trade-off between drought resistance and recovery (maximum $r=-0.5$) and contrasting strategies across the climatic gradient of the study area. Our study shows that MOFs have contrasting drought response strategies and may be susceptible to extended legacy effects associated with extreme and/or recurring droughts. This work highlights the drought vulnerability of MOFs and emphasises the need for further studies on long-term resilience to droughts.

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ID: 743

How commercial video games could engage players with biodiversity conservation: a systematic map

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Tackling mass anthropogenic extinction demands global support. Reaching more than 3 billion players, commercial video games have been proposed as tools for conservation outreach. Although video games increasingly address ecological concerns and promote environmental activism, literature on this practice is disparate. In collaboration with key industry stakeholders, our systematic map is the first to explore how commercial video games are designed and deployed to engage players with biodiversity and conservation. To provide a comprehensive synthesis of available literature, we are performing searches in six languages across more than 20 sources, and will complement our results with a freely accessible online interactive database. Our systematic map has great informative and practical value for both conservationists and game developers. First, we will illustrate research findings, trends, clusters, and gaps, and highlight where more robust evidence is needed to better understand the role of commercial video games for conservation outreach. Subsequently, we will interrogate whether engagement with this media type merely distracts players from the natural world, or could motivate them to understand, appreciate, and protect it.

ID: 761

Macroecological modelling of small-scale phytodiversity patterns to help conserve Palaearctic grasslands

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Eurasian grasslands hold the world records for small-scale plant alpha-diversity, yet they are among the ecosystems most threatened by human impact. A better understanding of the patterns of this diversity and the factors that control it is key to their effective conservation. Local studies have not been able to derive general trends to explain patterns of grassland diversity across regions. One way to overcome this shortcoming is to make use of large data sets that cover a wide geographical area.

The GrassPlot database (https://edgg.org/databases/GrassPlot) collects vegetation plot data of grasslands (broadly defined) from the Palaearctic. GrassPlot contains nested plot series or data of eight standard grain sizes: 0.0001, 0.001, 0.01, 0.1, 1, 10, 100, 1,000 m². It also collects a wide range of in-situ measured environmental variables. It currently stores data for >200,000 georeferenced plots throughout the Palaearctic.

The aim of the present study is to determine the drivers of alpha-diversity of vascular plants, bryophytes and lichens in Palaearctic grasslands at different scales using data stored in GrassPlot, supplemented by environmental data retrieved from open access global databases. We included a wide range of topographic, climatic, edaphic, anthropogenic and historical parameters as predictors of richness in generalised linear mixed models.

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ID: 762

Spatiotemporal modelling of avian influenza in the UK identifies common targets for public health and conservation

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Avian influenza poses a major and growing threat to animal welfare, food security, and public health. In recent years there have been increasing numbers of outbreaks in Europe, where wild bird populations experienced influenza–associated mass mortality events. Also, sustained circulation of influenza A virus in wildlife raises serious concerns for the risk of emergence of zoonotic viral clades through viral reassortment. Here, we 1) implement a retrospective analysis to assess spatio-temporal patterns of influenza outbreaks in wild birds and 2) model the probability of viral sharing among wild birds and mammals in the UK. We compiled a dataset of time and point locations of infection reports in wildlife and used a set of explanatory covariates (including land-cover, livestock headcounts, and metrics of wildlife diversity) to predict areas where influenza outbreaks are more likely to occur. Then, by using host-phylogenetic similarity, geographical

overlap, and geospatial covariates, we predicted influenza sharing patterns within wild communities, highlighting hotspots of potential viral reassortment and emergence. In this way, we identified hotspots of influenza outbreaks and circulation in the UK, highlighting potential common targets between public health initiatives to anticipate zoonotic influenza emergence and conservation efforts to mitigate wildlife mortality under a One Health perspective.

ID: 774

On the right tracks - how tramway transport affects biodiversity

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Linear landscape elements such as transport infrastructures, mainly roads and railways, ambiguously influence many aspects of wildlife communities. The use of tramways in urban areas for mass transit has been suggested as having a lower environmental footprint, especially compared to the roads. However, to date, the impact of tramways and the surrounding infrastructure on biodiversity has been directly tested extremely rare, despite the potential ecological effects associated with this anthropogenic feature. We found less than 10 papers published on tramway-wildlife interactions, sometimes very general, which is a small drop (vs dozen of thousands) compared to other transportation ways. As tramways and stations may be managed in a sustainable way by planting short vegetation on the track and roofs of tramway stations, they may be good examples of land sharing policy in green urban planning, improving both biodiversity and people's well-being. In our opinion, research exploring the cons and pros of tramways for urban landscape wildlife is urgently needed. The potential environmental benefits of green practices on tramways, which are commercially available, should be strictly tested and applied, especially in the context of the growing popularity of tramway systems around the world.

ID: 780

Is plastic really fantastic? The comparison of artificial bee nests made of plastic and natural materials.

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The decline of pollinators is now a global problem. Various activities are undertaken to increase the biodiversity of pollinating insects, for example supporting nest sites for solitary bees. Some commercially offered artificial nest for solitary bees are made of plastic alongside to common natural materials like for example reed or wooden nests.

Because plastic pollution is a pervasive and growing problem, we tested the suitability of plastic nests of two types in comparison with common reed nests for solitary bee Osmia bicornis. Additionally, we estimated commercial availability of plastic and common reed nests in online shops.

We found that females of O. bicornis significantly more often established brood chambers in common natural materials compared to plastic ones. Also, survival and fat content were higher for O. bicornis developing in common reed nests. Contrary, sex ratio and mass of the broods were not affected by type of the nests. Our search of the Internet showed that plastic nests for solitary bees are offered worldwide, however availability of these products was lower compared to common reed nests.

Manufactures should test their products to deliver nest which are suitable for solitary bee preferences and which properties allow for the successful development of bees.

ID: 790

Impact of social information broadcasting on forest fragmentation and avian biodiversity

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Habitat fragmentation is nowadays considered to be one of the greatest biodiversity threats. However, there are few studies addressing how the different biodiversity metrics (taxonomic, phylogenetic and functional diversity) react to the habitat fragmentation when comparing one to another, and how the effects of habitat fragmentation could be mediated by the social public information. Our goal was to examine how biodiversity metrics of bird communities in forest patches change with the increasing isolation of those patches, and how those changes could be mediated by manipulating social information. We have inspected over 150 forest patches in Poland. For each bird community inhabiting a given patch, biodiversity metrics were calculated. After that we have conducted a large scale behavioral landscape experiment in those patches, where we have broadcasted a different types of social information (songs of similar species, voices of predators, neutral sounds etc.). Biodiversity metrics reacted in a different way to changing the values of parameters describing stand features and its isolation. Social information proved to be able to mediate the effects of patch size and isolation. Our research helps to understand the importance of individual patches of forest habitats in the farmland for the preservation of biodiversity.

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ID: 802

Plant-pollinator dynamics in a changing Arctic landscape

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In a changing Arctic environment characterized by limited pollen resources and an increasingly variable growing season, mapping plant-pollinator networks can reveal fundamental ecosystem properties and vulnerabilities, ultimately informing conservation considerations. Our project uses DNA metabarcoding of pollen collected on pollinators to examine the degree to which plant and pollinator diversity and network structure varies across different Arctic habitats and latitudes. By metabarcoding the pollen on individual pollinators, we will study network properties at both a species and individual level. We hypothesize that key generalist pollinator taxa will be shared among different habitats, and that most networks will reveal high levels of nestedness indicative of the variable and seasonal Arctic environment. With increasing latitude, we predict lower species diversity yet increased interaction diversity within networks, characterized by more individualized specializations within species and lower network modularity. Ultimately, the structure, composition, and degree of species and individual specialization within these Arctic networks will dictate their functional ability to exhibit resilience to future climate change.

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ID: 803

Alien plant species occurrence and cover in mediterranean mountains

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Alien plant species (APS) pose a significant threat to biodiversity, challenging the traditionally resistant mountain ecosystems with their unique ecological features [1]. Global change, particularly in the Mediterranean region, may compromise this resistance. Roads serve as preferred pathways for the dispersal of APS across elevation gradients [2]. In this study, we explored the impact of ecological characteristics and level of disturbance in native plant communities on APS spread in the Central Apennines (Italy).

We applied the MIREN protocol [3] in three massifs within protected areas (Gran Sasso and Monti della Laga National Park, Maiella National Park and Mt. Terminillo). We calculated community-weighted means for native plant communities, using species Ecological Indicator Values for Europe [4] and Disturbance Indicator Values [5], as predictors for the presence and cover of APS within a machine learning classification and regression framework.

Results showed increased APS presence near roads, facilitated by soil disturbance and the presence of warm- and light-adapted native communities. Conversely, APS cover correlated more with grazing pressure and the prevalence of nitrophilic communities. This study provides a baseline for understanding APS spread in Mediterranean mountain regions, offering ecological insights for facing the challenge of APS in protected areas in a changing climate.

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ID: 806

Metabarcoding relates Dead wood beetle diversity and land-use changes in the Peneda-Gêres National Park

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Metabarcoding offers a great opportunity for monitoring biodiversity while identifying species faster and more cost-effectively than current morphological identification.

We collected deadwood beetles using 70 window traps from 14 sampling sites across the northern part of the Peneda-Gerês National Park from May to August 2021. We collected a total of 43 136 individuals from 3 size categories. We identified morphologically 265 different morphospecies. We develop a metabarcoding pipeline with main aim to identify all OTUs by amplifying a short fragment of the mitochondrial COI gene. First, a reference COI library for insects in the Peneda-Gerês National Park is being created from the morphologically identified morphospecies and second, a metabarcoding library is prepared for the molecular identification of the bulk samples. Finally, we compare the sequences obtained form and create a list of OTUs that will be used to calculate the alpha and beta diversity within and between different habitat types, patch sizes and other biotic factors in this area.

ID: 811

The Scaling Challenge - an approach to help scale conservation impact

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The magnitude of the issues we collectively face in conservation – global loss of biodiversity, land-use change, invasive species, and climate change – means we cannot simply focus on individual projects and sites. Instead, we must take action more effectively across the larger range of program scales to address these issues globally. The Taking Conservation to Scale Learning Network has been working with real-world conservation programs to develop and test a framework for achieving impact at scale more systematically. In this poster, we will summarise our overall framework and share some key findings and lessons learned. We will present this through the lens of what we call 'The Scaling Challenge' using examples from various partners (including Birdlife, the Vulture Conservation Foundation, Conservation International, Rare, and Euronatur).

ID: 817

Impacts of Bombus terrestris terrestris on endemic Bombus xanthopus on Capraia Island (Tuscan Archipelago, Italy)

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Bumblebees are declining worldwide mostly due to land use, intensification of agriculture, climate change and the loss of suitable habitats (1). However, some species are reared and commercialized throughout Europe for pollination in greenhouses crops, and this practice led to introduction of allochthonous species and subspecies into new countries, determining the alteration of distribution ranges (2).

Since 2021 a survey of apoideo-fauna in the Tuscan Archipelago National Park was performed in order to implement a monitoring network of bees and increase the conservation knowledge status of these pollinators.

On Capraia Island only pure populations of B. xanthopus have been historically reported, while the last presence of B. t. terrestris dates back to 1917 and no hybrids between the two taxa have never been reported (3,4). During the survey 11 B. t. terrestris, 59 B. xanthopus and 94 hybrids were detected and captured. The occurrence of such hybrids is raising concern on the conservation of the endemic B. xanthopus of Capraia. For this reason future research on the spread mechanisms, the genetic origin and colonization pathways of B. t. terrestris on the island and the fertility status of hybrids should be investigated.

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ID: 832

Monitoring the reforestation of the Brazilian Atlantic Forest: from biodiversity hotspot to biodiversity "hope spot"

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The implementation of rewilding initiatives in forest areas is crucial for biodiversity recovery, particularly in biodiversity hotspots such as the Brazilian Atlantic Forest. This study compares different reforestation practices, including passive restoration, active reforestation with different native seedlings and eucalyptus plantations. Using an ecosystem approach, we estimated the level of biodiversity from tree and mammal diversity, collecting data through forest plots and camera traps, respectively. Furthermore, we applied linear regression models to investigate possible relationships between ecological variables such as biodiversity, above-ground tree biomass and altitude. Our results suggest that eucalyptus plantations are a simplified ecosystem, which supports lower biodiversity. In contrast, active reforestation with various native species achieved an ecological status comparable to that of naturally grown secondary forests, considerably reducing the time required for recovery. Our results also suggest that biomass increases at higher altitudes and confirmed a positive correlation between tree and mammal diversity. These results underscore the importance and potential of restoration efforts in recovering local biodiversity, contributing to the vision of a future where the Brazilian Atlantic Forest can be acknowledged as a biodiversity "hope spot".

ID: 840

Citizen Science and alien species detection and monitoring. An insight on the Central Adriatic coast

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Coasts are hotspots of biodiversity facing severe threats [1,2]. Effective conservation demands costly monitoring activities and, Citizen Science (CS), may aid them [3,4].

We explored the potential of CS for monitoring alien species on the Central Adriatic coast. We used the generalist iNaturalist project called Wild Coast (WCoast; 2020-2023) including sites of the Long Term Ecological Research (LTER) and the N2K networks as well as many protected areas.

Of the 2174 WCoast Research Grade records, 179 refer to aliens of 64 species.

Regarding Invasive Alien Plants (IAPs), we registered 91 records of 15 taxonomic families belonging to 28 species, coming from America (74%) and Africa (13%). Moreover, we gathered 15 records of IAPs of EU concern (Acacia saligna, Ailanthus altissima).

Regarding alien fauna, WCoast host 88 records of 36 species coming from Asia (35%), North (26%) and South America (18%). Insects is the most represented taxon (41%), followed by Mollusks (18%) and Reptiles (14%). Noticeable are the 17 records of species of EU concern (Myocastor coypus, Trachemys scripta, Gambusia holbrooki).

The generalist WCoast project detected and mapped a substantial number of non-native species highlighting the potential of CS for monitoring alien species distribution and spread in natural environments [5].

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ID: 844

Potential for evolutionary responses to climate change in the tropical tree species Dicorynia guianensis

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Rainforests play a pivotal role in sustaining life on Earth by delivering essential ecosystem services. Tropical rainforest regions worldwide face imminent threats of habitat and biodiversity loss due to agricultural development, mining, overexploitation of timber, and climate change. Preserving genetic diversity within tropical rainforest species is thus imperative for ensuring their continued adaptability and resilience in a changing world. Within the smaller context of French Guiana, the specters of climate change, affecting temperature and rainfall, pose unprecedented challenges to this ecosystem, including on the hyperdominant tree species, Dicorynia guianensis (Fabaceae), commonly known as Angelique. Genetic data suggest a strong differentiation of populations in the west of French Guiana and regionally variable population demographic histories. New genome resequencing data allows us to examine regional-scale genomic signatures of adaptation to climate and soil in this drought-sensitive species and to model genetics-informed distribution range projections under future climate regimes. High-throughput SSR-Seq data will provide further insights into the local-scale family structure which may explain differences among sites in colonization dynamics and in local-scale spatial genetic structure. Understanding genetic responses to climate will enable us to develop conservation strategies adapted to the challenges posed by future climate scenarios.

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ID: 854

Assessing the importance of landscape permeability variables in species distribution models

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Species assemble over space and time based on their ability to disperse to nearby patches. This dispersal is exponentially affected by human modification to the landscape both by shrinking species habitats, and by creating man-made structures that restrict species movement. To quantify this, our paper defines 'permeability' metrics of a landscape as the ratio of species dispersal geometries (area, shape-factor, direction etc.) from all initial points in a 250m resolution human-modified landscape compared to a theoretical maximum dispersal based on a homogenous landscape favourable for species movement. We further calculate the change in such metrics over time based on time-series of landcover information across the swiss plateau. Each metric and its time-series identify a different process of species range change i.e. shrinkage, amputation and fragmentation, due to decrease in landscape permeability over time. We calculate the metrics for forest, agriculture/grassland and wetlands species separately and for a temporal resolution of 10-15 years covering 120 years of landscape change based on historical and current landcover maps. We further test and show the empirical importance of these metrices for a wide range of species by using them in conjunction with established species distribution models.

ID: 859

Insect communities erode from extensive grasslands to intensively used farmland and urban areas

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In Europe, agricultural intensification and land-use change are causing a widespread decline in insect diversity, requiring an impact assessment of land-use practices. Butterflies and orthoptera are considered important ecological indicators for biodiversity, especially in grasslands, where human intervention is often both required to sustain their populations and cause of diversity loss.

Communities were compared on over 100 sites in seven land-use types in South Tyrol, Italy. These land-use types include extensive meadows and pastures, semi-intensive meadows, vineyards, arable land, settlements, and apple orchards. For butterflies, we found that high nature value (HNV) grasslands had higher diversity, more specialized and threatened communities compared to less diverse and generalist communities in all other land-use types. Butterfly community compositions varied across different land-use types and were influenced by plant-based indicator values and landscape metrics. Similar analyses are planned for orthopterans.

These evidences support the effectiveness of regional Agri-Environmental Measures and the general European conservation strategy, aiming to preserve HNV grasslands. Locally a dedicated subsidy program is recommended to conserve extensive pastures with suggestions to generally extensify grassland management. Finally, a more biodiversity-friendly the management of apple orchards and urban green spaces could significantly improve the conservation of the regional insect fauna.

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ID: 868

Acting against the biodiversity crisis - a classification framework for university strategy papers

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Life and its biodiversity are possibly unique characteristics of planet Earth. Humans are part of this diversity and at the same time responsible for a major loss of genetic variation, species, and habitats. Ecosystem functions and services are needed by humans and hence make it an important task to tackle the biodiversity crisis. In urban environments, as well as in all ecosystems, many anthropogenic global change factors coexist and interact with each other in a partly unforeseen manner. In the face of global change and its impacts on biodiversity, several universities and other public organizations have written strategy papers. These include practices for the protection and promotion of species, that aim to remove, reduce, mitigate, replace or modify various factors of global change. A framework for classifying these practices is proposed here. Strategies developed by various universities have been used to capture biodiversity positive practices, and we analyze these here. The addressed global change factors, their sources, and main target organisms are listed. We discuss whether biodiversity strategies target the global change factors mostly responsible for biodiversity loss and what efforts should be made in the future.

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ID: 877

Development of an integrated watershed fragility index to assess the cumulative effect of multiple stressors on freshwater fish and their habitat.

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The Watershed Fragility Index (WFI) is an innovative tool for assessing the cumulative impact of multiple stressors on freshwater fish and their habitats. Addressing limitations of existing assessment frameworks the WFI incorporates advanced spatial analysis and ecological modelling, notably Geographic Information Systems (GIS). This technology enables detailed mapping of environmental stressors, both spatially and temporally, crucial for understanding their collective effects on riverine ecosystems. Key to the WFI's innovation is the integration of fuzzy logic, which handles the inherent imprecision in ecological data, and the Analytic Hierarchy Process (AHP), which systematically evaluates and prioritizes various environmental stressors. These methodologies together provide a comprehensive and evidence-based assessment of watershed vulnerabilities, offering a deeper understanding of ecosystem fragilities. The WFI marks a significant contribution to conservation science, moving beyond traditional expert judgment-based assessments to a holistic approach. This tool enhances decision-making in conservation efforts, enabling targeted and effective strategies to protect key species and their habitats. The development of the WFI is a pivotal contribution to ecosystem vulnerability assessment, advocating for a comprehensive and integrated approach to addressing the complex challenges facing riverine ecosystems in the era of climate change.

ID: 880

The role of sexual selection and population structure moderating the effect of high temperatures on the reproductive success of a model insect species

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Understanding the ecological and evolutionary processes of adaptation is essential to assess the ability of populations to persist in the face of rapid environmental modifications associated with climate change. Sexual selection and population spatial structure (e.g., degree of fragmentation) are potential determinants of the individuals' ability to adapt to environmental stress, and they influence traits that shape reproductive success and the amount of genetic variation, thereby ultimately impacting population viability. Our study investigated the effects of unpredictable high temperatures on reproductive success in different seed beetle (Callosobruchus maculatus) populations undergoing different selection regimes. The experimental evolution program consisted of a 2 x 2 design (sexual selection x spatial population structure treatment). After 120 generations, temperature treatments were applied: a) constant low temperature (29oC), b) constant high temperature (36oC), c) fluctuating temperature (29oC and 36oC changed every day), d) random temperature (29oC and 36oC changed randomly every day). Constant high temperatures had a strong, significant negative effect on the number of eggs laid, and interestingly, groups with divergent evolutionary histories responded differently to constant and randomly varying high temperatures. Adult emergence success was negatively affected by constant and non-constant high temperatures but not by lineage.

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ID: 884

Preserving Hyblaean heritage: navigating conservation challenges in a dynamic landscape

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The traditional rural landscape of the Hyblaean Region (SE-Sicily) bears extraordinary cultural, ecological and aesthetic interest. It holds important archaeological sites, reflecting human interactions with the ecosystems over generations, and serves as a living record of traditional farming practices that have preserved through the centuries an extraordinary floristic richness and the integrity of natural dynamic processes.

At best these contexts are protected by landscape or archaeological conservation acts, because regulations and indices that apply strictly naturalistic criteria are poorly suitable to identify rural landscapes as conservation targets, because they are mostly based on the occurrence of rare habitats and species or on vegetation structure and data collectors tend to overlook rural areas.

To fill this gap, besides of collecting new data, efforts should be made to include criteria related to landscape heterogeneity and to the integrity of ecosystem dynamics in the naturalness evaluation indices. This is particularly important because current mitigation strategies and regulatory frameworks tend to identify forest vegetation as the maximum expression of naturalness in the area, with a clear risk for

the survival of cultural landscapes of great value, not only due to land abandonment but also to reckless interventions aimed at promoting the wood recovery.

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ID: 902

Factors influencing the formation of long-lasting kelo trees in the Finnish boreal forest

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Kelo trees, barkless, silver-colored dead-standing Scots pines are key structures in boreal natural forests that have been documented to last for centuries. While naturally prevalent, kelo trees' existence is at risk due to decreasing natural forests and increasing human impacts. Although their conservation importance is recognized, why some Scots pines develop into long-lasting structures is largely unknown. Our study aims to understand and identify factors leading to the formation of certain trees into kelo. We conducted field analysis across three geographically separated protected landscapes in Finland, focusing on 116 plots on different site types. We measured characteristics of altogether 3,048 dead pine trees, including DBH, height, and decay class. We sampled 941 trees for dendrochronological analysis, which involves measurement of tree ring widths and cross-dating. Utilizing the data from the different sites, tree characteristics, and growth histories, we will determine the age of the trees, identify the time of their death, and their lifetime growth patterns. We will then analyze the tree, stand, and landscape-level factors influencing the development of kelo trees in boreal forests. We expect the findings to contribute to the understanding of kelo formation, with the ultimate aim of restoring these structures to the managed boreal forests.

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ID: 905

Protecting British ancient woodlands from development-related pressures: research priorities and knowledge gaps

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Although considered 'irreplaceable' in scientific, cultural and policy contexts due to their high biodiversity and societal value, ancient woodlands in Britain remain highly fragmented and increasingly exposed to anthropogenic pressures. Up to date, policy-relevant evidence is needed to better protect these ecosystems from development-related activities such as farmland intensification, urban expansion and national infrastructure projects, yet significant knowledge gaps exist around individual and cumulative development impacts on woodland ecosystems. A multi-stakeholder research prioritization exercise and systematic map were used to identify knowledge gaps and research priorities which are discussed here. The research area ranked most highly by stakeholders by a considerable margin was the need to identify the appropriate buffer size and composition necessary to minimize development impacts. The systematic map of current evidence reveals a lack of empirical studies dedicated to development impacts on British woodland ecosystems. This underscores the importance of establishing a research agenda to further understand the vulnerability of ancient woodlands to growing urbanization. Findings are presented as an open access, interactive, online data visualisation tool. The results will guide the design of a field study to quantify the buffer properties required to ameliorate urban edge effects on invertebrate taxa and tree health in ancient woodlands.

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ID: 908

Individual variation in the development of Hungarian meadow viper behaviour

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The Hungarian meadow viper (Vipera ursinii rakosiensis) conservation program started captive breeding of the species in 2004. Over the past years altogether nearly 4900 vipers were born in the Hungarian Meadow Viper Conservation Centre and over 900 vipers were released to eleven habitats in Kiskunság and Fertő-Hanság National Parks in Hungary. As captive environment affect development of individual behavior and though future survival of reintroduced vipers, we decided to test different variables with the intention to fine-tune future captive breeding techniques. In a controlled study, post-release behavior in seminatural enclosure, origin and sex of the vipers and structural diversity of captive environment was tested on 48 juvenile vipers, representing 12 families. The vipers behavior was observed in a standardized way: recording their position, posture, external body tempterature every hour over the whole day at least once a week over a four week period. Consistency of individual behavior was tested by using R-statistic. We detected difference between sexes and various origins, showing slower adaptation to new environment by those who spent their early life stages in indoor conditions, and females tending to be slower in reacting to changing environmental conditions.

ID: 917

Biochemical and genomic characterization of a Silybum marianum L. germplasm collection

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Silybum marianum L. is a multipurpose crop native to the Mediterranean area mainly known for the hepatoprotective properties of seeds-derived silymarin. In the framework of the National Biodiversity Future Centre-spoke 3 (NBFC) project, the biodiversity of S. marianum was explored at both biochemical and genetic levels to improve the current knowledge of this species.

The current S. marianum ex-situ GenBank maintained at CREA-CI (Bologna, Italy) was expanded through de novo sampling conducted in Southern Italy between June and July 2023. A core collection of 63 lines was biochemically characterized for silymarin content via HPLC, revealing the predominance of chemotype B with silydianin as a major constituent, although some variability in the amount of each flavonolignan was observed within the collection. Thirty-one accessions were also deepened using the DArT technology. Principal component analysis (PCA) based on 2,409 high-quality markers revealed three distinctive groups that reflected their geographical origins. Interestingly, compared to other lines, Italian genotypes showed a divergent phenotypic distribution with higher values of palmitic and oleic acid but lower content of linoleic acid and total fatty acid. A high-quality genome sequencing project of a chemotype B is currently ongoing to boost genomic studies in this species.

ID: 918

Is herbivore’s diversity a factor of dung beetle’s diversity?

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Dung beetles play a decisive part in the degradation of organic matter, among other important ecosystem services. The different species can be generalists or specialized in the processing of different resources. Therefore, we tested the attractiveness of different resources and we hypothesized that higher diversity of herbivores induced a higher diversity of dung beetle’s species. To inventory dung beetles inside and outside a zoo, we used 64 pitfall traps, baited with different combinations of dung from herbivore species living in the respective areas. Herbivores inside the zoo were all fed with the same food. In total, 442 dung beetles belonging to 18 species were inventoried. The most abundant species was Onthophagus vacca. Insects were scarce outside of the zoo (N = 31). Zebra’s dung was significantly

more attractive than the bovine's or ostrich's feces. The observed dung beetles' feeding preferences for equids, contrasting with previous studies, might result from pressures of selection induced by the long-term presence of the zoo in an area poor in available trophic resources. Thus, zoos play a decisive part in native dung beetle species' conservation, and should act on herbivore's density or variation of habitats, more than herbivore's diversity.

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ID: 926

Best practices for genetic indicator estimation from DNA-based data

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The 2022 Kunming-Montreal Global Biodiversity Framework (GBF) of the Convention on Biological Diversity recognized the protection of genetic diversity (GD) as a major objective for biodiversity conservation. To monitor GD for the GBF, genetic indicators have been proposed, including an effective population size above 500 (Ne>500) as an indicator for a healthy evolutionary status and adaptive potential.

Numerous DNA datasets have recently been published due to increasingly cost-effective DNA sequencing technologies and enhanced collaborations between researchers and conservation practitioners. These datasets allow estimating GD within and across species. However, Ne estimates from DNA data are sensitive to species features including population spatial genetic structure and life history traits such as reproductive system or life span, sampling designs and estimation methods.

The general aim of my PhD is to use both simulations and existing empirical datasets to perform sensitivity analyses for GD estimation. I will select DNA reference datasets representative of contrasted evolutionary histories, biological and data features to explore how their properties impact Ne estimates and will conduct simulations mimicking some of these features. This approach will eventually provide standardized workflows for robust sampling, molecular and statistical procedures, and best practices for reliable estimation of Ne to support conservation managers.

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ID: 953

Conservation status of the endemic blind mole rat species of the Pannonian region

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The most recent phylogenetic study of the European lesser blind mole rats evidenced the existence of two endemic species in the Pannonian region (Central Europe) and the presence of a third species (samples of which were not included in previous studies) is highly possible. Accordingly, three species of the Nannospalax genus, namely the Vojvodina (N. montanosyrmiensis), the Hungarian (N. hungaricus) and the Srem blind mole rat (N. syrmiensis) occur in the Pannonian region. We reviewed the conservation status of these three species by compiling all data available in scientific papers and in research reports. Particular attention was paid to the distribution of the species, the number of existing populations and the extent of their habitats, the existence or absence of legal protection and the threatening factors. In line with the revised taxonomy, based on the criteria and categories of the IUCN Red List we propose renewed assessments for each of species. All of them were found to be highly endangered, with reduced population sizes, small numbers of individuals, severe and persistent threats, and a lack of legal protection for their critical habitats. Significant conservation efforts are needed if these important components of Europe's biodiversity are to be preserved.

ID: 955

Spatio-temporal dynamics of free-ranging cats on a subtropical oceanic island

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Free-ranging cats (Felis catus) are one of the top 100 worst invasive species globally, with their impacts being keenly felt in island ecosystems. Whilst there has been an increase in scientific literature documenting the ecology of free-ranging cats, little is known about their temporal dynamics and there is a significant lack of longer-term studies of cat density and abundance. This study used camera traps to assess the abundance and activity of free-ranging cats on the subtropical oceanic island of Madeira, Portugal in 2021 and 2023. For a total of 1170 trap-nights, we used SECR analysis to estimate a density of 1.6 cats per km2, representing an increase of 0.2 cats per km2 between study periods. A landscape-scale analysis showed that the dependency of cats on human food subsidies had changed between study periods, further illustrated by a Model Consistency Index (MCI) of 50%. These findings should be viewed as evidence for the dynamic nature of temporal cat ecology on subtropical oceanic islands, highlighting the need for continued study in these ecosystems.

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ID: 958

Stronger and more positive effects of fragmentation per se on patch occupancy in landscapes with higher matrix quality and lower matrix heterogeneity

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Habitat fragmentation per se - independent of habitat amount - often increases patch occupancy, possibly because patches are closer together, increasing dispersal. Here, we ask whether this effect is influenced by the quality and/or heterogeneity of the landscape matrix. High-quality matrices should intensify the positive effects of fragmentation per se by reducing dispersal mortality. In contrast, when the matrix is hostile, high dispersal mortality should lead to fewer colonisations, and accumulation of extinctions across the smaller patches in a more-fragmented landscape could lead to negative effects of fragmentation per se. Additionally, matrix heterogeneity could obscure fragmentation effects, as the link between habitat spatial distribution and between-patch dispersal becomes less predictable. We use Glanville fritillary butterfly (Melitaea cinxia) occupancy data for 4,291 habitat patches in the Åland Islands, Finland. Our predictions were mostly supported. Fragmentation effects were more strongly positive in less hostile matrices; however, we did not see the predicted negative effect of fragmentation in landscapes with a hostile matrix. As predicted, fragmentation effects were weaker in landscapes with a more heterogeneous matrix. Our findings may explain why fragmentation effects are often weak. They also suggest considering matrix quality and heterogeneity when interpreting effects of habitat configuration on species distributions.

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ID: 963

Decisive conservation action in areas beyond national jurisdiction is urgently required for seabird recovery in the face of global change

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Areas beyond national jurisdiction, or the high seas, are vital to life on Earth. However, the conservation of these areas, for example, through area-based management tools (ABMTs), is challenging, particularly when accounting for global change. Using decision science, integrated population models, and a Critically Endangered seabird (Kuaka; Pelecanoides whenuahouensis) as a case study, we evaluated potential ABMTs in the high seas under global change and different governance structures, while accounting for uncertainty and imperfect compliance. Our study highlighted that global change in these areas will likely cause population declines of ~60% by 2050. However, decisive conservation action could cost-effectively address predicted declines, particularly when implemented as soon as possible and under the Biodiversity Beyond National Jurisdiction Treaty. We illustrate how decision science can transparently navigate a complex seascape of management decisions and we advocate for its wider integration in the management of the largest sections of our planet, the high seas.

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ID: 985

Mind the gap: different forms of Integrity undermine the conservation of terrestrial ecosystems under the post-2020 Global Biodiversity Framework

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With its Target 1 of the post-2020 Global Biodiversity Framework, the international community committed to retain the remaining ecosystems of high-ecological-integrity. Monitoring progress towards this target require to adopt suitable indicators. In this study, we analysed how existing measures of integrity can shape priorities in conservation by overlaying nine global maps of terrestrial-ecological-integrity. Additionally, we assessed how different dimensions of integrity (structure, composition, and function) are represented within these frameworks. Notably, structural-integrity is the most represented dimension (5 maps), followed by compositional-integrity (4 maps), whereas global measures of functional-integrity remain unavailable. Although 73% of terrestrial surface hold conservation value according to at least one map, a mere fraction (<1%) attains high-ecological-integrity across all maps. Solely relying on one integrity measure as an indicator for Target 1 poses the risk of underestimating the integrity value of at least 41 million square kilometres, while potentially overestimating the ecological role of certain regions. However, when used in combination, complementary dimensions of integrity identify a priority area encompassing more than 41.1% of the terrestrial surface. The synergetic use of existing structural and compositional measures can effectively guide conservation action to protect the integrity of terrestrial ecosystems, while we work to develop indicators of functional-integrity.

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ID: 988

Influence of temperature, pH and salinity on the biometry and skeletal properties of the Adriatic clam Chamelea gallina

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Climate change driven mainly by human activities is causing an increase of temperature and acidification in oceans with negative effects on marine ecosystems. Understanding how marine organisms may respond to environmental changings is crucial when considering future predictions. The Mediterranean clam Chamelea gallina was used in this study as a model organism to investigate the complex interactions of temperature, pH and salinity on its shell biometry and skeletal parameters. Clams of commercial size were exposed for 21 days to eight different treatments resulting from the combination of two temperatures (18 and 22 °C), two pH levels (8 and 7.9) and two salinity levels (35 and 32). During the experiment, the daily mortality rate was assessed, and it resulted to be higher in clams reared in low pH and warm temperature. Despite the short-term exposure, reduced pH and increased temperature and salinity negatively influenced porosity and bulk density by making less dense and more porous shells. Our findings revealed that climate change is likely to affect the health and survival of this species, with significant economic implications for fisheries in the Adriatic Sea, potentially reducing its economic value.

ID: 1008

Reliability of data collected by volunteers: a nine-year citizen science study in the Red Sea

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The quality of data collected by volunteers in citizen science programs is crucial to render them valid for implementing environmental resources management and protection plans. The present study assessed the reliability of data collected by non- professional volunteers during the citizen science project Scuba Tourism for the Environment (STE), carried out in the Red Sea between 2007 and 2015. STE involved 16,164 volunteer recreational divers in data collection on marine biodiversity using a recreational citizen science approach. Through a specifically designed questionnaire, volunteers indicated which of seventy-two marine taxa surveyed were observed during their dive, giving an estimate of their abundance. To evaluate the validity of the collected data, a reference researcher randomly dove with the volunteers and filled in the project questionnaire separately. Correlation analyses between reference diver and volunteer records were performed on 513 validation trials, testing 3,138 volunteers. Data reliability was analyzed through 7 parameters. Overall results confirmed that the recreational citizen science approach can effectively provide reliable data for biodiversity monitoring. The use of a recreational approach enhances volunteer participation in citizen science projects, thus increasing the amount of sufficiently reliable data collected in a reduced time.

ID: 1014

"Medium-size mammals as selected prey for wolf pups living in a human-modified landscape in central Italy"

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In Italy the diet of adult wolves has been widely studied and shown that it is quite diversified and is mainly based on wild ungulates, without excluding other source of alimentation due to the great adaptation of the wolf to more anthropized ecological conditions. Conversely, wolf pups diet has been poorly investigated and no study has been yet performed in Italy. The aim of this work was to preliminarily assess which prey categories are more consumed by pups and if a selective provision of food is operated by adults.

Overall, 55 pup scats and 132 adult wolf scats were tested from samples collected from 2018 to 2021 in a suburban area in the lower Pisan hills in Tuscany, Italy. Results obtained showed that wild ungulates resulted to be the main prey category in pups diet as for adults. However occurred a selective provision of medium-size mammals (hare and coypu) and birds prey categories for pups by adults. Further investigation to assess the importance of these prey species for pups survival are desirable.

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ID: 1015

Policy brief – Introducing agro-environmental measures in Serbia

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Serbia has implemented significant agricultural reforms, but addressing environmental issues in farming remains challenging. Eco-friendly farming programs are not fully implemented, and the country is taking initial steps towards incorporating agroecological measures (AEM) into its agricultural policy. Research in the Bačka district of Vojvodina assesses AEM options in Serbia, focusing on understanding farmers' choices and the environmental impact of five common European AEM. The study utilizes agent-based models linked to farm data and

remote sensing to simulate scenarios of AEM adoption. It further included economic, biophysical, and biodiversity models to quantify the impact of AEM on ecosystem services and precisely compare scenarios. Recommendations include introducing simpler AEM aligned with local practices, providing unique support for small farms, and securing long-term contracts to encourage positive farmer responses while benefiting the environment through, for example, open grassland elements preservation. This approach aims to balance environmental sustainability with the challenges of farmers' inexperience and the still unfavorable economic status in Serbia.

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ID: 1016

Roadless areas as an effective strategy for protected areas expansion: Evidence from China

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The post-2020 global biodiversity framework aims to expand the global coverage of protected areas (and other effective area-based conservation measures) to 30% by 2030. Roadless areas are ecologically important and can play a role in achieving this target but lack explicit emphasis in conservation frameworks. Here, we develop a framework to identify roadless areas suitable for protected area expansion in China. It is estimated that 53% of China’s territory remains roadless, 78% of which is unprotected. Although roadless areas are rapidly diminishing, we demonstrate they encompass higher conservation value than existing protected areas. We propose 4 strategies for selecting roadless areas that can contribute to achieving 30% national protection, based on different value propositions. These strategies make roadless areas contribute to existing protected areas in terms of reducing human disturbance, improving spatial imbalances, and increasing species representation. However, protecting roadless areas would also generate social trade-offs between protection demands objectives and economic growth generated from roads, especially in the surroundings of Sichuan Basin and major urban agglomerations.

ID: 1018

Seven years of Italian hare, Lepus corsicanus, monitoring in Sicily

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A successful wildlife management requires monitoring. The Italian hare, Lepus corsicanus, is an endemic species of central-southern Italy and Sicily, of conservation and hunting interest. From 2017-2023 the Italian Hunting Federation promoted a monitoring program in Sicily, through spot-light census, a simple and cost-effective method, suitable to be applied on a large scale and long periods by educated laypeople. 152 volunteers were trained for monitoring activities. The activity progressively involved 3-15 out of 18 ATCs – Hunting grounds - and was carried out at the end of summer. On average, 39 sample transects per year were monitored (min. 27, max. 76), of 7.28 km per transect (±4.83) and 287.22 km traveled per year (min. 179.80, max. 551.94). We calculated the kilometric abundance index (KAI) considering the hares seen on a band of approx. 100 m to the side of transept. The mean value of KAI among ATC (2017-2023) was 0.30 (±0.19), 0.58 (±0.40), 0.61 (±0.41), 0.64 (±0.48), 0.59 (±0.35), 0.64 (±0.35), 0.63 (±0.24), respectively. In Sicily, the Italian hare is widespread and the populations abundance is stable and improving. Our results show that monitoring data generated by instructed volunteers can be reliable, if implemented and conducted in a standardized scientific way.

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ID: 1019

Exploring biodiversity in coastal lagoons through an integrated palynological, geochemical, and hydrological modeling approach

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Coastal lagoons represent one of the most vulnerable ecotones, with terrestrial and marine ecosystems closely interconnected through linkages which can shape biodiversity and ecosystem functioning across spatial scales. Spatially distributed surface sediments representing the last few years of deposition were sampled at the Burano and Orbetello coastal lagoons (WWF oasis, Tuscany). Analyses were conducted for palynological content and contaminants, and detailed flux models were computed to investigate the contribution of the input from inflowing streams and runoff. Analysis of palynological assemblages revealed the submerged macrophyte Ruppia to occur almost everywhere. High concentrations of potentially harmful algae (eg., Alexandrium spp.) were found in both basins. Extra-local pollen source areas are also consistently recorded. Pinus Dyploxylon pollen type dominates in the Orbetello lagoon (35%, mean value) due to the proximity of a pine forest sown in the early 1900s. Olea dominates among anthropogenic taxa. Pollen concentrations of some Mediterranean and Sub-Mediterranean taxa are unevenly distributed. In this context, inflowing rivers, which are also pathways for contaminants appear to contribute to the long-distance transport of pollen and meso-charcoal into the basins. Understanding these dynamics has implications for the reliable interpretation of fossil pollen records, and more effective management strategies.

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ID: 1022

Urbanisation impoverishes the gut bacterial microbiome of the protected ground beetle Carabus convexus

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Urbanisation has a substantial impact at all levels of biological organisation, from individuals to ecosystems. At the ecosystem level, symbiotic interactions, especially those involving microorganisms in digestive tracts, are crucial, as they can influence host fitness. Urbanisation negatively influences several facts of biodiversity, and this may extend to microorganisms, the potential pool of the microbiome. Still, relatively few studies, all focusing on flying insects, have assessed the impact of urbanisation on the microbiome. To address this gap, we investigated the gut bacterial microbiome in rural and urban individuals of a protected, flightless ground beetle, Carabus convexus, using next generation sequencing. In the sequenced 48 gut samples, we identified 1163 different operational taxonomic units. The composition of the gut bacterial communities differed significantly between rural and urban beetles. The taxonomic diversity of the gut bacterial microbiome, expressed by the Rényi diversity function, was significantly higher in rural than urban beetles. The functional diversity, assessed by Rao’s quadratic entropy, was marginally significantly higher in urban beetles than rural ones. The study was supported by the National Research, Development and Innovation Fund (grant numbers: OTKA K-131459 and K-146628).

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ID: 1024

Outdoor recreational activities can shape ungulate temporal behaviour in an alpine protected area

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Non-consumptive human activities, such as eco-tourism, are increasing worldwide and may represent a disturbance source for wildlife, possibly influencing their behaviour and/or ecology even in areas where other forms of human activities are limited or forbidden. Information on behavioural responses of animals to recreational activities is still fragmented, particularly in the Alps. Using systematic camera-trapping in an alpine protected area in June-October 2022, we investigated whether ungulates (chamois, roe deer and wild boar) modulated their activity patterns in response to increasing human detection rates, by comparing sites with high and low frequency of use by people (defined as “HP” and “LP”, respectively). We observed a gradient of temporal responses across species. The wild boar was nocturnal in both HP and LP, with consistently low temporal overlap with people. The roe deer showed crepuscular activity across sites but slightly decreased its temporal overlap with people in HP. The chamois showed the strongest response, by both decreasing its temporal overlap with people and shifting part of its diurnal activity around dawn in HP. Our results suggest interspecific plasticity in temporal responses to human activity. Moreover, they provide information useful to inform the management of outdoor activities, especially in protected areas.

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ID: 1028

Land-based protection affects Red Sea coral reef communities over 8 years of monitoring

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Coral reefs, vital for their biodiversity and ecosystem services, face multiple threats, making marine protected areas (MPAs) crucial for their conservation. Spatial-temporal data was collected through recreational citizen science from 2007 to 2015 within the Red Sea by Scuba Tourism for the Environment (STE; www.steproject.org) biodiversity monitoring program. A subset of this data was used to analyze coral reef community structure variations across three land-based management levels (protected, intermediate, impacted) along Sinai Peninsula's Eastern coast from 2007 to 2014.Distinct community structures were identified between all levels of land-based management strategy and all target taxa were sighted throughout the study. Key taxa driving community variations differed among management areas

and exhibited a general increase during the last years of the monitoring program. This research emphasizes the importance of integrating land-based elements into marine conservation planning within MPAs to enhance biodiversity and community stability.

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ID: 1029

Conservation museomics applied on intensively managed game species: opening Pandora's box? The case of the red-legged partridge (Alectoris rufa)

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Naturally ranging from Iberia across southern France to central Italy, the red-legged partridge (Alectoris rufa) is referred to as one of the most socio-economically valuable small game in southwestern Europe. A number of threatening factors, primarily agricultural intensification, but also overhunting and intense management, warranted its inclusion among the species of conservation concern at European and global level. In particular, the pervasive introgressive hybridization with the chukar partridge (A. chukar) and genetic homogenization following the release of captive-bred individuals are deemed to have jeopardized the genetic uniqueness of the red-legged partridge and, first and foremost, its adaptive potential. The first genome- and range-wide study on this species, however, revealed that the extent of A. chukar introgression might be lower than expected. Nevertheless, this investigation was carried out on modern wild populations, which are never totally unrelated to the prolonged management the species was subjected to. To get a more reliable picture of the impact exerted by intense management on A. rufa genomic integrity, the genotyping of museum specimens collected over the XIX and the XX century is ongoing. The results might well unveil a more concerning scenario than that previously emerged, pointing to an overall loss of diversity and distinctiveness.

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ID: 1037

Spatial scale matters for predicting plant invasions along roads

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Biological invasions threaten global biodiversity, economies, and human livelihoods. However, effective management of invasive species is challenging because the complex mechanisms underlying invasions are not well understood. Here, we identify key determinants of the occurrence of two invasive alien plants commonly found in European landscapes, the North American goldenrods (Solidago canadensis and S. gigantea). We used Google Street View imagery to conduct a remote, large-scale goldenrod inventory along 1,347 roadside transects in Poland. Using geospatial data and machine learning techniques, we investigated the relative role of variables potentially influencing the distribution of the studied species at five spatial scales (from 0.25 to 5 km around the study locations). Goldenrod occurrence was associated with multiple drivers, of which those related to human impact, climate, soil properties, and landscape structure were the most important. Local characteristics such as road parameters or the presence of other alien plants were less influential. The relative importance of these variables was scale-dependent, suggesting that different invasion drivers operate at different spatial scales and that some important relationships may be missed when focusing on a single spatial context. Using multi-scale approaches that involve a wide range of variables may enable setting priorities for invasive alien plant management.

ID: 1040

Native vegetation and paved surfaces favour the diversity of mediterranean urban spiders

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Urban factors affecting spider diversity have been poorly studied, despite being urbanization one of the main causes of biodiversity loss. Spiders are key for ecosystems given that they are important predators and help regulating insect populations. In this work, we studied ground-dwelling and web spiders in the city of Granada (Spain) aiming to detect differences in spider diversity in different urban areas (e.g. university campuses). Previous studies have associated Mediterranean university campuses to higher levels of diversity for certain animal groups (e.g., birds, butterflies and beetles). Contrary to our predictions, university campuses showed no differences in spider diversity compared to other urban areas. However, we detected a strong positive effect of native vegetation and paved surfaces. Native vegetation seems to maintain higher levels of spider diversity, probably due to a higher prey availability than in exotic vegetation. Furthermore, paved surfaces can hold higher temperatures, promote prey abundance and the extension of the reproductive period, thus favoring the survival of spiders. Therefore, we recommend urban stakeholders of Mediterranean cities to promote native vegetation in urban green spaces and try to balance it with impervious surfaces as although they may benefit spiders, they can also have negative effects on other animal groups.

ID: 1042

Integrating vegetation mapping and grassland specialist habitat preferences: a proposal for grassland restoration monitoring method

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We propose a novel approach to monitor grassland restoration through vegetation mapping, employing the EUNIS classification. To improve the effectiveness of monitoring and practical application, the methodology incorporates the habitat and dietary preferences of a grassland habitat specialist, the European ground squirrel. The method was employed on a sandy steppe site in northern Serbia which is ongoing restoration. After designating EUNIS classes and establishing the conservation status of the classified vegetation, we translated EUNIS classes into site-specific key habitat types, crucial for on-ground management by site managers.

The grassland was categorized into four habitat types: Fallow land (stage I), Young steppe I (stage II), Young steppe II (stage III), and the final, Steppe phase (stage IV). Quantification of each phase involves assessing both the extent (total surface) of the mapped habitat succession phase and its suitability for the European ground squirrel population. This approach provides a comprehensive understanding of the grassland restoration process, aiding site managers in effective on-site monitoring and management. By linking vegetation mapping with specific habitat requirements of a grassland flagship species, the proposed method contributes to a more targeted and ecologically informed monitoring and management strategy, facilitating the preservation of grassland ecosystems.

ID: 1048

Demographic and behavioral responses of the roe deer to human activities and predator presence in north-western Italy

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The roe deer represents a primary prey species for large carnivores and game species for hunters. Consequently, it is expected to exhibit distinct responses aimed at minimizing exposure to both humans and predators, generating a complex landscape of fear. This study aims to assess a non-invasive and cost-effective method for collecting useful data to analyze population parameters and behavioural responses shaped by the landscape of fear.

Over a two-year research period, we collected roe deer data through camera-trapping across seven study areas in north-western Italy, characterized by variations in the presence of wolves, landscape composition, and species management. Our data analysis focused on estimating population density and structure, activity patterns, time budgeting, and habitat use.

Based on the obtained results, we identified the most suitable areas for species persistence and the key factors negatively impacting population parameters. Notably, we observed considerable adaptability in roe deer responses to spatio-temporal variations in risk perception, with human disturbance emerging as a primary influencer on roe deer behaviour.

In summary, our study provides valuable insights into the dynamics of roe deer populations and their behavioural adjustments in response to environmental factors, particularly human presence.

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ID: 1052

Study on the geographic origin of ringed birds from Cremona's rubbish dump, Northern Italy, with some implications for bird conservation

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The current study, through recoveries of ringed birds observed in the area of Cremona's rubbish dump, located in the Parco Locale di Interesse Sovracomunale del Po e del Morbasco, aims to provide a first contribution to the knowledge of their geographical origin. Mainly during 2021-22 and 2022-23 winters, 58 rings belonging to 5 species were read: 9 on White Stork (Ciconia ciconia), 10 on African Sacred Ibis (Threskiornis aethiopicus), 11 on Caspian Gull (Larus cachinnans), 27 on Black-headed Gull (Chroicocephalus ridibundus) and 1 on a Mediterranean Gull (Ichthyaetus melanocephalus). Overall, the most represented countries are Italy (25.9%), Poland (22.4%), Croatia (15.5%) and Hungary (10.3%). Rubbish tips, such as Cremona's rubbish dump, 1) support alien species, as the sacred ibis, 2) are sources of risk of ingestion of plastic and other contaminants and 3) are a place for pathogenic exchanges for both animals and humans: these factors potentially impact both on local and non-local populations of birds (e.g. ringed animals). For this reason, works as the one here presented can give a further contribution not only to the study of migrations, but also to the management of potentially dangerous urban ecosystems such as landfills, both at local and international scale.

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ID: 1057

Threatened at home, alien abroad

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Many alien species are safe in their native ranges, but some are threatened with extinction, posing a difficult conundrum for conservation and invasion science. Alien populations of threatened species may become invasive and require control, but they may also reduce the species' extinction risk. We characterized those alien threatened mammals, including their native and alien ranges, invasion history, threat assessments, and conservation strategies. We also reassessed their IUCN Red List category to evaluate the effect of including alien populations in extinction risk categorization.

We identified 41 alien threatened mammals, classified as Critically Endangered (19%), Endangered (27%), and Vulnerable (54%). Native distributions are localized in Southeast Asia, whereas alien ranges are concentrated in eastern Australia. Alien threatened mammals were mostly introduced for hunting purposes and exchanged within Asia. Multiple threats, particularly biological resource use, affect all species, calling for multi-faced species management. Including alien populations in the categorization reduces the estimated extinction risk of 22% of the species. Some alien populations may thus serve as "safety populations," ensuring the preservation of viable populations under unexpected events, such as sudden demographic declines. Those context-specific decisions shall be carefully evaluated by conservation managers and Red List assessors.

ID: 1066

Degraded Yet Diverse: habitat characteristics, diversity and site area affect species richness of beetles and butterflies

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Between 2017 and 2023, the Czech Nature Conservation Agency conducted species inventories of 420 protected sites for beetles and 224 for butterflies, using a unified data collection methodology. The species data were combined with the data on habitat. The habitat characteristics were used to calculate the quality and diversity of natural habitats in the protected site. The results confirm the assumption of a positive effect of increasing site area on the total number of species and, in addition, show the absence of threatened taxa in the protected areas with the lowest area. Higher species richness across groups is recorded at lower elevations. A major influence on the species richness, regardless of threat status to species, is the diversity of habitats. Higher insect species richness hosts heterogeneous environments. In contrast, individual groups differ in the effect of habitat quality. The number of butterfly species, including Red List taxa, increased with increasing ratio of degraded area. The same applies to the endangered beetle species, but for all beetle species, the relationship is opposite. A possible explanation is the association with increasing habitat heterogeneity as habitat quality declines. The results support the biodiversity hotspots identification in Czechia - highly heterogeneous environments in the lowlands.

ID: 1069

Is marine debris accumulating where loggerhead turtles are nesting?

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Marine turtles nesting grounds face imminent threats from coastal extent reduction, driven by factors such as increasing urbanization, rising sea levels, and pollution. In this study, we surveyed 62 sandy beaches in Cabo Verde, one of the largest rookeries for loggerhead turtles (Caretta caretta) globally. We built orthophotos and digital surface models from aerial drone surveys to assess marine litter pollution, vegetation presence, and topographical variables. We determined the habitat suitability of loggerhead turtle nesting locations by modelling nests' locations with the topographical variables and distance to vegetation. Then, we overlaid these models with predictions for sea level rise and current marine litter pollution, assuming a constant level of pollution over time. Our results reveal a significant reduction in available nesting areas in the future. The integration of habitat suitability models with predictions for sea level rise and ongoing marine litter pollution provides valuable insights into the potential impact on sea turtle nesting grounds. This work is funded by Centro de Investigação em Ciências Geo-Espaciais, reference UIDB/00190/2020, funded by COMPETE 2020 and FCT, Portugal.

ID: 1071

The 2022 wildfire in Saxon-Bohemian Switzerland (Czech Republic/Germany): consequences for nature conservation

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The 2022 wildfire in the Bohemian and Saxon Switzerland National Parks affected more than 1,100 ha. The fire burnt mainly dead spruce forest due to the previous bark beetle outbreak. As the post-fire modelling concluded (Hruška 2022), even clear-cutting did not prevent the fire from spreading. Although most fires in this area have been human-caused and influenced by the extent of non-native spruce plantations, fires in central European sandstone areas have always been part of natural vegetation dynamics (Adámek 2015, 2016). The national park assumes to leave the burnt area to spontaneous succession with the exception of some invasive alien plant species. In 2023, we recorded intensively spreading species along roads and trails on and off the burnt area. Some already present species (Digitalis purpurea, Conyza canadensis) became more dominant, whereas other species invaded the area only after the fire (Erechtites hieracifolius). In case of Senecio inaequidens and Cytisus scoparius, nature conservation will try to control the invasion. The wildfire also has practical consequences such as closed roads and tourist trails for safety reasons due to the dead trees, high level of erosion and risk of rock slides, which creates tension between nature conservation, local stakeholders and the public.

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ID: 1074

Indirect effects of stream pollution on the activity and hunting behaviour of bats

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Chemical pollution is an important stressor for freshwater streams that can alter the emergence of flying aquatic insects. Bats living in riparian areas depend on these emergent insects as high-quality prey, but may be affected by a reduced prey availability due to negative effects of chemical stream pollutants from agricultural and wastewater inputs. We evaluated indirect effects of chemical stream pollution on bats in an 11-week field study at 14 forested stream sites in Rhineland-Palatinate, Germany. We measured insect emergence, nutrient concentrations, wastewater and pesticide pollution, and recorded bat activity and hunting rates at streams. We expected that higher pesticide toxicity and wastewater pollution in streams would be associated with lower insect emergence, and consequently, decreased bat activity and hunting rates. While we did not observe an overall reduction in insect emergence associated with pollution, we found that the activity and hunting rates of riparian bat species was higher at more polluted streams. The continued reliance of bats on aquatic prey at polluted streams indicates that bats may be exposed to pollutants accumulated in emergent insects at these sites. Our results add important information for the conservation of bats and the riparian forest ecosystem.

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ID: 1079

The true scale of the impact of construction mineral mining on biodiversity

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As of 2020, human-made mass outweighed all of Earth's living biomass. Construction minerals – sand, gravel, limestone – account for almost 90% of this anthropogenic mass, and the unsustainable extraction of these coveted resources poses an intensifying and overlooked threat to global biodiversity. There is limited and dispersed information concerning the magnitude, geography, and profile of this threat. To bridge this knowledge gap, long-term data from the IUCN Red List and new species descriptions have been used to systematically evaluate the species threatened by construction mineral extraction globally. Further, we have used the previously untapped information sources of expert-based assessments and the Natura 2000 protected areas network to compile the most comprehensive database of species threatened by construction mineral mining globally to date. These efforts are vital in supporting an essential global effort to limit the impacts of construction mineral extraction on biodiversity, in line with international policy commitments.

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ID: 1083

Problematic protection of the Pinus mugo complex

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The Pinus mugo complex refers to a group of closely related pine species typically found in mountainous regions of Europe, especially the Alps, Carpathians and Pyrenees.

The taxonomic recognition of individuals from this complex is problematic and has been the subject of research using various methodological approaches for several decades. To clarify the taxonomy and systematics of the complex, as well as to develop species determinants, researchers combine morphological, anatomical and molecular techniques.

Of particular concern in the Pinus mugo complex is the peat-bog pine known as Pinus uliginosa/Pinus rotundata/Pinus × rhaetica, whose taxonomic status and origin are controversial and the subject of lively discussion among researchers.

Unfortunately, over the years the number of peat-bog pine individuals in Poland has significantly decreased due to the drainage of peat bogs. There are also problems with natural regeneration and the threat of hybridization with other pine species. In Poland, the peat-bog pine is under strict protection.

The integration of a variety of methods and approaches forms the basis for informed conservation practices. The aim of this review is to present multi-faceted research initiatives focusing on taxa belonging to the Pinus mugo complex.

ID: 1086

Assessing plant, insect and habitat diversity in the Austrian farmland – the ÖBM-K/BINATS monitoring programme

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Valuable loss of biodiversity is not only occurring in wild habitats, but also in farmland. Since 2006, the ÖBM-K/BINATS monitoring programme has been implemented in the Austrian farmland in order to record status, changes and trends in biodiversity and of habitats – fields, grassland and semi-natural areas – and to improve biodiversity-promoting measures. In 2017/18 and 2023/24, 200 representative test areas, which were defined based on a stratified random sampling procedure in the open cultural landscapes, have been surveyed. They cover cultivation areas, grassland and regions at higher altitudes including alpine pastures throughout Austria. Species richness of vascular plants, butterflies and grasshoppers is determined in ten test circles with a radius of 20 m per test area; habitats are mapped in

the entire test area of 625x625 m following the Austrian Red Book of endangered habitats. A parallel wild bee survey is linked to the BINATS design. Other indicators, such as earthworms, will be integrated into the monitoring system in 2024. In all 200 test areas, almost half of the approximately 3,400 plant species described in Austria and more than 3/5 of the 215 known butterfly and 139 grasshopper species were recorded in the first round of surveys.

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ID: 1092

Embracing urban and territorial abandonment: the policy of inaction for an alternative people and nature relationship

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In response to the escalating exposure of the human-nature system to the dissipative processes of the eco-socio systemic order, this study addresses key issues in urban and territorial design for ecological transition, focusing on waste at territorial, urban, and social levels. Adapting design to new sustainability policies requires innovative approaches, reconducting the linear real estate/coastal capitalism to a self-organizing system driven by a shared ethic. The awareness of the lost sense of sharing among humans and with the land serves as the root motivation for change.

This study, contributing from a design sciences perspective to broader themes, envisions "reconnection" in the project's potential to lead the return to the land through the establishment of new value-based relationships. Assuming that shape language informs the preference system, architecture's task is to represent the ethical instance of the "aesthetics of sobriety" and the rightful claim of renunciation in its language.

From northern Sardinia to the stone city of Buddusò (SS), this research identifies causes and motivations for the loss of recognizability of urban and territorial forms, seeking possible reversals of trends or justifying abstention by courageously entrusting to nature itself what can no longer belong to us.

ID: 1093

Diversity of foraging niches of the Galápagos marine iguanas (Amblyrhynchus cristatus)

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Marine iguanas, endemic to the Galápagos Archipelago, inhabit all major islands and smaller islets, displaying distinctive nutritional adaptations for consuming marine macroalgae. Previous identification of their dietary habits relied on direct observations and microscopic analysis of feces. In this study we developed primers for the rbcL and nuclear ribosomal 18S genes, applying a DNA metabarcoding approach on fecal samples from marine iguanas across 11 archipelago islands. This facilitated the identification of ingested algal species. Additionally, the primers allowed us to establish the first DNA reference library of Galápagos macroalgae.

Preliminary findings indicated divergent trophic niches between subspecies on San Cristóbal Island, specifically in the consumed macroalgal taxa and also indicates a clear preference towards red algae as food item. Despite similar algal species richness (OTU richness; $P = 0.383$), A. c. mertensi and A. c. godzilla exhibited low diet overlap (Schoener index = 0.345), suggesting distinct algal preferences. Ongoing analysis across more islands aims to unveil potential variations in the diet among subspecies, exploring whether differences stem from habitat-specific algal abundances or genetically influenced preferences for specific algal species among subspecies.

ID: 1097

Role of soil-living mesofauna in conservation management indication

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Soil-living mesofauna exhibit high diversity and are abundant in most ecosystems. These organisms, known for their rapid response to environmental changes, serve as valuable bioindicators for assessing soil health and for the evaluation of conservation practices. Despite their good potential in bioindication, several questions about their levels of responses are still unresolved.

We conducted studies with soil-living mesofauna in different management experiments targeting conservation goals. In agricultural management, (1) we compared long-term monocultures and crop rotations. Additionally (2) we examined conservation- with convenient management. In forestry management, various practices were compared with continuous cover forestry. These experiments aimed to identify key mesofauna variables that can give meaningful insights into the evaluation of different management practices.

Our case studies revealed that different variables play crucial roles in diverse environments. The biodiversity of mesofauna served as a positive indication of conservation management practices in highly perturbed areas, such as agri-environments, while no comparable response was observed in forestry treatments. Across all three experiments, disturbance resistance traits showed differences. We showed that seasonal sampling is essential in the case of evaluating the effects on soil mesofauna.

Our findings suggest that traditional approaches must be complemented with trait-based approaches when evaluating conservation management practices.

ID: 1100

Assessing landscape connectivity and potential range expansion for the Eurasian otter (Lutra lutra) in Italy

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The Eurasian otter (Lutra lutra) is a semi-aquatic mammal that has undergone a dramatic reduction of range distribution in Europe since 1970 [1]. As it is sensitive to habitat fragmentation [2] assessing the ecological corridors existing in human-dominated landscapes is a conservation priority. Our aim is to identify the connectivity routes between and within river basins that could play a fundamental role in the re-expansion of the south-central population of otters towards the north of Italy. First, we collected presence data in south-central Italy and produced a species distribution model to identify suitable areas. Then we used the Circuitscape software [3] to consider all pathways existing across the landscape, also including the sea as a possible connection route between basins [4]. The model identifies multiple corridors existing in the southern and northern parts of Italy, and confirmed the sea as a good connection route, in contrast to large cities and mountain areas. Highest connectivity values are observed in the central (north-south direction) portion of Italy and lowest ones among river basins in the southern part of the peninsula, within the western portion of the Po basin, and in Marche region. Implications for future dispersal and management will be further discussed.

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ID: 1103

The people-biodiversity relationship: how affective response, cognitive response, and norms influence human preferences for bird diversity

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At the individual level, human-nature relationships are theorized to include affective responses, cognitive responses, and social norms. In our study we aim to empirically explore an individual's relationship with biodiversity in three countries. We tested the importance of affective responses, cognitive responses, and norms related to urban resident preferences for bird species they would like to see in public urban parks. Previous research has indicated that aesthetic appraisal related to nature is associate with human wellbeing. Aesthetic appraisal of birds has received little attention in the literature, making birds an interesting case study to examine human-nature relationships. We explored people's familiarity with and knowledge of bird species as a measure of cognitive response, species traits (colorfulness) as a measure of affective response, and subjective understanding of other park-goers preferences as a measure of norms in relation to species preference. By surveying individuals in France, the United States, and Israel, we explore responses are predictive of preference. Preliminary results from France indicate strong relationships between cognitive (knowledge of species), affective (colorfulness) responses, and norms (what others would not like to see) on individual preference for species.

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ID: 1104

A refuge for Lepus europaeus meridiei Hilzheimer, 1906.

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The European brown hare (Lepus europaeus Pallas, 1778) is one of the most translocated mammals in Europe. Due to the massive restocking of allochthonous individuals for hunting purposes, Italian populations have lost their native gene pool. Thanks to RESTO CON LIFE project, it was possible to study the hare population inhabiting the island of Pianosa (Tuscan archipelago). Genetic analysis evidenced the presence of the ancestral haplotype formerly described in Lepus europaeus meridiei Hilzheimer, 1906, once inhabiting Northern and Central Italy and now considered extinct due to the introgression from allochthonous gene pools. Moreover, autosomal markers allowed describing a genetic differentiation from the other populations living on the Italian peninsula. In addition, Pianosa hare skull morphology shows significantly smaller measurements when compared to historical Italian samples. These differences denote a long isolation period. The origin of Pianosa hares is uncertain: historical records report hare presence on the island as early as 1835. Paleontological findings related to the Genus Lepus, currently under study, date back to the late Pleistocene. This unique population is important for Italian biodiversity as it possibly represents an evolutionarily significant unit (ESU) and Conservation Unit (CU), which requires proper monitoring and protection measures, including ex-situ conservation strategies.

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ID: 1107

Nature-based solutions as an opportunity to align climate and biodiversity policy agendas in Hong Kong

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The protection and restoration of natural ecosystems are a crucial component of climate change mitigation and adaptation strategies. Similarly, the transition to net zero greenhouse gas emissions will alleviate a critical driver of biodiversity loss. These interlinkages between climate change and biodiversity loss necessitate a comprehensive, integrated approach to address both challenges simultaneously. Hong Kong, a key financial hub in the Asia Pacific region, offers a unique case study for exploring opportunities to align nature and climate policy agendas.

This study utilizes the mitigation hierarchy framework to assess Hong Kong's existing policy commitments and public expenditure on climate change mitigation and adaptation, identifying points of alignment with nature-positive actions. Examples of local nature-based solutions are then explored as potential leverage points for future policy development or private sector investment to jointly achieve outcomes for Hong Kong's climate and biodiversity goals. The findings underscore the necessity for coordinated action at the policy level to attain net zero emissions and foster nature-positive outcomes and identify areas for financial mobilization by Hong Kong's private sector. These outcomes may be particularly informative in the development of Hong Kong's updated Biodiversity Strategy and Action Plan following the enactment of the Kunming-Montreal Global Biodiversity Framework.

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ID: 1108

Wildfires increase animal-vehicle collisions

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Extreme wildfires pose significant risks to human well-being, wildlife, and ecosystems and are increasing in frequency and severity due to anthropogenic climate change. Recent studies have speculated that human and wildlife responses to wildfires, such as changes in movement, can alter human-wildlife contact rates. However, it remains unclear whether wildfire-altered human-wildlife interactions pose a significant risk to human well-being. We acquired animal-vehicle collision data from 2,000 western US counties experiencing wildfires between 1997 and 2020 to test the hypothesis that wildfires increased animal-vehicle collision rates. We found that animal-vehicle collisions increased by up to 34.12% during periods of large wildfires relative to baseline fire seasons. This effect was primarily driven by the occurrence of mega-fires, defined as fires burning over 10,000 acres and, in some states, resulted in excess damages of up to $67.9

million USD during extreme wildfire years. Our study sheds light on the complex consequences of extreme wildfires and underscores the need to consider the changing dynamics of human-wildlife conflicts under global climate change.

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ID: 1111

Drones and citizen science to monitor the endangered Galápagos marine iguanas

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The endemic Galápagos marine iguana (Amblyrhynchus cristatus) is vulnerable to extinction, mostly because of invasive species, marine pollution, climate change related events, and increasing urbanization and tourism. This is an iconic well-studied species; however, a reliable and complete population size estimate is not available, mainly because monitoring with traditional ground-based methods has been logistically limited and even impossible for several colonies. We tested the use of commercial drones by comparing outcomes of aerial surveys to traditional ground-based surveys. Results showed that drones always registered higher abundances when compared to the most traditional ground-based method used (simple counts) – corroborating less effort and lower risk to surveyors and the environment. To reduce data analysis workload, we tested citizen science approach to crowd-source counting. Results showed that when images have good quality, volunteers can accurately identify and count marine iguanas from aerial images. Moreover, we evidenced positive responses of the public towards conservation in the Archipelago. We are working together with local wildlife managers in the Galápagos to develop and implement the new method for future standardized monitoring efforts to improve conservation management of marine iguanas.

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ID: 1112

Potential future climate change effects on global marine mammal diversity

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Marine mammals play important roles in marine ecosystems and biodiversity. Anthropogenic pressures, such as climate change, are already threatening their communities. Successful conservation and management plans of marine mammal communities rely on knowledge of spatial patterns of biodiversity and how it may change in the future. Given that marine mammals are a highly threatened group of species in the world today, there is a distinct lack of research exploring how climate change may impact marine mammal distributions and diversity. In this study, we provide a detailed account of projected climate change impacts on global marine mammal taxonomic, functional and phylogenetic diversity. We used ensemble species distribution models to projected species distributions in 2100 under a medium-high emissions scenario. We predicted considerable changes in all facets of biodiversity. The largest declines in species richness and functional richness occurred in tropical regions. We also projected losses in functional originality and specialisation in both the Arctic and Antarctic waters as well as the Indo-Pacific, indicating functional homogenization of these communities and the loss of key functions. These results suggest considerable global reshuffling of marine mammal assemblages and highlight the potential for climate change to alter ecosystem structure and function.

ID: 1116

Quantifying biodiversity impacts in Life Cycle Assessments of agricultural products using multi-source data

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Agriculture remains a principal driver of biodiversity loss. However, due to the complexity of quantifying biodiversity, impacts on biodiversity of agricultural systems are often neglected in quantitative environmental assessments such as Life Cycle Assessment (LCA). In particular, established methods rarely capture relevant differences between production systems (e.g., organic vs. conventional agriculture). There is therefore a need for rigorous yet pragmatic methods to estimate biodiversity impacts of different agricultural production systems in LCA. Utilizing data from multiple existing sources, such as monitoring studies (published and unpublished), enables

an efficient quantitative comparison of biodiversity impacts between, for example, organic and conventional agricultural crop production and extensive and intensive beef production. This can capture a wider range of critical ecosystem services provided by systems whose benefits may be misrepresented solely by land use and climate impacts with similar production outputs. The development of characterization factors for biodiversity impacts for use in LCA provides framework for “biodiversity footprinting” of different production systems in Swedish agriculture, with implications for policy implementation and valuation of biodiversity at the consumer level.

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ID: 1129

The structure and restoration implications of the vegetation of Jeju coastal sand dune

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Through this study, we intend to conduct research on the structure and restoration of dune plants, focusing on the coastal dunes in Jeju Island, which are affected by artificial development pressure and the continuous increase in tourists among many coastal dunes in Korea. In 23 major coastal dunes of Jeju Island, a whole species survey and quadrat survey were carried out. Vegetation survey in the field was performed by 103 quadrat establishments and was conducted using Braun-Blanquet method. A total of 277 species appeared, and the frequency of both Vitex rotundifolia and Calystegia soldanella was approximately over 90%. The total number of species found in the quadrat survey was 98. As a result of classifying plant communities based on species dominance in the quadrats, it was analyzed into 30 plant communities. The DCCA based on the vegetation and environment factor matrix showed that the height and covers of the dominant plant species explain significantly the variation and distribution of coastal sand dune species on Jeju island.

This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2021S1A5A2A01064405).

ID: 1136

Water wars: Disentangling human-elephant conflicts over dwindling water in Zimbabwe

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Human–elephant conflicts (HECs) threaten elephant survival and human well-being throughout Asia and Africa. In drought-stricken regions of southern Africa, elephants searching for water in or near human settlements empty water reservoirs and cause increasing destruction of infrastructure at communal water points, leaving people and livestock without water and causing communities to retaliate with fatal consequences.

Traditional mitigation strategies aimed at preventing conflict often neglect details about the individual elephants involved and their relevant behaviour. Thus, my PhD project investigates why African elephants are coming into conflict with humans, and whether there are individual behavioural differences between elephants within and across populations that make them more or less likely to engage in conflict over water resources. Understanding the contribution of individual traits to HECs will help develop targeted mitigation strategies that work best with certain elephant groups, and local people.

Additionally, I am co-producing research tools with people who live close to Hwange National Park, which will infuse scientific discourse with rural people’s perceptions of elephants. This is critical to overcoming deep-seated legacies of excluding local people from influencing conservation practices in their area.

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ID: 1140

Fifty years of dynamic process for land cover in the long-term ecological research Molise coastal area (Central Italy)

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Coastal ecosystems, located at the interface of land and sea, are essentially transient and thus extremely vulnerable [1]. Surveying them is also challenging, and in this aspect, remote sensing has emerged as a valuable and inventive technique for enhancing our comprehension of the dynamic processes occurring along the coasts [2], [3].

The objective of our research is to analyse the Land Cover changes that have transpired over the past 50 years at two Long-Term Ecological Research sites located in the Molise coastal area: Foce Saccione - Bonifica Ramitelli and Foce Trigno - Marina di Petacciato.

The method uses historical and current aerial images to examine coastline mosaic changes. After that, Random Forest modelling determines the main processes. Based on the early findings, agricultural activities (especially in Saccione), erosion (notably in Trigno), and woodland growth due to pine species planting dominated both regions in the second half of the 1900s. These processes are still relevant but less prominent. Both areas continue to urbanise, though slightly less so.

This study has the potential to offer a comprehensive understanding of the mechanisms that influence the Molise LTER sites. Furthermore, it promotes the use of comparable methodologies on various levels and in diverse ecosystems.

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ID: 1147

Observation of Ecosystem Changes for Action - OBSGESSION

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Over the past decades, biodiversity has continued to decline significantly. Simultaneously, we know that biodiverse ecosystems are more productive as well as resistant to the impacts of environmental change due to their high degree of integrity and diversity. The newly launched Horizon Europe project OBSGESSION develops tools to monitor and predict biodiversity status and change across Europe, and its direct and indirect drivers in terrestrial and freshwater ecosystems. The project builds on novel integration of state-of-the-art multi-sensor Earth Observation (EO) data, innovative in-situ (including citizen science) monitoring data, and derived products such as Essential Biodiversity Variables (EBVs), together with next-generation ecological models that account for uncertainty and science policy needs, particularly for implementing the EU biodiversity strategy for 2030.The project aims to develop a blueprint to assess how terrestrial and freshwater biodiversity is jointly changing and develop efficient science-based solutions for the observation of ecosystem changes for action. OBSGESSION will link and contribute to scientific programmes such as GEO BON, GEOSS and the EC and ESA joint Flagship Action of Biodiversity, while embracing FAIR and open science practices. Here, we provide an overview of the project, emphasizing the expected outputs serving not only society but also the wider research community.

ID: 1148

Contribution to European bison (Bison bonasus) reintroduction: a behavioural study in a zoo setting

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The recovery of the European bison from extinction in the wild in the 1920s to "Near Threatened" on IUCN Red List in 2020 is an example of zoo dedication to conservation programs. This study focuses on assessing behaviour of two wisents hosted in an Italian zoo (Parco Natura Viva) before their reintroduction to Făgăraș Mountains as part of LIFE CARPATHIA project. 1559 minutes of focal animal video recordings were collected and analysed using BORIS©. Activity budgets and behavioural richness were calculated employing Excel and RStudio. Pairwise Wilcoxon tests compared the durations of morning and afternoon activities. Results reveal that individuals’ behaviour aligns with wild counterparts receiving supplementary feeding. Maintenance activities is over 40%, and inactive behaviours exceeded 35% of the budget. The interactions with conspecifics within the social group accounted for over 4% of the time. Both subjects showed 44 out of 66 behaviours considered in wisent’s ethogram and were statistically more active in the morning than during the afternoon ($p<0.05$). The exhibited behavioural diversity and absence of abnormal behaviours support potential reintroduction success of the animals. Pre-realise phase should consider animals’ behavioural competence. In zoos, natural elements, environmental enrichment, and social group facilitate species-specific behaviours and social skills.

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ID: 1152

Effects of structural connectivity on taxonomic and functional biodiversity: a multi-taxa case study on Austrian beech forests

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Landscape connectivity is key for biodiversity conservation but it is still not known how structural connectivity (in terms of habitat cover, shape and distances of the patches) is related to biodiversity in many habitats.

We collected data of the species richness for three taxonomic groups (birds, vascular plants and fungi) in 40 sites in the center of Austria, some of these sites occurring in protected areas and the others being the forest in between them.

We made a spatial analysis of the habitat to calculate several structural connectivity indices like the IIC (Integral Index of Connectivity) and the PC (Probability of Connectivity), and then analyzed its relations with the sampled biodiversity data.

We expect to find different effects of the structural connectivity over the taxa occurrence related to the species moving traits (birds are expected to be less affected than sessile taxa like plants and fungi).

Furthermore, we will look into other biological traits of the species (body size, average dispersing distance, reproduction rate, etc.), and the degree of habitat specialization (we expect generalist species to be less affected by smaller amounts of habitat or larger edges) to explore if the measured connectivity could have effects on these.

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ID: 1162

20 years of monitoring in a Mediterranean nature park: long-term perspective and insights

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The Ramat Hanadiv Nature Park is a diverse landscape mosaic, representing open landscapes in the Mediterranean region of Israel and a unique touristic site on a national scale. For 35 years, active management has been applied in the park area, accompanied by on-going research and monitoring. In 2003, a long-term monitoring program was established at the site, as part of the LTER Europe network.

The program was built to address the main processes and threats to the ecosystem, primarily controlling woody vegetation encroachment, reducing fire risk and preserving biological and landscape diversity.

Within this framework different protocols were developed, and variables representing various aspects of ecosystem condition are being monitored routinely, including vegetation community composition and structure, and selected biological groups. Alongside the advantages of maintaining fixed protocols, the program has changed over time due to new insights into the sampling effort and technological innovations.

Three case studies and the insights that emerge from them are presented hereby: herbaceous vegetation, nesting birds and the dynamics of the gazelle population. The intensive monitoring enables us to apply a scheme of adaptive management for the park.

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ID: 1168

"Bioversity" case: preliminary results

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Citizen Science projects are among the innovative tools to implement monitoring of species, whether allochthonous or of conservation interest, and many activities are involved in communicate the importance of these practices, explaining their purpose and how to implement them. Among various online platforms and databases, iNaturalist is one of the most user-friendly and freely accessible. I present the results obtained from activities co-organized with entities of the University of Pisa to engage university students in biodiversity monitoring activities. To involve students from different degrees, a photographic competition has been held to document taxa present in different areas of the city of Pisa, asking participants to join the Bioblitz project set on iNaturalist. The analysis of the data collected in the Bioblitz of 2022 and 2024, in addition to contributing to update the checklists of organisms present in the urban and suburban areas of Pisa, allowed us to make preliminary considerations on the University of Pisa students interest and engagement in this activity, on the use of the platform, and about Species Awareness Disparity .

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ID: 1172

Urban habits of the bent-winged bat (Miniopterus schreibersii) in Italy

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The bent-winged bat (Miniopterus schreibersii) is an endangered species with hypogeal habits and a wide distribution across the southern European Palearctic Region. This bat has been associated with zoonotic viruses, including West Caucasian Bat virus (WCBV), a member of the genus Lyssavirus. In 2020, we confirmed a rabies case associated with WCBV in a free-roaming cat in an urban centre in Italy and a stopover population of bent-winged bats was founded in a tombed river beneath the city. The present study investigated the relevance of Miniopterus schreibersii in this roosting site, which raises concerns in conservation and public health. We performed a species distribution model with a Bayesian approach, gathering occurrence data from online repository (GBIF, iNaturalist) and considering bioclimatic variables (WORLDCLIM database), urban settlements and tombed rivers distribution as explanatory variables. Tombed rivers are likely not driving the distribution of these bats but they can provide suitable roosts within urban settlements. Another similar site was found in another town where the presence of a maternity colony of bent-winged bats was confirmed. It is pivotal to unravel the occupancy of suitable urban roosts to warrant protection of this bat and mitigate risks for the spillover of WCBV and other viruses.

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ID: 1185

Bat incidents due to the use of mist nets, handling, and mark-recapture with collars in a long-term sampling database from Brazil

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Bat capture, handling, and tagging can cause injuries to the animals. Here, we aim to describe and quantify the most common incidents during the capture, manipulation, and marking of Neotropical bats by analysing a database of long-term studies in Brazil. We found 401 incidents (0.95% of the total bats captured). The most common incidents were collar removal due to neck injuries, wing injuries, deaths, and opportunistic predation, with all injuries occurring more often in smaller than larger species. Based on our results, we recommend:

1) tagging animals with collars be used only in bats with a forearm > 50 mm; 2) mist net checks be carried out with intervals of no more than 15-20 minutes; 3) at least three researchers or technicians with experience in using nets and manipulating bats be in the field at any one time, independent of the number of nets being used, and we recommend an additional researcher or technician for every two additional nets open; 4) pregnant females should be prioritised when collecting biometric data. Finally, we strongly recommend that other researchers analyse and publish their data in this way to create and update best-practice guidelines for capturing and handling animals in the field.

ID: 1189

Species distribution comparison and interactions of Clethrionomys glareolus and Chionomys nivalis in a changing climate

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Climate change exacerbates global biodiversity loss, particularly impacting vertebrate species with specialized ecological niches. Species distribution models (SDM) have been instrumental in exploring species dynamics under changing environmental conditions, aiding in understanding future trends, identifying critical environmental factors, and guiding conservation efforts. This study employs SDMs to examine the distribution and interactions of two vole species in the European Alps, the Pyrenees, and the Apennine: the generalist Bank vole (Clethrionomys glareolus) and the specialist Snow vole (Chionomys nivalis). Utilizing an ensemble of three statistical models, the study predicts the presence of both species under current and future environmental scenarios. The findings reveal a projected decline in the occurrence of both species within the study area, an increased overlap in environmental niches, and a higher altitude range for the Bank vole. These insights contribute to understanding the impact of climate change on species interactions and inform targeted conservation strategies.

ID: 1193

Insectivorous bat diversity and activity in West African oil palm-dominated landscapes

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Oil palm (Elaeis guineensis), is the most productive vegetable oil crop worldwide. The impacts of palm oil cultivation has been studied extensively in Southeast Asia but very little is known about its impacts in Africa. To address this knowledge gap, we conducted acoustic surveys of insectivorous bat assemblages across 54 plots throughout old-growth forest, “country oil palm” (plots are in fallowed traditional farms, established using slash-and-burn practices) and “industrial oil palm” across a 56 km distance in Sinoe County, Liberia. Based on more than 1400 bat passes recorded from five taxa, we found substantial changes in species abundance across habitats, and certain bat species were almost exclusively found in either old-growth forest or “country oil palm”, the latter of which also had the highest bat activity. Our study provides valuable insights into the effects of land-use changes on the insectivorous bats in West Africa. The fact that certain bat taxa, such as Rhinolophidae, are dependent on old-growth forest, highlights the importance of protecting native vegetation cover. This research is part of the Sustainable Oil Palm in West Africa (SOPWA) Project – that is evaluating the relative ecological impacts of oil palm cultivation in plantations managed traditionally or industrially in Liberia.

ID: 1195

Cumulative effects of Poland’s state border infrastructure and associated human activities in Białowieża Forest

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Białowieża Forest is a transborder World Heritage area. With a variety of methods including camera-trapping, transect sampling, snow-tracking, and audio recording, we are evaluating how Poland's border infrastructure is affecting this forest. To date, our observations suggest mixed effects of human activities and barriers on wildlife in Białowieża Forest. For example, opportunistic mesocarnivore species appear to be relatively undeterred by barriers and attracted to military outposts on account of human food and garbage; cervids do not cross barriers nor approach outposts. Signs (tracks) of domestic animals, especially cats, also appear near military outposts (and not only near permanent human settlements) suggesting potential risk of domestic-wild animal contact. Along transects, human signs (and sounds) are ubiquitous immediately along the border and up to 100m but fall off by 250m from the edge. Integrating data, we will construct a wildlife-human interaction index; the soundscape will be characterized with an acoustic index of biological and anthropogenic sounds. Given patrols and daily commutes between bases and outposts, the human footprint extends beyond the border to at least habitats along forest roads (roadkill, roadside tree damage). We discuss cumulative disturbance effects of border infrastructure and associated human activities to help inform mitigation.

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