7TH EUROPEAN CONFERENCE OF

TROPICAL ECOLOGY

LISBON FEBRUARY 12-16, 2024

TROPICAL ECOSYSTEMS IN A FAST-CHANGING PLANET

PROMOTED BY

ce3c centre for ecology, evolution and environmental changes

CHANGE Global Change and Sustainability Institute

HOSTED BY

Ciências ULisboa

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SUPPORTED BY

SPECO SOCIEDADE PORTUGUESA DE ECOLOGIA

Turismo de Lisboa

ON BEHALF OF

Society for Tropical Ecology

EUROPEAN CONFERENCE OF

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WELCOME TO LISBON!

We are delighted to extend our warm invitation for you to join us at the European Conference of Tropical Ecology 2024 in the enchanting city of Lisbon. The conference will take place from the 12th to the 16th of February 2024.

This conference, set against the backdrop of Lisbon's rich architectural, historical, and cultural heritage promises to be a gathering of researchers and enthusiasts from around the world. It will be an excellent opportunity to learn, exchange experiences and ideas, establish partnerships, and contribute to the advancement of tropical ecological science, ultimately fostering a sustainable future for the incredible ecosystems of tropical regions.

In addition to the scientific program, we have also organized exciting field trips and social programs to enhance your experience during your stay, providing opportunities to connect with old friends and make new ones.

We look forward to the opportunity to meet you in Lisbon!

With warm regards,

Jorge Palmeirim
Conference Chair

ORGANISING COMMITTEE


JORGE PALMEIRIM CONFERENCE CHAIR


ANA LEAL


ANA RAINHO


LUÍS CATARINO


HUGO REBELO


RÚBEN OLIVEIRA

LOCAL VOLUNTEERING ECOLOGISTS

The organising committee thanks and acknowledges the availability and dedication of the following volunteers: Ana Leite, Eva Nóbrega, Gonçalo Fernandes, Inês Lacerda, Inês Morais, João Albuquerque, Liliana Ferreira, Madalena Sottomayor, Martina Panisi, Patrícia Chaves, Paula Lopes, Raquel Oliveira e Tiago Gonçalves.

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VENUE
THE FACULTY OF SCIENCES OF THE UNIVERSITY OF LISBON

The Faculty of Sciences of the University of Lisbon is an institution of creation, transmission and diffusion of scientific and technological knowledge that promotes a culture of permanent learning, valuing critical thinking and intellectual autonomy.

Its mission is research and teaching, and the transfer of knowledge and innovation in the areas of exact and natural sciences and techno-sciences, as well as the dissemination and sharing of cultures, stimulating a permanent opening to civil society.

What we do not know today, we will know tomorrow

The Faculty's motto, by Garcia de Orta, 1563

CONFERENCE FACILITIES

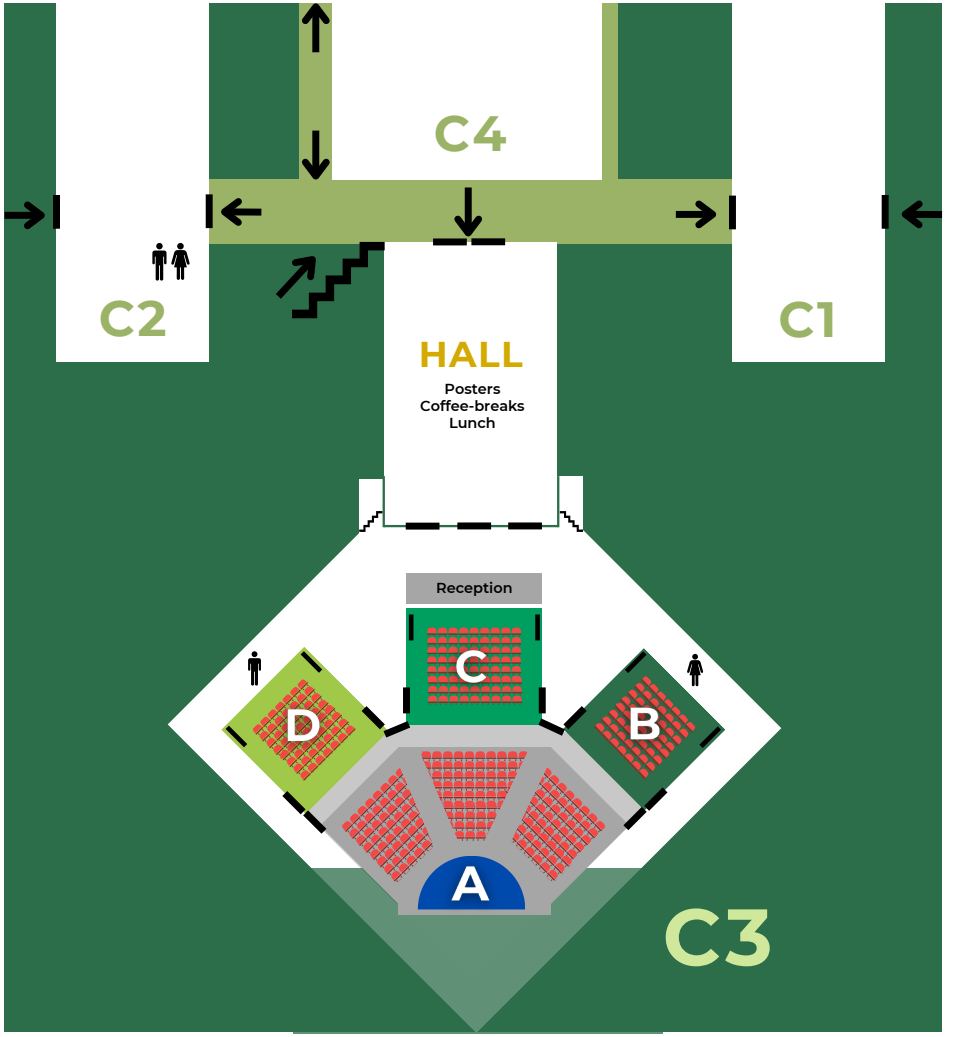
The Conference will take place at the C3 building of the Faculty of Sciences of the University of Lisbon. The entrance is located on the second floor and can be accessed through a direct staircase, marked on the image. It can also be accessed via buildings C1 and C2 as signalled.

After the entrance, the participants will enter the Hall (H in the programme) of the building, where the welcome reception, posters sessions, coffee-breaks and lunch will occur. If you a poster to display, please ensure that you placed accordingly to the code that was given to it.

The Main Auditorium, designated by A, will receive the opening and closing ceremonies, as well as the presentations by the invited plenary speakers.

Three auditoriums, marked with a B, C and D, adjacent to the main one, will be used for the parallel sessions, whose content can be explored in the extended programme. After the sessions have started, we kindly ask all participants that enter the rooms through the upper doors, ensuring that there are no interruptions, no inconvenience to the speakers and no delays in the sessions.

Men's restroom is located behind Room D, and women's behind Room B.



INVITED KEYNOTE SPEAKERS

MIGUEL BASTOS ARAÚJO

Professor Spanish Research Council (CSIC) National Museum of Natural Sciences, Madrid
Professor Chair of Biodiversity at the University of Évora

Miguel Bastos Araújo is a biogeographer seeking to understand how different facets of Life distribute in space and time, and why. He uses a plethora of data-driven and modelling approaches to improve understanding of how climate determines the distributions of species and properties of self-organised community dynamics. Past, current, and future climate changes offer the context for much of his work as they provide spatiotemporal laboratories for understanding change. He is currently a Research Professor at National Museum of Natural Sciences of the Spanish Research Council (CSIC) and Professor at the University of Évora, while serving as Editor-in-Chief of Ecography. Previously, he held positions at the Imperial College London, University of Copenhagen, Oxford University, the CNRS, and the Natural History Museum in London. He his recipient of several prestigious awards, including the European Ecological Federation Ernst Haeckel Prize (2019), the Pessoa Prize (2018), the Rey Jaime I Prize (2016), International Biogeography Society MacArthur & Wilson Award (2013), and the Global Biodiversity Information Facility Ebbe Nielsen Prize (2013).

Moving away from individual species models of biodiversity response to climate change

Moving away from individual species models of biodiversity response to climate change In the past two decades, there has been a significant increase in studies using models to understand and predict the impact of environmental changes on biodiversity. Typically, these studies begin by examining the relationship between species distributions and environmental variables, based on the assumption that the environment determines the limits of tolerance for species survival. As a result, alterations in environmental conditions are expected to lead to shifts in species distributions. However, a major shortcoming of existing models is their focus on individual species. Although these models can be applied to thousands of species at once, they often treat each species as an independent entity, reacting in isolation to environmental changes. This approach neglects the complex dynamics within ecological communities, where collective species responses to environmental changes are not merely the sum of individual responses. While incremental improvements to existing models are possible, progress necessitates the development of models that capture the response of entire communities to environmental change. I suggest a promising direction would be to shift from the traditional environmental-limiting niche theory, which is applicable to individual species, to a resource-limiting niche theory. This approach considers the impact of the environment on the coexistence of multiple species within communities, providing a more comprehensive understanding of ecological dynamics.

INVITED KEYNOTE SPEAKERS

RICARDO ROCHA

University of Oxford, United Kingdom

Ricardo Rocha is an Associate Professor in Conservation Science at University of Oxford. His research aims to provide evidence-based knowledge to support conservation decision-making under contemporary global change, with a special focus on how to restore biodiversity in the aftermath of habitat loss and fragmentation and how to manage human-modified landscapes to retain biodiversity and maximize ecosystem services. He does this by: i) investigating taxonomic, functional, and phylogenetic responses to habitat loss, fragmentation, and secondary forest regeneration from both spatial and temporal perspectives, ii) identifying management options that can augment the permeability of agricultural land to disturbance-sensitive species and investigating agriculture-related ecosystem services and disservices, and iii) assessing the efficiency of conservation interventions and providing tools to facilitate and inform evidence-based decision-making. His work is grounded in ecological theory and involves biodiversity surveys across large-scale manipulative experiments, "real-world" working landscapes, and island ecosystems.

The role of secondary forests in mitigating fragmentation-related extinctions: Insights from an Amazonian whole-ecosystem manipulation experiment

Secondary forests are the predominant type of forest cover across the tropics. They provide myriad services and natural products to human populations worldwide and key habitat for countless forest-dwelling species. Although some fragmentation-related extinctions can be averted by forest regeneration, the role of second growth in biodiversity conservation remains controversial. Central to the debate is the capacity of secondary forests to preserve old-growth specialist species and to buffer the impacts of fragmentation on assemblages living in forest remnants. The Biological Dynamics of Forest Fragments Project (BDFFP) is one of the world's largest and longest-running experimental investigations. Spanning an area of 1000 km2 in the Central Brazilian Amazon, the BDFFP was initially designed to assess how fragment size influences biodiversity and ecological processes within rainforests. However, it has transcended its initial objectives, offering a wealth of insights into the long-term ecological dynamics of fragmented landscapes and their intricate relationship with forest regeneration. This talk will provide an overview of the research conducted over the last decades at the Biological Dynamics of Forest Fragments Project (BDFFP), examining with particular detail the taxonomic, functional, and phylogenetic responses of bats, one of the richest Amazonian mammalian groups, to forest regeneration. I will explore area, edge, and matrix effects and investigate time-related complexities related to both short- and long-term responses to changes in matrix structure and composition. Finally, taking the BDFFP as an illustrative example, we will discuss the conservation implications of these findings for tropical biodiversity and propose avenues for future research in temporal ecology.

INVITED KEYNOTE SPEAKERS

ANNA TRAVESET

Mediterranean Institute of Advanced Studies (IMEDEA),
Mallorca, Balearic Islands, Spain

Anna Traveset is a Research Professor at the Mediterranean Institute of Advanced Studies (IMEDEA), a mixed institution of the Spanish Research Council (CSIC) and the University of the Balearic Islands (UIB). She leads the Terrestrial Ecology Laboratory at IMEDEA where, along with her team, she investigates the impact of global change on native communities, specifically on the ecological interactions established between species. For this, she uses the approach of network theory, collaborating also with theoreticians from other institutions. She mostly works on island systems, currently coordinating an ERC project that embraces different archipelagos worldwide. She was awarded the Jaume I Prize (modality: Environmental Protection) and the Ramon Llull Prize from the Balearic Government in 2022. Since 2019 she is the CSIC delegate at the Balearic Islands, and is currently the Principal Investigator of the accreditation Project “Unidad de Excelencia María de Maeztu” at IMEDEA (2023-2027).

Deciphering the complexity of ecological interactions in tropical islands. A multilayer netork approach

Globally, biodiversity is rapidly decreasing, with islands, constituting about 30% of biodiversity hotspots, facing heightened vulnerability. Anthropogenic activities have led to an alarming 80% of reported extinctions occurring among island species. Despite this, island biodiversity, encompassing diverse species and their interactions, remains inadequately explored. Urgent efforts are needed to document and predict the repercussions of its decline for effective mitigation. The challenge lies in detecting and understanding ecological interactions, a task addressed by emerging theories and tools like complex network analysis. Islands, as relatively simple systems with clear boundaries, offer significant potential to enhance our understanding of nature's complexity. In this talk, I will present you data on the ecological interactions we are studying, with a large variety of methodologies, in two tropical archipelagos, the Galapagos (Pacific Ocean) and the Seychelles (Indian Ocean). We are focusing on different layers of complexity, each corresponding to a different ecological function. We are using a multilayer network approach to unveil which are the keystone species in each community, which are the main functions, and to evaluate how vulnerable the community is to disturbance, specifically to biological invasions. The biodiversity of these ecosystems is indeed unique but shows to be highly vulnerable to the introduction of invasive species. I will show you some preliminary data on the coextinction models we are using to predict persistence and resilience of island biota to disturbances.

INVITED KEYNOTE SPEAKERS

AIDA CUNI-SANCHEZ

Norwegian University of Life Sciences
Honorary fellow University of York

Dr Aida Cuni-Sanchez is an Associate Professor at the Norwegian University of Life Sciences, and an honorary fellow at the University of York. She has a PhD in environmental Sciences from the University of Southampton (UK) and a Licenciatura in Biology from the University of Barcelona (Spain). She has over 10 years of work experience in 12 countries in tropical Africa, where she has focused on tropical forest ecology and carbon stocks, forest use and valuation by local communities and local communities' adaptation to climate change. She received the 2020 L'Oreal-UNESCO Women in Science UK Award for Sustainable Development and the Chr. Michelsen price for outstanding development research (Norway) in March 2022. As well as developing the AfriMont plot network, she is a key partner in research collaborations in Africa including AfriTRON (tropical lowland forest monitoring), Mountain Research Initiative, Mountain Sentinels and ATBC-Africa Chapter.

Local perceptions of forest ecosystem services, insights from Africa

Human culture has an important influence on how forests are utilised, yet its influence on ecosystem service (ES) use and valuation remains underexplored. During the past 5 years, we have investigated how livelihood strategy (farmers, pastoralists, hunter-gatherers) and ethnicity affect local peoples' perceptions of forest ES in tropical Africa, relating their views to instrumental, relational and intrinsic values of Nature. I will present our findings from different socio-ecological contexts in West, Central and East Africa, and also introduce unpublished data on a recent survey carried out with 'forest experts' (scientists and practitioners working in some of these forests).

INVITED KEYNOTE SPEAKERS

MARCO MELLO

University of São Paulo, Associate Professor

Imagine a world where ecological systems were a jigsaw puzzle, and the pieces were scattered across the vastness of data and ideas. This is where Marco comes in. As a biologist with a Ph.D. in ecology and an alumnus of the Alexander von Humboldt-Stiftung, Germany, he works as a professor at the University of São Paulo, Brazil, where he specializes in ecological synthesis. His mission is to unveil the hidden assembly rules of ecological systems formed by species interactions. Bats have always been his main study model, although he also conducts research on many other organisms. His work is like that of a detective, piecing together scattered fragments of information, connecting the dots between data and ideas to reveal the big picture. But his work doesn't stop there. As an educator, he is dedicated to training young scientists and making scientific knowledge accessible to all.

The elephant, the monks, and the topology of interaction networks

Sometimes, in science, we get so obsessed with a particular piece of a puzzle, that we miss the big picture. The same seems to be happening in the study of interaction networks, with different schools arguing over pieces of reality. Aiming to take a step back and change our perspective, this presentation describes a novel cognitive model that provides an integrative solution to two classical dilemmas about interactions between organisms of different species. Our research team, in collaboration with other experts, embarked on an extensive investigation to uncover the underlying principles that could lead to this solution. Through a comprehensive analysis, first, we demonstrated the commonalities between the dilemmas, and employed a graphical model to better understand the theoretical connection between them. We then developed an algorithmic model that predicts the four most commonly observed network topologies in nature. Our cognitive model, initially designed for antagonisms in monolayer networks, was subjected to a series of empirical tests and logical deductions. The results show that the model can be extended to mutualisms and multilayer networks, highlighting its broad applicability. Currently, we are working to refine the model and develop it into a new semantic theory, which may have significant implications for basic and applied ecology. We invite the audience to join us as we share the journey of discovery, unveiling the exciting possibilities that this new theory presents.

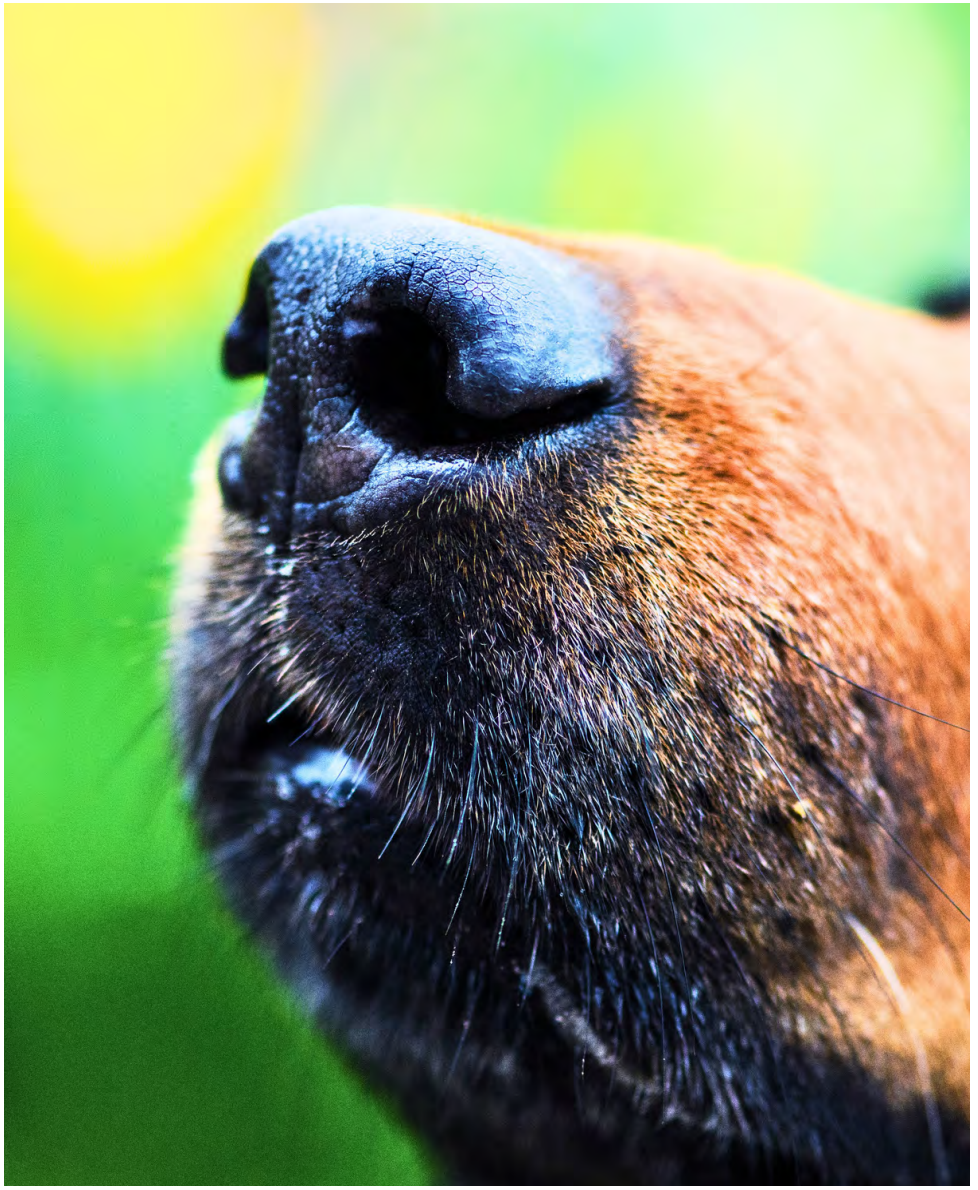
SESSIONS AND CHAIRS

S1

Role and potential of working dogs in conservation in the tropics

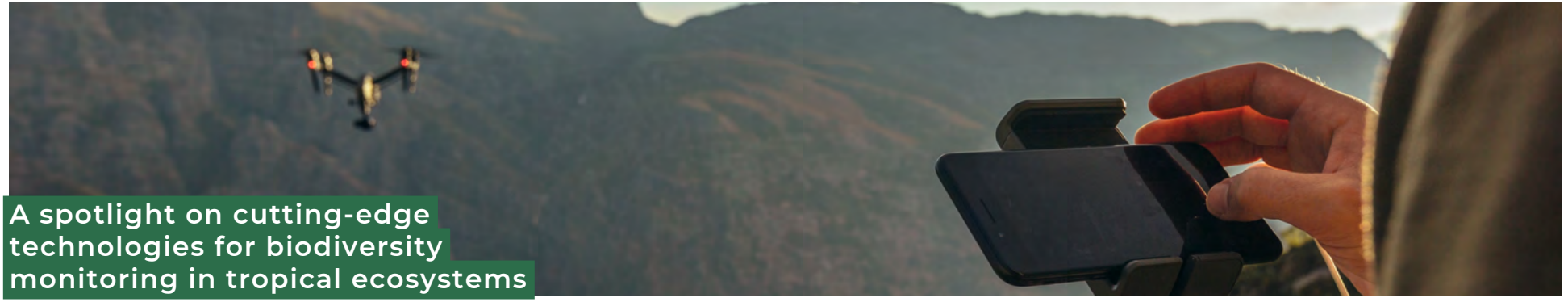
Chairs: Noreen Mutoro, Mary Wykstra, Leopold Slotta-Bachmayr & Jane Sharp

Use of dogs in conservation for wildlife population research, monitoring, management, prevention and enforcement of wildlife crimes is increasing globally due to the dogs' superior olfactory system and ability to develop close working relationships with humans. The tropics host more than two-thirds of the world's biodiversity and are crucial for ecosystem functions and services both at the local and global level. Tropical regions provide safe spaces to many threatened species which are highly elusive and prone to human-wildlife conflict and wildlife crimes such as poaching and trafficking. Effective conservation and management of biodiversity in such areas would therefore require adequate, standardized and cost-effective monitoring techniques that provide reliable data on changes in species abundance, distribution and physiological health over time. However, the use of conservation dogs in most of the tropics is not well established as compared to North America, Europe and Oceania. In this session, we discuss various ways working dogs are being used for conservation in the tropics and why there is scarcity of research on conservation dogs in some areas.



SESSIONS AND CHAIRS

S2



A spotlight on cutting-edge technologies for biodiversity monitoring in tropical ecosystems

Chairs: Thomas Luypaert, Yennie Bredin & Meley Mekonen Rannestad

The tropics are renowned as global bastions of biodiversity but are increasingly imperilled by human activities. In the face of human-induced environmental degradation, the collection of data that provides an objective record of community-level biodiversity is crucial to our understanding of fundamental ecological processes, the trends and drivers of change, and the progress made towards conservation targets. However, the rapid and global nature of the biodiversity crisis makes monitoring biodiversity at appropriate spatio-temporal scales a daunting task, especially in the hyper-diverse tropics, where many species are poorly known. Traditional biomonitoring methods are valuable, but on their own, often fall short in capturing the full extent of tropical biodiversity. In recent times, however, cutting-edge technologies and methodologies have shown great potential to help bridge this gap. In this session, we will explore a range of innovative tools that show promise to revolutionize biodiversity monitoring in the tropics. Automated acoustic sensors can capture tropical symphonies over long periods of time, while environmental DNA has been shown reveal hidden species from thin air.

Drones, equipped with advanced sensors, can capture the three-dimensional structure of rainforests using LiDAR, or reveal hidden species using heat signatures. Camera traps provide a glimpse into the presence and behaviours of elusive species, and GPS tracking can trace the movements of species where humans cannot go. Moreover, machine learning algorithms can aid in processing the vast datasets these new tools produce, enabling precise monitoring while reducing human workloads. This session aims to shine a spotlight on recent technological and methodological advancements that hold promise for enhancing the efficacy of tropical biodiversity monitoring. We aspire to foster cross-disciplinary collaboration, bringing together experts from various fields to harness the power of these groundbreaking tools. We invite researchers, conservationists, technologists, and innovators to join us in showcasing technological advances in tropical biomonitoring.

SESSIONS AND CHAIRS

S3

Multi-trophic interactions in tropical forests and agro-forestry systems

Chairs: Finn Rehling & Heike Feldhaar

Tropical forests are known for their incredibly complex networks of species interactions. The interplay of trophic levels (e.g., herbivores, pollinators, dispersers, pathogens, decomposers, and predators) structures the composition and persistence of primary producers, and thus patterns of biodiversity and ecosystem resilience. However, non-random shifts in the structure and diversity of communities of different trophic levels due to anthropogenic pressures will cascade through interaction networks and the way these interactions affect ecosystem functioning. Although the underlying ecological theory is relatively well-developed, empirical research that comprehensively assesses the consequences of changes in biodiversity on ecological interactions, networks, and their functioning across trophic levels is lacking. This session aims to unite researchers studying interaction networks and their functioning at and across multiple trophic levels along diversity gradients. The scale of studies can encompass a wide range, from interactions among individuals to entire ecosystems, spanning from primary producers to apex predators, and occurring both below and above ground. Priority will be given to studies on multitrophic networks in tropical forests and agro-forestry systems.

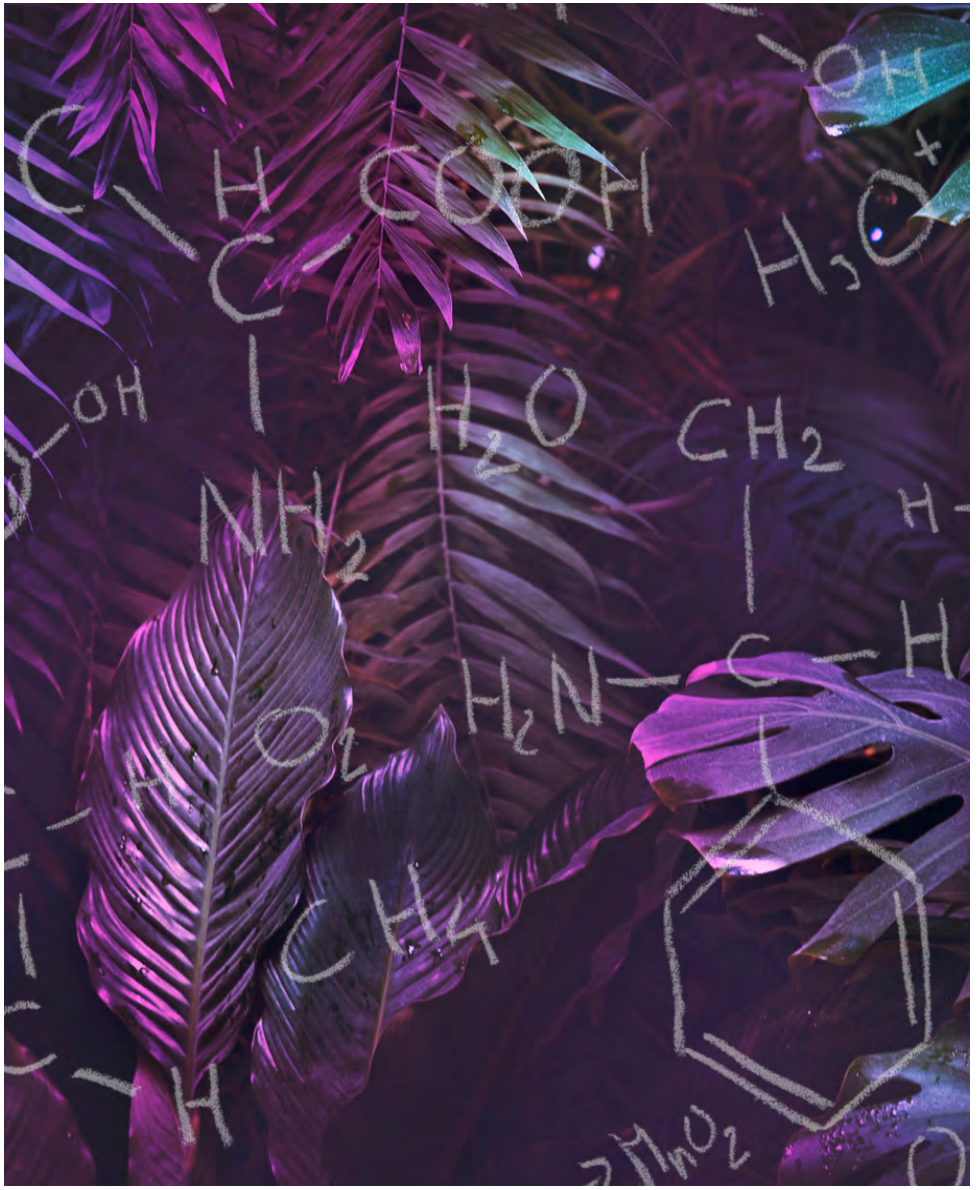
SESSIONS AND CHAIRS

S4

Tropical chemical ecology - current questions, future trends

Chairs: Omer Nevo & Linh M.N. Nguyen

Chemical cues and signals are widespread mechanisms that guide a diverse array of species interactions. In tropical systems, the complexity of species richness and intricate networks forms a highly diverse chemical environment. These chemical signals play a critical role in various essential processes, such as pollination, seed dispersal, predation, herbivory, and symbiotic relationships. Sometimes, these interactions are multifaceted, attracting both mutually beneficial and antagonistic partners, resulting in intricate trade-offs and dynamic interactions. Despite its significance, much of the complexity in chemical interactions within tropical systems remains unsettled, due to challenges in sampling, analyzing the vast diversity of compounds involved, and interpreting the complex systems. Recent advancements in chemical ecology, especially on the application of meta-omics, have presented exciting opportunities for integrated studies at the molecular level, offering broader insights into both the drivers of contemporary processes and their evolutionary history. This session will bring the current developments in chemical ecology and their application in understanding ecological processes within tropical systems. It aims to explore a wide range of interactions, spanning from pollinators to flowers, seed dispersers to fruits, symbiotic bacteria to roots, corals, and predators to their prey, in an effort to identify patterns and major drivers of variance in tropical chemical ecology. The session seeks to foster a comprehensive understanding of the chemical dynamics that shape the biodiversity and interactions within these ecosystems.



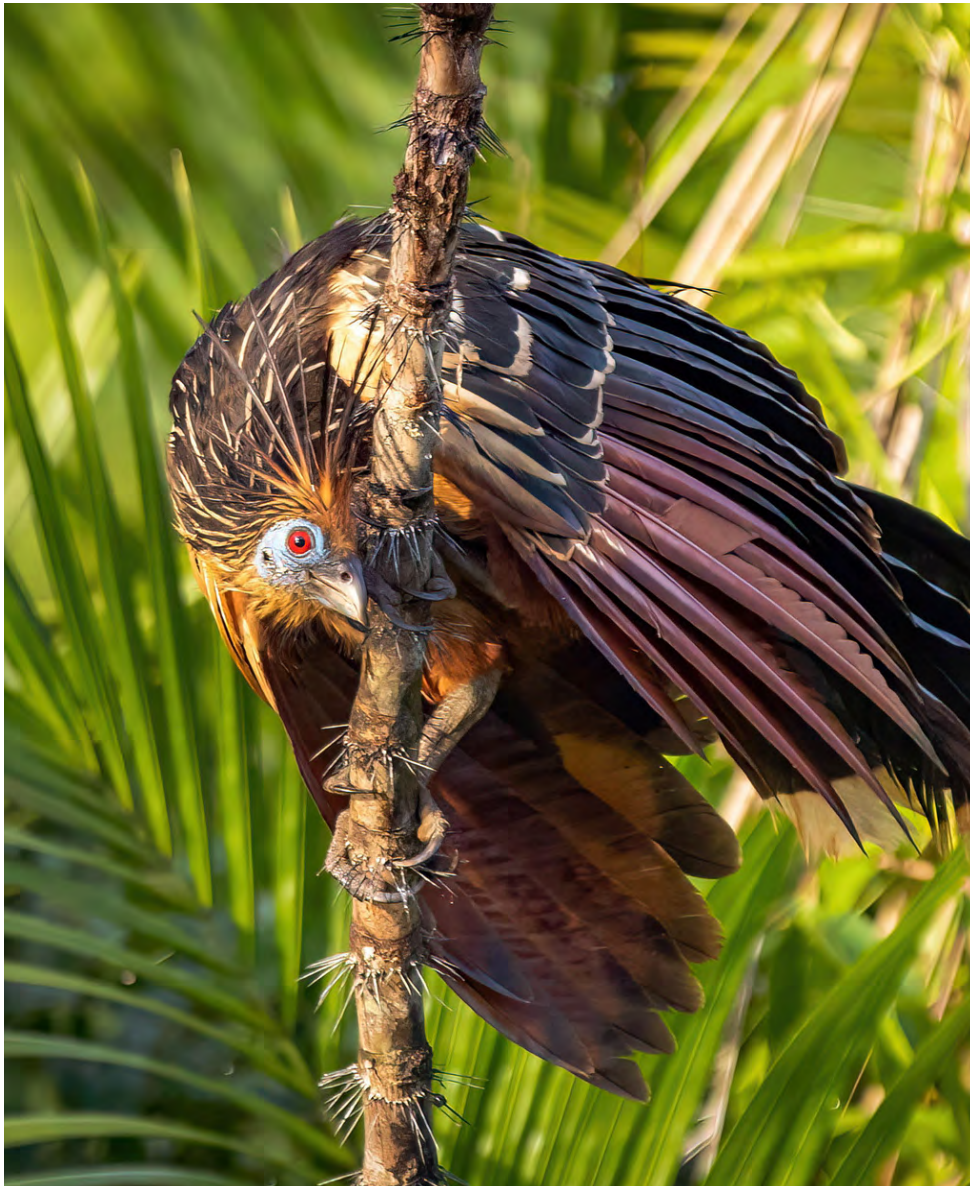
SESSIONS AND CHAIRS

S5

Understanding drivers of evolution and adaptation in Neotropical biodiversity

Chairs: Isabel Marques, David Draper & Clarisse Palma-Silva

The American tropics – Neotropics – comprise more species than any other region on Earth, due to a complex interaction of biotic and abiotic processes. This vast region extends from central Mexico to Argentina, including the Caribbean, and includes several different biomes and habitats such as high-elevation grasslands, seasonally dry forests, and rainforest systems. For centuries, scientists have sleeked to understand how ecological communities have been assembled over time and how abiotic and biotic factors have influenced species interactions, and the origin such astonish biodiversity. This quest is even more important nowadays as studies continue to show that Neotropical biodiversity is becoming increasingly threatened, with the potential to impact the goods and services provide to humankind. Global changes already affect individual species and the way they interact with each other and their habitats, reshaping ecological interactions and ecosystem processes. How will neotropical species respond to such changes is still a largely open question. This session aims to provide an international multidisciplinary platform for discussing the many gaps in neotropical knowledge including (1) drivers of changes in breaking ecological interactions, (2) causes that enhance the risk of extinction and loss of ecosystem functions; (3) to debate and identify gaps and priority areas for research in Neotropics; and (4) fueling the development of new methods. Overall, we aim to facilitate opportunities between students and researchers for networking, collaboration and exchange of ideas using evidence-based studies.



SESSIONS AND CHAIRS

S6

Exploring multi-level species responses to environmental changes in tropical mountainous ecosystems

Chairs: Joao de Deus Vidal Junior & Ana Patricia Sandoval-Calderon

This session aims to convene ecologists and researchers to delve into the intricate relationship between biodiversity, climate, and vegetation in tropical mountainous ecosystems. By linking studies from different tropical regions on multi-level species diversity responses to environmental change, we want to deepen our understanding of ecological changes in these fragile and megadiverse landscapes. This session will be a platform for presenting novel research, discussing methodological advancements, and sharing empirical findings. Throughout the session, we aim to deepen our understanding of the mechanisms driving changes in species composition, community dynamics, and ecosystem functioning in the face of climate and land use change. The ultimate goal is to foster knowledge exchange and collaboration among high-level ecologists and experts in this field. That will enable the development of more comprehensive conservation strategies and sustainable management of tropical mountain ecosystems in the face of environmental change.

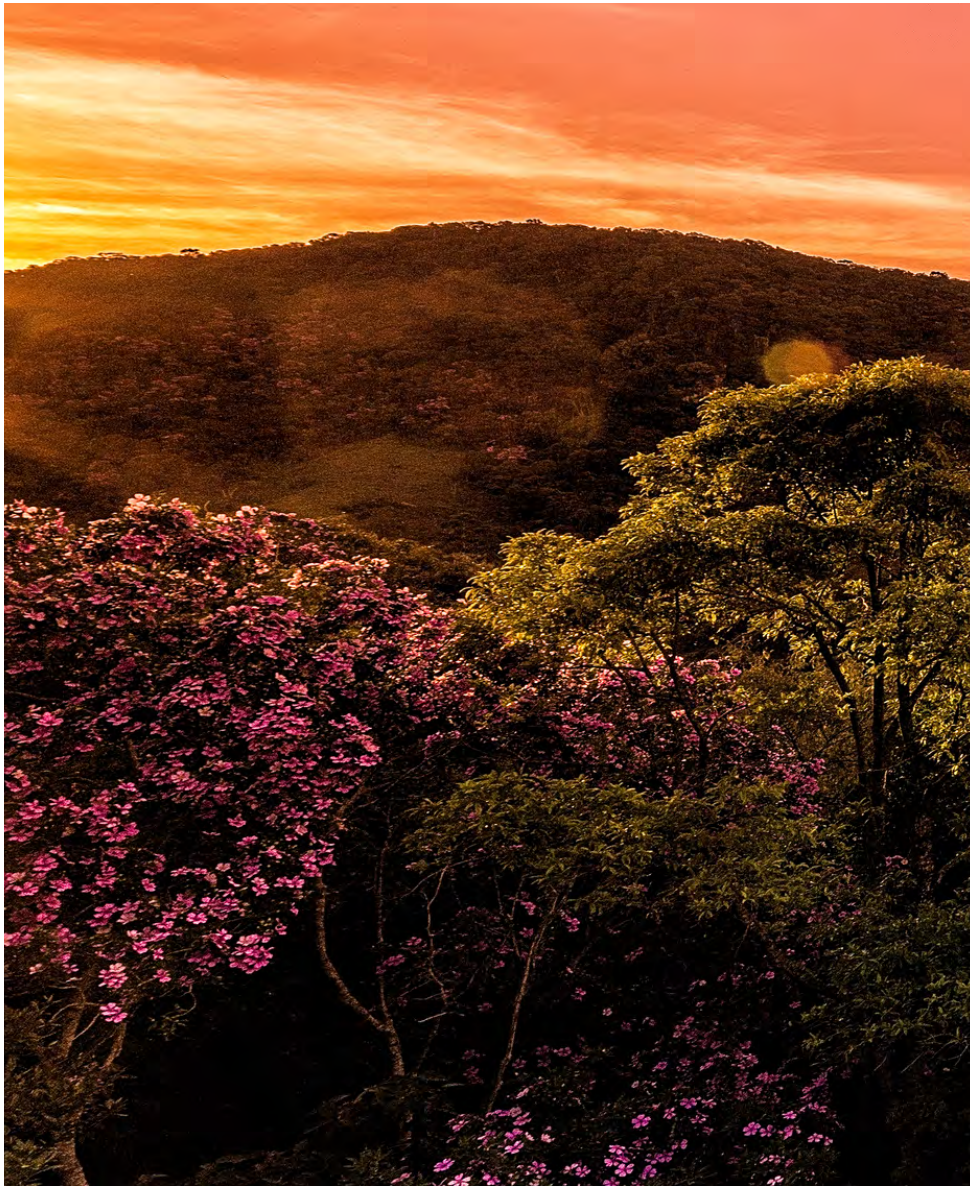
SESSIONS AND CHAIRS

S7

The seasonality of tropical forest/tree functioning

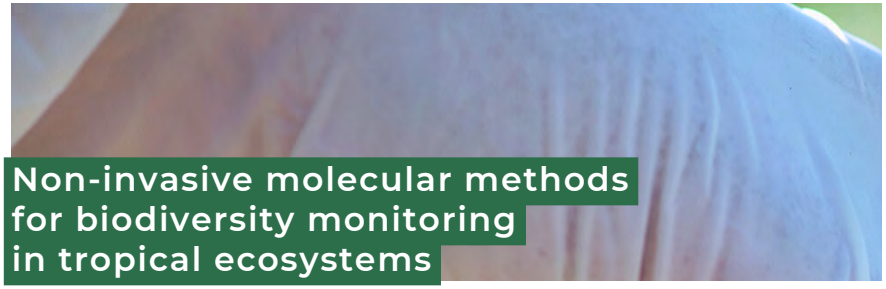
Chairs: Adeline Fayolle & Anais Gorel

Tropical moist forests form a closed canopy with a complex vertical structure under warm and wet environments, where rainfall is evenly distributed. While tropical forests are relatively uniform in physiognomy, recent data have highlighted cross-continental discrepancies. Tropical forests of south America and south-eastern Asia are extremely diverse, in comparison to the depauperate forests of Africa, which usually stands as the odd-man out of cross-continental comparisons. The lower diversity of Africa demonstrated both at local and regional levels has been related to the evolutionary history of lineages (more extinctions), to the history of disturbances (less stable), and also to the current climatic conditions (drier and more seasonal). In this symposium, we will explore the seasonality of tropical forest/tree functioning, in central Africa, and across the global tropics. We will specifically address the question of how tropical forests/trees cope with seasonal drought, combining various approaches including crown and cambium phenology, stem growth monitoring, functional ecology, tree ecophysiology, and high-resolution remote sensing.



SESSIONS AND CHAIRS

S9



Non-invasive molecular methods for biodiversity monitoring in tropical ecosystems

Chairs: Kasun H. Bodawatta & Christina Lynggaard

Effective and efficient biomonitoring tools are critical to evaluate biodiversity and ecosystem health. The rapid growth in non-invasive molecular methods, such as targeting DNA left by organisms in the environment known as environmental DNA (eDNA), has enabled us to detect organisms across the tree of life. These methods were initially developed targeting aquatic ecosystems, but they are currently also used in terrestrial ecosystems through targeting DNA in soil, carrion and hematophagous invertebrates, and faeces. Recently, new sources of DNA have been showcased, such as air, flowers and even spider webs, enlarging the tools available for biomonitoring. These methods can not only detect biodiversity in an area, but also provide valuable information on co-occurrence patterns, trophic interactions, and symbiotic associations. The value of these techniques are imperative in tropical environments, where it is difficult to monitor the extremely high biodiversity with traditional monitoring approaches. In this symposium we aim to showcase a diversity of non-invasive molecular approaches and the current state of the art methods in the field to characterise and monitor biodiversity in tropical ecosystems.

SESSIONS AND CHAIRS

S10

Sustainable agriculture and biodiversity conservation in the tropics

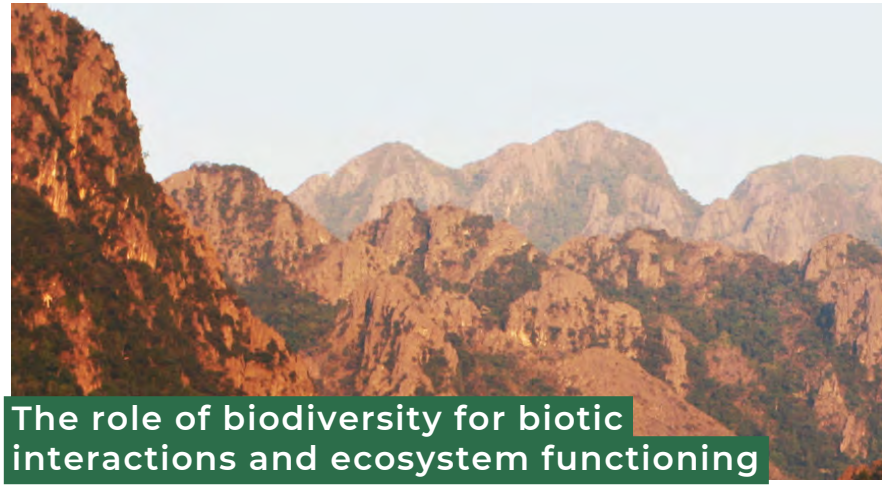
Chairs: Ana Rainho, Karen Mustin, Filipa Monteiro & Maria Manuel Romeiras

The goal of this conference session is to explore the synergies between sustainable agriculture practices, such as agroforestry and organic farming, and biodiversity conservation in tropical regions. As the demand for agricultural products rises, it is imperative to strike a balance that ensures both food security and the preservation of rich tropical ecosystems. One key pathway is through support for small-scale family farming which produces 80% of the food consumed globally and covers 70-80% of farmland.
In the Tropics, smallholders' farmlands are often diverse agricultural systems, as compared with agribusiness which usually involves large-scale monocultures of commodities for export. Smallholder farmers are not only key for food security, but they also play a role in biodiversity conservation, ecosystem services provision and in local economies, supporting rural services, increasing local spending and acting to shorten the food supply chain and thus, reducing waste.

Family farming also often represents on-going expressions of cultural traditions passed down through generations of Indigenous and Traditional Peoples and local communities (ITPLCs), and can be a key part of territorial development. In this session we will focus on the ways in which scientists and ITPLCs can work together to maintain diversified agricultural systems that simultaneously increase the availability of sustainably produced, culturally appropriate food and safeguard biodiversity. We will also discuss the importance of protecting natural habitats adjacent to farmlands and creating wildlife corridors to foster genetic diversity and resilience, the impacts of both staple and cash crops agroecosystems production as well as the incoming problems of monoculture regimes that foster imbalance agroecosystems by the reduced biodiversity and pests/diseases emergency. Join us in this critical discussion that aims to chart a sustainable and equitable path forward for tropical agriculture and biodiversity conservation.

SESSIONS AND CHAIRS

S11



The role of biodiversity for biotic interactions and ecosystem functioning

Chairs: Eike Lena Neuschulz, Jörg Bendix & Nina Farwig

Climate and land-use change modify the structure and composition of ecosystems across the globe. The severe loss of biodiversity calls for a mechanistic understanding of the relationships among environmental change, communities, biotic interactions, ecological processes and functions. Functional traits are considered as key to describe these relationships. Tropical mountain ecosystems with pronounced gradients of environmental conditions can be used as natural experiment to study the links between environmental changes, biodiversity and ecosystem functions. In this session we aim at compiling the latest knowledge on patterns of biodiversity and ecosystem functions and processes across elevational gradients. A special focus will be on the use of functional traits to model and predict biotic interactions and ecosystem functioning across elevational gradients in tropical mountains.

SESSIONS AND CHAIRS

S12

Bridging gaps: integrating local ecological knowledge in tropical ecology

Chairs: Clémentine Durand-Bessart, Stéphanie Carrière & Vincent Porcher

Tropical ecosystems face unprecedented challenges, such as deforestation, defaunation and climate change. To address these, an in-depth understanding of these ecosystems is needed to provide decision-makers with the best possible guidance. However, the accumulation of scientific knowledge is currently hampered by the rapid destruction of these ecosystems, which stresses the need to develop new approaches and collaboration across scientific fields and local knowledge holders to collect this data quickly. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) alerted on the necessity of paradigm shifts while recognizing the crucial need to involve local people in biological diversity assessments and conventions. This local ecological knowledge (LEK) encompasses a nuanced understanding of plant and animal communities, through resource distribution and ecosystem dynamics, often complementing what can be captured through traditional scientific methods alone. These endeavours to involve LEK in ecology research are supported by a growing bulk of literature examining local people's contributions to global ecological change detection, frugivory networks and biodiversity conservation strategies. In this line, this session aims to encourage a dialogue among researchers, practitioners, and local communities to foster mutual understanding and collaboration. By acknowledging and integrating LEK, we can enhance the scientific foundation of tropical ecology, strengthen conservation efforts, and contribute to the sustainable management of these invaluable ecosystems.

SESSIONS AND CHAIRS

S13

Towards sustainable, equitable and safe wildmeat use in tropical and sub-tropical countries: opportunities, lessons learnt, obstacles and risks

Chairs: Nathalie van Vliet, Lauren Coad & Donald Midoko Iponga

Wild meat refers to meat sourced from non-domesticated terrestrial mammals, birds, reptiles, and amphibians. Although wild meat is consumed andtraded all over the world, it is a particularly important staple in many tropical and sub-tropical areas, where it contributes to food security. Wild meat is often consumed due to a lack of alternatives and plays a pronounced role in peoples' health in contexts where other sources of protein are either unaffordable or unavailable. Wildmeat also contributes to wellbeing and serves as a source of cultural and spiritual value and collective identity, consumed during festive events, as part of certain traditions, and as a delicacy. Beyond subsistence, wild meat is also traded as part of peoples' livelihood portfolios, with income earned from wild meat sales often used to purchase other food items and necessities and to pay for school fees or medical care. In light of the importance of wild meat to food security, incomes and wellbeing, there is growing interest in understanding the structure and operations of wild meat use networks and how the sector can provide a sustainable and safe source of protein as well as contribute to equitable benefits. However, wild meat use may come along with irreversible ecological risks, when hunting reduces wildlife populations to extinction and contributes to a breakdown in ecological processes , or to significant health risks when it serves as interface for diseases spill over from wild animal hosts to human populations.

The aim of this session is to bring together practitioners and researchers from South America and Africa to share lessons learnt about the opportunities and risks offered by the wildmeat sector. The presentations will evolved around three main questions: 1. How are current wildmeat value chains structured and who benefits or bares the costs?; 2. What indicators, tools and approaches are being used to measure ecological sustainability of wildmeat use?; 3. What are the risks from a one health perspective and what processes are in place to develop food safety protocols related to the use of wildmeat?; 4. What are the determinants for sustainable, equitable and safe wildmeat use?. The presentations will include insights from various countries and regions (Guyana, Zambia, Democratic Republic of Congo, Gabon, Nigeria, Ghana, Tanzania, Indonesia) and will provide food for thought to participants to engage into a productive discussion to improve the sector, reduce risks of future pandemics originating from wildmeat use and prevent further biodiversity loss.

SESSIONS AND CHAIRS

S14

Tropical Forest conservation and management under a changing climate

Chairs: Meley Mekonen Rannestad, Aster Gebrekirstos, Yennie Katarina Bredin & Thomas Luypaert

Climate change is predicted to drive regional climate disruption and instability across the world, increasingly threatening global biodiversity, and ecosystem service delivery. Tropical forests, which makeup just under half of the world's forests (45%) and harbor more than half of Earth’s terrestrial biodiversity are particularly vulnerable to climate change impacts. On the other hand, climate change driven demands for tropical forest land and ecosystem services are increasing with increasing conflict with each other. Given their significance as both sources and sinks of CO2, conservation of tropical forests through mechanisms such as the REDD+ has been globally recognized as a cheap and quick climate change mitigation option with various co-benefits, including biodiversity conservation. Whereas meeting climate change adaptation and other demands such as domestic energy needs require utilization of different forest products and services.

Making management decisions to meet these conflicting demands for tropical forest ecosystems while addressing the problems of climate change and other environmental changes such as land use and habitat changes, and subsequent loss of important ecosystem services is complex. The implementation of forest policies at multiple levels (global, national, and local) extends the complexity of the problem. Consequently, there is a growing demand for tools that enable optimal decisions related to sustainable management vs conservation of tropical forest land and resources given the complexity of the above-mentioned problems. The goal of this session is therefore to bring together scientists working with climate change and its implications for tropical forest management to share recent insights.

SESSIONS AND CHAIRS

S15

Ecosystem services and conservation of tropical wetlands

Chairs: Pia Paroli & Florian Wittmann

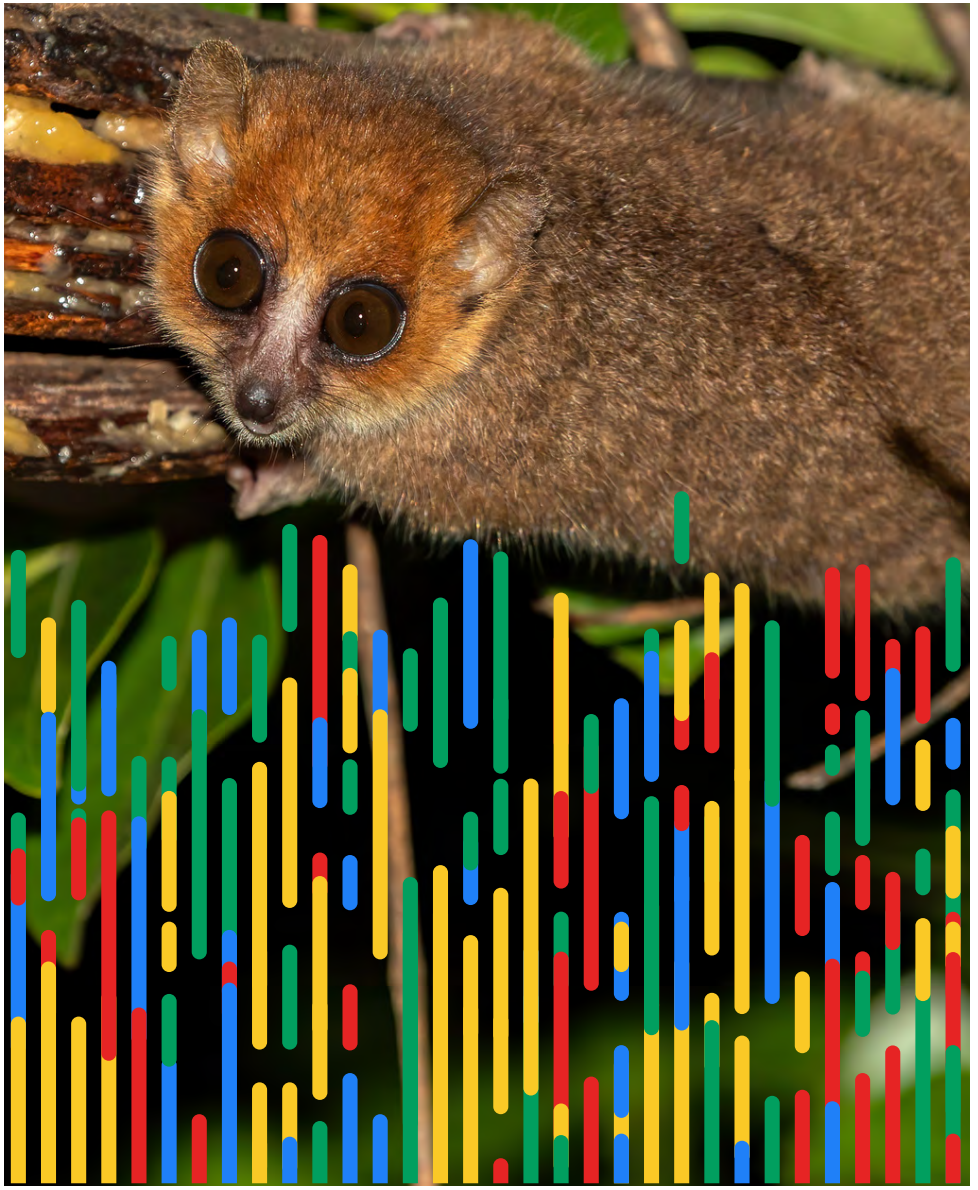
Wetlands are very important yet highly threatened. Their ecosystem services are of local and global importance. Most wetlands are subjected to increasing human pressure, e.g. by water abstraction, changes in the natural flood regime, land reclamation, pollution, and over-utilization of natural resources. The objective of the symposium is to present a state of knowledge about tropical freshwater wetlands: their status, new findings about ecosystem services, threats and solutions. Which are the important questions to ask in order to understand, sustainably use and preserve tropical wetlands? Which are the main challenges to address given the actual status of wetlands and threats like climatic changes and anthropogenic impacts?

SESSIONS AND CHAIRS

S16

Tropical molecular ecology

Chairs: Ute Radespiel & Pablo Orozco-terWengel



Tropical environments are under threat for a variety of reasons including human population expansion and encroachment, habitat loss and fragmentation, and climate change.
At the same time, tropical biodiversity often remains poorly understood or completely undescribed, so that many species may go extinct before being discovered. Species living in tropical environments are highly challenged, since they are generally adapted to relatively stable environmental conditions with narrow ecological niches but need to modify life history strategies and/or change distribution ranges in response to environmental changes. However, increasing landscape discontinuities in addition to natural barriers to gene flow (e.g., rivers, mountains) constrain movements, population dynamics and consequently the biogeographic plasticity of most species. Modern genetic and genomic techniques are excellent tools to investigate the evolutionary processes responsible for current patterns of biodiversity and the impacts of anthropogenic challenges (e.g., demographic changes, hybridization, extinction, inbreeding). This is of utmost importance for estimating the viability of populations and entire species and implementing effective conservation measures in the future. We aim to bring together a collection of contributions that address these and related questions in tropical biota from around the world. This session will provide the opportunity to present new data, critically review existing evidence and discuss important avenues for future research in tropical molecular ecology.

SESSIONS AND CHAIRS

S17

Current trends in tropical African plant ecology: from species to ecosystems; from conservation to sustainable use

Chairs: Luis Catarino, Salomão Bandeira, Maria Cristina Duarte & Maria Manuel Romeiras

African's major terrestrial and coastal biomes comprises a wealthy repository of biodiversity, with a high proportion of native and endemic plant species, which makes it biologically unique and provides a wide range of ecosystem services. Many of these ecosystems are being degraded, mostly due to the growing impacts from climate change and other anthropogenic and environmental problems, such as overexploitation of natural resources, droughts and floods, changes in land-use and spatial distribution of species. Current land cover change is damaging biodiversity, namely the conversion of forest and other natural areas, such as wetlands, for food production and urban development is happening at a fast step following the rapid transformation of African societies. Such conversion leads to habitat and biodiversity loss, affecting livelihoods, water supply, food security and reducing resilience to extreme events, particularly for people living in rural and coastal areas of African continent.

Also, Africa is extraordinarily rich in useful plants and local knowledge on its properties, comprising a strategic strength for sustainable development in the region. The continent has an important genetic diversity that reflects its unique variety of plants and several important native crop species, which are adapted to an ever-changing environment. The knowledge of the huge African plant diversity, as well as the structure, composition and processes involved in vegetation changes, are crucial to promote their sustainable use and to conserve one of the most understudied regions in the world. This session aims to gather contributions to deliver the timely and emerging research in the main topic of Tropical African plant ecology, and presentations covering a wide and multidisciplinary approaches (e.g. Structure and Composition of Plant Communities; Biogeography; Conservation; Ecological Modeling; Genetic Diversity; Ethnobotany; Agroforestry; Restoration, Climate changes and Ecosystem services) are welcome to be submitted.

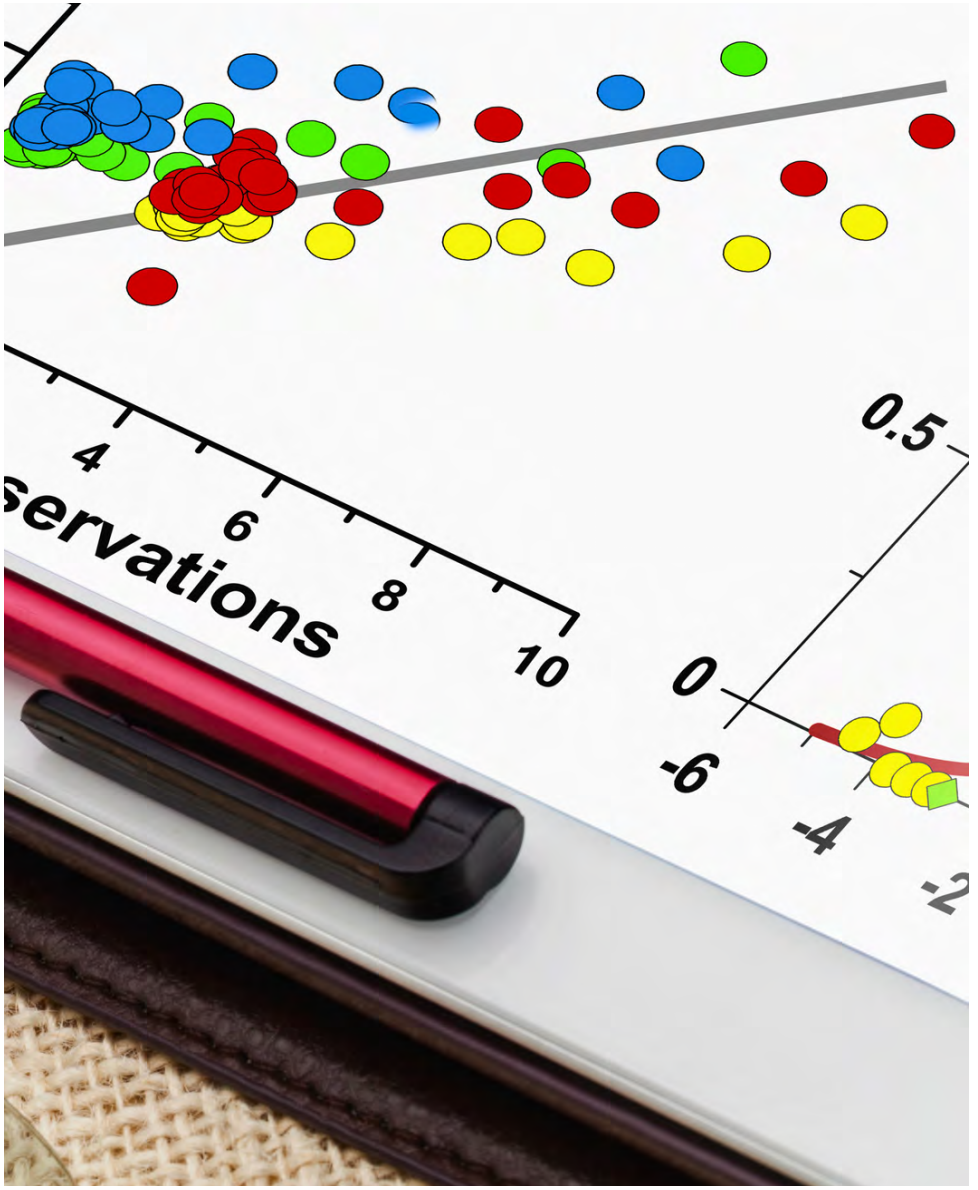
SESSIONS AND CHAIRS

S18

Recent advances in tropical ecological modelling

Chairs: Mateus Dantas de Paula

Tackling the complexity of ecological systems and understanding patterns and processes for the advancement of theoretical ecology and informing policy makers has been the main goals of Ecological Modelling. Due to their complexity, tropical ecosystems have been for decades a major challenge for the field, due to large spatial scales, biological diversity, interactions and novel processes in relation to other ecosystems. In spite of this, major advances in data collecting, artificial intelligence and improvement in computer power have provided new and exciting insights on key facets of tropical ecology, often out of reach for conventional empirical methods. In this session, we showcase recent work which advance theoretical and applied ecology through the use of models, involving remote sensing, process-based models, machine learning and random forests, species distribution models or other novel methods.



SESSIONS AND CHAIRS

S19

iEcology and the power of digital data in biodiversity conservation in the tropics

Chairs: Fernanda Alves-Martins & Javier Martinez-Arribas

In the age of smartphones and information technology, digital data, including social media content, has enormous potential to support and complement traditional ecological data. iEcology, an emerging research field that uses digital data to study ecological patterns, has demonstrated its potential to provide fresh insights into species distribution, their phenological and behavioral patterns, among other valuable applications. Furthermore, it plays a crucial role in filling biodiversity knowledge gaps, particularly in tropical countries that have historically faced challenges regarding the collection and availability of biodiversity data.
The symposium aims to showcase some case studies and discuss the use of internet and social media data as significant sources of information for conservation science in the tropics.

SESSIONS AND CHAIRS

S20

Adapting to change: exploring the ecology and evolution of tropical rainforest understory species amidst a changing world

Chairs: Jonas Depecker, Filip Vandelook, Steven Janssens & Piet Stoffelen

Large trees dominate one's perspective of the African tropical rainforest, which is mirrored in a research focus on canopy trees. Yet, most of the floristic diversity in these forests is actually found in the forest's understory as shrubs or small trees (Lasso et al 2011; Lü & Tang 2010). The communities in this forest layer also play a key role in succession and ecological functioning of the whole forest (Cicuzza et al 2013; Kusuma et al 2018). However, we know very little about ecological processes such as pollination and seed dispersal, and evolutionary processes such as speciation in understory species. The forest's understory is also home to several crop wild relatives (CWR) of for example Coffee and Cocoa, which support multibillion-dollar sectors. Coffea species for example have diversified in the understory of African rainforests (Ref). However, like many understory species, coffee species are facing a plethora of threats related to a fast-changing planet, including climate change, deforestation, and forest degradation. To conserve understory shrubs, including coffee, more research on the evolution and ecology of these species is crucial. The main objective of this session is to gather knowledge on different aspects of the ecology and evolution of tropical rainforest understory species. Specific objectives include bring together early career scientists studying rainforest understory from different perspectives, share knowledge about state-of-the-art techniques and analyses, explore possibilities for joint research projects, share research experiences with early and late career scientists.

SESSIONS AND CHAIRS

S21

On the ecological and social dimensions of hydropower development across the tropics

Chairs: Ana Filipa Palmeirim & Isabel Jones

The burgeoning energy demand worldwide has led to a proliferation of hydroelectric dams, firstly in the northern hemisphere and subsequently across tropical developing countries, which have become the new hydropower frontier. As such, hydroelectric dams have induced widespread loss, fragmentation and degradation of terrestrial and aquatic habitats in lowland tropical and sub-tropical ecosystems. In this symposium, we aim to synthetize current interdisciplinary knowledge on the ecological and social impacts of hydropower development in tropical ecosystems, with a focus on forest habitats. We will give particular emphasis to biodiversity responses to habitat loss and insular fragmentation induced by hydroelectric dams, as well as bringing socio-ecological dimensions of dam development to the fore. During the symposium, researchers currently working on a variety of tropical landscapes will focus on diverse aspects of dam-induced impacts.

As such, our symposium expects to bring together theoretical advancements and guidelines for biodiversity conservation and social-environmental impact mitigation from future dam development across the tropics. This symposium further represents a great opportunity for researchers working on hydropower to get together and discuss about the long-term and ongoing research to be presented. To cover a reasonable number of topics and study areas within the subject of our symposium, we propose a gender-balanced list of six speakers, including both well-established and younger scientists (below we provide the list of potential speakers and corresponding tentative titles) Given that hydropower development is a major environmental issue across the tropics, we expect this symposium to potentially attract a wide range of attendees in the conference.

SESSIONS AND CHAIRS

S22

Fossil fuels in tropical forests: corporate impunity, pollution and unextractable resources

Chairs: Martí Orta Martínez, Cristina O'Callaghan, Pedro Mayor & Gorka Muñoa

Tropical rainforests have an essential role in mitigating the increasing negative effects of the climate crisis. In addition they sustain half of world's species and directly provide home and resources for millions of indigenous people. Besides, tropical rainforests indirectly shape the basic foundation for human welfare worldwide. Yet, despite the common interest in preserving these ecosystems, tropical rainforests are being increasingly affected by the expansion of fossil fuel projects that seek to exploit their resource wealth. Numerous scientific publications point to negligent practices and poor maintenance of infrastructure by the fossil fuel industry. This situation happens in a context of already low environmental standards and weak public systems of environmental control and accountability, which results in the release of pollution and the impunity of fossil fuels corporations. In this context, this session wants to provide a space to researchers to present results on the effects (e.g., water pollution) of extractive industries on ecosystems and human populations, as well as spurring discussions on the role of corporate impunity and the mechanisms of accountability existing in highly biodiverse areas with weak state governance. Furthermore, the session wants to bring in discussions over the role of fossil fuels phase down in areas with outstanding social and ecological values (unburnable fuels) following the paradigmatic case of the Yasuní in Ecuador. The session will be open to the discussion of criteria and the operazionalisation of a methodology to select exclusion fossil fuel extraction areas.

PROGRAMME OVERVIEW

MONDAY, 12TH

TIME	ROOM	
14h30	H	Registration
16h00	A	Opening ceremony
16h30	A	Plenary **Miguel B. Araújo**
17h00	H	Welcome cocktail, music & network

EXCURSIONS FRIDAY, 16TH

09h30 Departure from the Faculty of Sciences of the University of Lisbon

Discovering the Tagus estuary north-eastern shores and its birds

From birdwatching in Lagoa Pequena to Arrábida´s mediterranean gem

18h30 Arrival at the Faculty of Sciences of the University of Lisbon

TUESDAY, 13TH

TIME	ROOM	
09h00	A	Plenary **Ricardo Rocha**
09h45	B	S1: Dogs in conservation: the nose knows
		S4: Tropical chemical ecology
	C	S9: Tropical biomonitoring in a molecular era
	D	S3: Multi-trophic networks in tropical forests
11h15	H	Break for coffee & posters
11h45	B	S5: Adaptations of neotropical biodiversity
	C	S6: Ecology of tropical mountains
	D	S3: Multi-trophic networks in tropical forests
13h15	H	Lunch
14h45	A	Plenary **Anna Traveset**
15h30	B	S5: Adaptations of neotropical biodiversity
		S8: Free session
	C	S6: Ecology of tropical mountains
		S2: Cutting-edge biomonitoring in the tropics
	D	S7: Tropical forest/tree functioning
17h00	H	Break for coffee & posters
17h30	B	S8: Free session
	C	S6: Ecology of tropical mountains
	D	S7: Tropical forest/tree functioning

WEDNESDAY, 14TH

TIME	ROOM	
09h00	A	Plenary **Aida Cuni-Sanchez**
09h45	B	S10: Biodiversity and sustainable tropical agriculture
	C	S11: Biodiversity, biotic interactions and functioning
	D	S13: Wildmeat: Opportunities and risks
11h15	H	Break for coffee & posters
11h45	B	S10: Biodiversity and sustainable tropical agriculture
	C	S11: Biodiversity, biotic interactions and functioning
	D	S13: Wildmeat: opportunities and risks
13h15	H	Lunch
14h30	B	S10: Biodiversity and sustainable tropical agriculture
	C	S11: Biodiversity, biotic interactions and functioning
		S12: The place of ethnoecology in tropical ecology
	D	S13: Wildmeat: opportunities and risks
		S8: Free session
16h00	H	Break for coffee & posters
16h30	B	S10: Biodiversity and sustainable tropical agriculture
		S19: iEcology in the tropics
	C	S12: The place of ethnoecology in tropical ecology
		S15: Ecosystem services of tropical wetlands
	D	S8: Free session
17h30	H	Poster session
	B	gtö's General Assembly
20h00		Conference dinner

THURSDAY, 15TH

TIME	ROOM	
09h00	A	Plenary **Marco Mello**
09h45	B	S14: Tropical forest management under climate change
	C	S22: Fossil fuels in tropical forests
		S17: Current trends in tropical African plant ecology
	D	S16: Tropical molecular ecology
11h15	H	Break for coffee & posters
11h45	B	S14: Tropical forest management under climate change
	C	S17: Current trends in tropical African plant ecology
	D	S16: Tropical molecular ecology
13h15	H	Lunch
14h30	B	S21: Ecological and social dimensions of hydropower
		S20: Understory shrubs: adapting amidst change
	C	S17: Current trends in tropical African plant ecology
	D	S16: Tropical molecular ecology
		S18: Tropical ecological modelling
16h15	H	Break for coffee and posters
17h30	A	Closing ceremony + Awards + Invitation for 2025

PROGRAMME

MONDAY, 12TH | AFTERNOON

14h30 | **Hall** | Registration

16h00 | **Room A** | Opening ceremony, with:

Jorge Palmeirim, Conference Chair
Professor at the Faculty of Sciences of the University of Lisbon

Luís Carriço
Dean of the Faculty of Sciences of the University of Lisbon

Cristina Máguas
Coordinator of CE3C - Centre for Ecology, Evolution and Environmental Changes

Pierre-Michel Forget
President of gtö, the Society of Tropical Ecology

16h30 | Room A | Miguel B. Araújo
Moving away from individual species models of biodiversity response to climate change

17h15 | **Hall** | Welcome cocktail, music & network

PROGRAMME

TUESDAY, 13TH | MORNING 1/2

09h00 | Room A | Ricardo Rocha

The role of secondary forests in mitigating fragmentation-related extinctions: Insights from an Amazonian whole-ecosystem manipulation experiment

Room B

S1: Dogs in conservation: the nose knows

09h45 | O01 Leopold Slotta-Bachmayr
Dogs as a possible tool to improve research in the tropics

10h00 | O02 Noreen Mutoro #
Impact of weather conditions on cheetah (Acinonyx jubatus) monitoring with scat detection dogs

S4: Tropical chemical ecology

10h15 | O01 Brian Sedio
Species differences in foliar metabolites define fundamental niche dimensions in a tropical forest

10h30 | O02 Omer Nevo
Fruit scent: an evolved signal for seed dispersal?

10h45 | O03 Linh M.N. Nguyen #
Unveiling the Scent Evolution of Madagascar's Figs

11h00 | O04 Katharina Brandt
How do prey signals attract wasps as pollinators in two generalist plant species of the Caatinga?

Room C

S9: Tropical biomonitoring in a molecular era

09h45 | O00 Christina Islas Lynggaard
Gathering terrestrial biodiversity data through environmental DNA

10h00 | O01 Naiara Sales
Ecosystem monitoring powered by eDNA surveys in megadiverse areas: challenges and perspectives

10h15 | O02 Céline Condachou
Application of eDNA for species conservation: the case of Harttiella (Siluriformes, Loricarridae)

10h30 | O03 R. Haderlé
Environmental DNA (eDNA) in the French West Indies : a non-invasive molecular method to monitor the biodiversity of mobile marine species

10h45 | O04 Jan F. Gogarten
Flies as tools for studying disease ecology in tropical ecosystems

11h00 | O05 Anais K. Tallon
A dive into landfill ecology: The role of New World vultures in the dissemination of anti-microbial resistance

Room D

S3: Multi-trophic networks in tropical forests

09h45 | O02 Marie Séguigne
Interactive effects of drought and deforestation on multitrophic communities and aquatic ecosystem functions – an experimental test using tank bromeliad ecosystems

10h00 | O03 Mingqiang Wang
Tree diversity effects on higher trophic levels in a subtropical forest experiment of China

10h15 | O04 Georg Albert #
Multi-trophic network properties mediate tree biodiversity effects on forest ecosystem multi-functionality

10h30 | O05 Eva T. López
Recovery of tree seedling-herbivore interactions along a tropical chronosequence

10h45 | O06 Elise Sivault #
Bats and birds top-down regulate arthropods to a similar magnitude across temperate and tropical forests

11h00 | O07 Katerina Sam
Insights from the canopy: Both vertebrate- and ant-mediated regulation of arthropod communities and herbivory was revealed in temperate and tropical forests

11h15 | **Hall** | Break for coffee & posters

Eligible candidates for the Merian Award are marked with an #

PROGRAMME

TUESDAY, 13TH | MORNING 2/2

11h15 | **Hall** | Break for coffee & posters

Room B

S5: Adaptations of neotropical biodiversity

11h45 | O01 Guido Briceno
Diversity of frontier processes and frontier metrics to uncover major types of forest cover changes

12h00 | O02 Crystal McMichael
Ecological legacies of past fire and human activity in a Panamanian forest

12h15 | O03 Edith Villa Galaviz
Dynamics of species turnover along a chronosequence in the Ecuadorian Chocó forest: a comparison across different ecological communities

12h30 | O05 Luís M. Rosalino
Drivers of the density and conservation of red-handed howler monkeys, Alouatta belzebul, in an Amazonian savannah

12h45 | O06 Clarisse Palma-Silva
Adaptive Genomics of Bromeliads Along an Elevational Gradient in the Mountains of the Brazilian Atlantic Forest

13h00 | O07 Lucas Buffan
Palaeogene climate deterioration increased South American mammal turnover near the Eocene-Oligocene Transition

Room C

S6: Ecology of tropical mountains

11h45 | O01 Hermann Behling
Ecological response on environmental change in tropical South America during the late Quaternary

12h00 | O02 Homeier Jürgen
Functional properties of Andean upper montane forest trees – the role of rare species

12h15 | O03 João D.V. Junior
Climate-driven loss of plant diversity in African mountains

12h30 | O04 Göran Wallin
Warming responses of growth and mortality of tropical montane tree species in relation to functional traits

12h45 | O06 Bianca Zoletto
The effects of lightning on tropical forests in Central Africa

13h00 | O05 Camille Ziegler #
Heat and drought plasticity in hydraulic traits of Afromontane tree species from contrasting successional types

Room D

S3: Multi-trophic networks in tropical forests

11h45 | O08 Jingting Chen
The ecological effect of tree diversity on spider-prey interaction in subtrophical forest

12h00 | O09 Mareike Mittag
Thriving in Diversity – herbivory and predation rates respond to tree diversity in a subtropical forest biodiversity experiment in China

12h15 | O10 Karen M. Pedersen
Tritrophic mammal dung dung beetle seed interactions in the Ecuadorian Choco

12h30 | O11 Sarah Tossens
Impacts of carnivores on tropical forest dynamics through trophic cascades: the study case of Central African wild cats

12h45 | O12 Natalia Revilla-Martín
Stable landscapes help maintain stable bird communities

13h15 | **Hall** | Lunch

14h30 | Group photo

Eligible candidates for the Merian Award are marked with an #

PROGRAMME

TUESDAY, 13TH | AFTERNOON 1/2

14h45 | Room A | Anna Traveset

Deciphering the complexity of ecological interactions in tropical islands. A multilayer network approach

Room B

S5+

15h30 | O08 Mauricio Bacci
Climate change may differently affect pest and non-pest leafcutter ants and threaten food security

15h45 | O09 Isabel Marques
Effects of natural hybridization on the diversity of Neotropical orchids

16h00 | O10 David Draper
Species extinction in neotropics: how far have we gone and what will future climate change bring?

S8: Free session

16h15 | O01 Guillermo Porriños
Fish community composition in the tropical archipelago of São Tomé and Príncipe

16h30 | O02 Patrícia Guedes
Reassessing the conservation status of the Príncipe's island endemic shrew Crocidura fingui, Central Africa

16h45 | O03 Gonçalo Curveira-Santos
Postwar defaunation in Angola: mammal assemblages in Bicuar National Park

Room C

S6+

15h30 | O07 Olivier J. L. Manzi
Partial thermal acclimation of the photosynthetic heat tolerance in tropical trees

S2: Cutting-edge biomonitoring in the tropics

15h45 | O02 Antoine Plumacker
Comparative Analysis of Large Tree Segmentation in the Canopy of African Tropical Forests

16h00 | O03 Sá N. Lisboa
Drivers of deforestation and degradation of miombo woodlands in Mozambique: what is the extent and shares of forest change?

16h15 | O04 Carly Batist
Eavesdropping on Nature: How ecoacoustics can scale up biodiversity monitoring and inform conservation

16h30 | O05 Dylan Carbone
Automated monitoring of insects supports new research into flying insect populations in tropical ecosystems

16h45 | O06 Massimo Martini
Using DNA barcoding to resolve quantitative multi-trophic interaction network response to tree identity

Room D

S7: Tropical forest/tree functioning

15h30 | O01 Adeline Fayolle
How seasonal is tropical forest/tree functioning?

15h45 | O03 Anais Gorel
How tropical trees in Africa adapted to cope with seasonal drought? Exploring the phylogenetic and climatic distribution of the species leaf habit, maximum height, and wood density

16h00 | O05 Megan K. Sullivan #
Climate & tree crown phenology in Nyungwe National Park, a montane tropical forest in Rwanda

16h15 | O06 Marjane Kaddouri
Tracking the seasonal rythm of tropical forests and savannas with phenocams in Lopé NP, Gabon

16h30 | O07 Bo Zhou
Are intra-annual responses of subtropical trees to climatic variation consistent across species?

16h45 | O08 Achim Bräuning
Forming leaves does not mean not grow: dendrometer records reveal growth failure of dry tropical forest tree species in extreme years

17h00 | **Hall** | Break for coffee & posters

Eligible candidates for the Merian Award are marked with an #

PROGRAMME

TUESDAY, 13TH | AFTERNOON 2/2

17h00 | **Hall** | Break for coffee & posters

Room B

S8: Free session

17h30 | O04 Marion Tafani
Angola as a pivot to promote wildlife ecology research and capacity building opportunities through the establishment of a dynamic collaboration network

17h45 | O05 Filipe Rocha
Unveiling the impacts of fire severity on herbivore occupancy patterns

18h00 | O06 Víctor Fernández-García
Exploring the relationships between fire regimes, plant diversity, and carbon stocks in African savannas

18h15 | O07 Luis Pedro Pratas-Santiago
Withdrawal and expansion: a decade of dynamic ungulate distribution in Amazonian lowland sanctuaries (2010-2020)

Room C

S2+

17h30 | O07 Desamarie A. Fernandez
Temporal ecology of carnivorans in Palawan Island, Philippines

17h45 | O08 Daniel V. Garcéz
Unveiling rat predation dynamics in São Tomé and its implications for conservation

18h00 | O09 Julia Fa
Empowering local communities for effective biomonitoring in Guinean Forests of West Africa

Room D

S7: Tropical forest/tree functioning

17h30 | O09 Pauline Hicter
Seasonality of tree growth and carbon uptake through assessments of the cambial phenology in the Biosphere Reserve of Yangambi in the Democratic Republic of the Congo

17h45 | O10 Claire Wauquiez
Foliar water uptake: a seasonal drought mitigation strategy of central African canopy tropical trees

18h00 | O11 Cristina Antunes
How does water-table depth affect the physiological status of a tropical dune forest?

18h15 | O12 Ligia Vieira
Patterns and drivers of herb biomass in a Caatinga dry tropical forest

Organising committee's suggestion:

Enjoy the end of the day in Lisbon!

PROGRAMME

WEDNESDAY, 14TH | MORNING 1/2

09h00 | Room A | Aida Cuni-Sanchez

Local perceptions of forest ecosystem services, insights from Africa

Room B

S10: Biodiversity and sustainable tropical agriculture

09h45 | O01 Pablo Aycart Lazo #

Interacting effects of local and landscape factors shape bird and bat diversity in Amazonian cacao agroforestry systems

10h00 | O02 Blanca Ivañez-Ballesteros

Assessing cacao pollination: impact of landscape and farming practices on pollinator diversity and fruit yield in Northern Peruvian Amazon

10h15 | O03 Eliza Van de Sande #

Solving the cacao pollinator puzzle: new insights into pollinator identity and ecology

10h30 | O04 Jamal Kabir #

Restoring biodiversity to oil palm plantations in Sumatra, Indonesia: can riparian buffer restoration treatments support Anuran populations?

10h45 | O05 Raquel Oliveira

Conserving biodiversity and enhancing food security: understanding small mammal diversity patterns in mosaic landscapes of Guinea-Bissau (West Africa)

11h00 | O06 Cárol Sierra-Durán #

Bats and rice: contribution of insectivorous bats to pest suppression services in Mexican rice fields

Room C

S11: Biodiversity, biotic interactions and functioning

09h45 | O01 Jörg Bendix

Hyperspectral sensing of functional traits in tropical mountain forests for the parameterization and validation of a biodiversity-informed land model

10h00 | O02 Jürgen Homeier

Drivers of tree diversity in Andean forests: comparing species richness, phylogenetic diversity and functional diversity

10h15 | O03 Laura Würzberg

Root sap flow measurements reveal different plant water uptake strategies in a seasonal tropical dry forest in southern Ecuador

10h30 | O04 Lea Kerwer

Abiotic and biotic filters shape seedling recruitment in a tropical dry forest

10h45 | O05 Jana E. Schön

Do leaf traits of tree canopies shape herbivory in tropical montane rainforests?

11h00 | O06 Nina Farwig

Environmental heterogeneity consistently increases diversity effects on ecosystem functioning in tropical mountains

Room D

S13: Wildmeat: opportunities and risks

09h45 | O01 Oswin David

Towards the conservation and sustainable use of Yellow-Spotted River Turtle (Podocnemis unifilis) in the Rupununi region, Guyana

10h00 | O02 Jonas Kakule Muhindo

Reducing wild meat sales and promoting local food security: lessons learnt from a behavior change campaign in Yangambi, Democratic Republic of Congo

10h15 | O03 Sagesse Nziavake

Uneven transmission of traditional knowledge and skills in a changing wildmeat system: Yangambi, Democratic Republic of Congo

10h30 | O04 Sandra Owusu-Gyamfi

Monitoring frog meat harvesting and population estimation as a key step to sustainable wildlife utilisation in Ghana

10h45 | O05 Juanita Gómez

Is place at the foundation of Indigenous Stewardship for wildlife: Case studies from Guyana and DRC

11h00 | O06 Jonas K. Nyumu

Alternative livelihoods to reduce reliance on wildmeat in the Yangambi landscape, DRC

11h15 | **Hall** | Break for coffee & posters

Eligible candidates for the Merian Award are marked with an #

PROGRAMME

WEDNESDAY, 14TH | MORNING 2/2

11h15 | **Hall** | Break for coffee & posters

Room B

S10: Biodiversity and sustainable tropical agriculture

11h45 | O07 Madalena Sottomayor
Nature-based solutions to increase rice yield: an experimental assessment of the role of birds and bats as agricultural pest suppressors in West Africa

12h00 | O08 Gonçalo A. Fernandes
Patterns and predictors of insectivorous bat activity around isolated trees in rice fields of Guinea-Bissau (West Africa)

12h15 | O10 Eike Lena Neuschulz
The benefits of eco-certification for biodiversity

12h30 | O11 Patrícia A. P. Chaves
Friend or Foe? Attitudes of Rice Farmers towards Wild Animals in West Africa

12h45 | O12 Aster Gebrekirstos
Agroforestry for food security, biodiversity, and climate resilience

13h00 | O13 Mary A. George #
Influence of household livelihood assets on agrobiodiversity and food availability and accessibility outcomes along urbanisation gradients in tropical smallholder agroforestry systems

Room C

S11: Biodiversity, biotic interactions and functioning

11h45 | O07 Christoph Meyer
Fear or food? Prey availability is more important than predation risk in determining aerial insectivorous bat responses across a disturbed tropical forest landscape

12h00 | O08 Divya Divya #
Understanding the functional dynamics of plant-avian frugivory in novel urban ecosystem of Delhi

12h15 | O10 Gladys N. Kungu
Movement behaviour of a cooperatively breeding bird scales to the level of habitat degradation in Afrotropical cloud forests

12h30 | O11 Luke Powell
The queens of the Congo rainforest and their loyal subjects: Dorylus driver ants and the specialized birds that follow them

12h45 | O12 Finn Rehling #
Animal carrion decomposition and decomposers are influenced by canopy cover, topography, ants and tree species richness in a subtropical forest biodiversity experiment

13h00 | O13 Natalia Medina-Serrano #
Plant-animal interactions in restoration ecology: insect pollinators and other floral visitors in the semi-arid savannas of the Ferlo region in Senegal

Room D

S13: Wildmeat: opportunities and risks

11h45 | O07 Lola Nihotte
Are tropical countries prepared to guaranty food safety in wild meat use: a comparative analysis of legal frameworks across different countries

12h00 | O08 Emmanuela Mbangale
Using Local knowledge and camera traps to assess and monitor hunting systems in the Democratic Republic of Congo

12h15 | O09 Chanda Mwale
The legal game meat value chain in Zambia: Lessons Learned for Supporting the Socio-Economic and Sustainability Potential of Wild Meat Economies

12h30 | O13 Nadia Balduccio
Assessing the impact of traditional hunting on mammal populations in the buffer zone of Salonga National Park, DRC

12h45 | O14 Julia Fa
Wild foods are less important for those who farm for sedentarised Baka in Cameroon

13h00 | O15 Joshua Bauld
The impact of local market access on wildmeat consumption in Gabon

13h15 | **Hall** | Lunch

Eligible candidates for the Merian Award are marked with an #

PROGRAMME

WEDNESDAY, 14TH | AFTERNOON 1/2

13h15 | Hall | Lunch

Room B

S10: Biodiversity and sustainable tropical agriculture

14h30 | O14 Karen Mustin
Impacts of agribusiness expansion on territorial development in the Savannas of Amapá

14h45 | O15 Jean C. Nsengiyumva #
Assessing Fairtrade Feasibility for Sustainable Practices in Guinea-Bissau's Cashew Agroecosystems

15h00 | O16 Filipa Monteiro
Nuts for cashews: achieving sustainable production in Guinea-Bissau (West Africa)

15h15 | O17 Sofía Ocaña-Cabrera
Sweet beekeeping from the middle of the world

15h30 | O18 Paola Sierra-Baquero
Cashew field prospection in Guinea-Bissau: characterization of the production system and pest occurrence

15h45 | O19 Rafael António
Discriminating cashew varieties from Guinea-Bissau through agromorphology, nutritional, and allergen analysis

Room C

S11+

14h30 | O14 Joana Ribeiro
Functional and phylogenetic correlates of invasion risk across tropical biomes

14h45 | O15 Belinda Kahnt
When lizards shift to a plant-based lifestyle: The macroevolution of mutualistic lizard-plant-interactions

S12: The place of ethnoecology in tropical ecology

15h00 | O01 José M. V. Fragoso
Enhancing collaboration among scientists and traditional peoples for biodiversity research: identifying and addressing diverse interests in biodiversity monitoring programs

15h15 | O03 Chiara Bragagnolo
Tell me what you do in the park and I'll tell you who you are: Exploring human-nature interaction in the Obô Natural Park (São Tomé Tropical Island)

15h30 | O04 Martina Panisi
Which species do children prefer to protect and why? Exploring wildlife knowledge and conservation preferences in two African tropical sites

15h45 | O05 Opale Coutant #
Confronting forest dweller local ecological knowledge and eDNA measurements of biodiversity

Room D

S13+

14h30 | O16 Lilian Mangama
The impac of subsistence hunting on local wildlife communities

14h45 | O17 Franciany B. Pereira
Access, technology, and urbanization drive wild meat trade dynamics in Guyana, at the heart of the Guiana Shield

S8: Free session

15h00 | O09 Gargi R. Chowdhury
Sounds of survival: impact of vessel traffic on endangered Ganges river dolphins in the Hugli River

15h15 | O10 Eckhard W. Heymann
Sisi e'u ("food of the tamarins") – plant-frugivore interactions of the Neotropical understory tree Leonia cymosa (Violaceae)

15h30 | O11 Fatima Chaudhary #
Human visitation alters the behavioral response of wildlife: a study on vigilance behavior of Japanese pika at Mount Highashi-nupukaushi-nupuri

15h45 | O12 Anastasia Poliakova
Applied palaeoecological and molecular methods in the studies of material codicology: new aspects of known techniques used for palm-leaf manuscript studies

16h00 | Hall | Break for coffee & posters

Eligible candidates for the Merian Award are marked with an #

PROGRAMME

WEDNESDAY, 14TH | AFTERNOON 2/2

16h00 | **Hall** | Break for coffee & posters

Room B

S10+

16h30 | O22 Tamanna Tamanna
Groundwater quandary of Bathinda, Punjab: a balance between sustainable agriculture and ecology

16h45 | O23 Alex B.D. Etchike
Characterization agroforestry systems based on cocoa and oil palm on the outskirts of a forest concession in southern Cameroon

S19: iEcology in the tropics

17h00 | O01 Fernanda Alves-Martins
A culturomics approach to map African protected areas value and vulnerability

17h15 | O17 Sofía Ocaña-Cabrera
Using social media and machine learning to understand negative sentiments towards Brazilian National Parks

Room C

S12+

16h30 | O06 Clémentine Durand-Bessart #
Local ecological knowledge enhance our understanding of Afrotropical frugivory networks

S15: Ecosystem services of tropical wetlands

16h45 | O01 Pia Parolin
Introductory overview on diversity and the conservation of globally important tropical freshwater wetlands

17h00 | O02 Florian Wittmann
Amazonian large-river floodplain forests: ecology, biogeography and conservation

17h15 | O03 J. Ethan Householder
How unique are the tree communities of the Amazon's floodplain forests?

Room D

S8: Free session

16h30 | O13 Beatriz Lucas Arida
Consequences of floral colour polymorphism on the reproductive success of a Neotropical deceptive orchid

16h45 | O14 Arianna Tartara
Leaf litter decomposition along a chronosequence in the Ecuadorian lowland Choco' forest

17h00 | O15 Guido B. Castillo
Diversity of frontier processes and frontier metrics to uncover major types of forest cover changes

17h15 | O16 Gonzalo Rivas-Torres
Summarizing two decades of research on Scalesia (Asteraceae), the most endemic and iconic plant genus radiated in the Galapagos Islands

17h30 | **Hall** | Poster Session

17h30 | **Room B** | gtö's General Assembly (Members only)

20h00 | Conference dinner

Eligible candidates for the Merian Award are marked with an #

PROGRAMME

THURSDAY, 15TH | MORNING 1/2

09h00 | Room A | Marco Mello

The elephant, the monks, and the topology of interaction networks

Room B

S14: Tropical forest management under climate change

09h45 | O02 Joana S. Carvalho
Will there be any suitable habitat left for African great apes by 2050?

10h00 | O03 Noé Madingou
Vulnerability of African tropical rainforest to projected climate change

10h15 | O04 Andrés Gerique
Unraveling the effects of market-based conservation on the sociocultural capital of indigenous peoples in the Western Amazon

10h30 | O05 Mikkel Vindegg
Community perceptions of dry forest change in Tigray, Ethiopia: the role of local perspectives for governance and policy

10h45 | O07 Carolina Soto Navarro
The AmistOsa lifeboat: building resilience to climate change through nature-based solutions in one of Central Americ´s last great forests

11h00 | O08 William Gosling
A 2300 year perspective on land-use change in the Andes biodiversity hotspot

Room C

S22: Fossil fuels in tropical forests

09h45 | O01 Martí Orta-Martínez
Compensation for Rights Holders of Unextractable Fossil Fuels in Tropical Rainforests

10h00 | O02 Guillem R. Taberner
Environmental justice for the transition away from fossil fuels in tropical rainforests

10h15 | O03 Gorka Muñoa
Assessing unburnable fossil fuels in the world's tropical rainforests: scaling down to oil and gas fields and coal deposits

S17: Current trends in tropical African plant ecology

10h30 | O01 Antonia Reinhardt
Rainforest fragmentation in northern Madagascar during the past millennium - a result of intensified human impact and climate dynamics?

10h45 | O02 Juliette Picard
Mapping tropical forest types and associated floristic, functional and faunistic composition in central Africa

11h00 | O03 Madalena Matias
Between land and sea – Analysis of historical land cover dynamics at the coastal interface in Guinea-Bissau

Room D

S16: Tropical molecular ecology

09h45 | O01 Helena Teixeira
Past volcanic activity predisposes an endemic threatened seabird to negative anthropogenic impacts

10h00 | O02 Shawn Lehman
Dispersal dynamics of mouse lemurs in fragmented dry forests of Northwestern Madagascar

10h15 | O03 Marine Ha-Shan
Inferring a demographic scenario accounting for population structure in two Indian Ocean bird species endemic to a single island

10h30 | O04 Cock van Oosterhout
Genomics-informed conservation to the rescue

10h45 | O05 Jordi Salmona
The critically endangered Coquerel's sifaka retains pre-deforestation genetic makeup

11h00 | O10 Kasun Bodawatta
Living with toxins: convergent modifications of sodium channels against deadly batrachotoxin in New Guinean toxic birds

11h15 | **Hall** | Break for coffee & posters

PROGRAMME

THURSDAY, 15TH | MORNING 2/2

11h15 | **Hall** | Break for coffee & posters

Room B

S14: Tropical forest management under climate change

11h45 | O09 Laura Benitez
14,000 years of climatic andB anthropogenic change in theB Afromontane forest of São Tomé Island, Gulf of Guinea

12h00 | O11 Hailemariam Tsegay #
Modeling the current and futureB distribution of Dracaena ombetB Kotschy and Peyr. under climateB change in Ethiopia

12h15 | O12 Abrha M. Meressa
Strict protection reducesB environmental and economicB sustainability of dry afromontaneB forests in low-income countries

12h30 | O13 Bianca W. Kassun
Fuelwood or carbon: spatio-temporalB trade-offs between major forestB ecosystem services in a dryB Afromontane Forest in Ethiopia

12h45 | O14 Dora M. Villela
Edge effect caused by linear canopyB openings on tree biomass dynamicsB in an Atlantic Forest fragment

Room C

S17: Current trends in tropical African plant ecology

11h45 | O05 Francisco Gonçalves
Leaf phenology across southern African woodlands varies with floristic composition and structure

12h00 | O06 Nathaly R.G. Ramírez
Contributions of subtropical and tropical plant species to belowground ecological strategies

12h15 | O07 Ana Leite
Rural communities' views on woodland contributions to people in Guinea-Bissau: the importance of wild edible plants

12h30 | O08 Maria Romeiras
Conservation and sustainable use of tropical biodiversity: ongoing projects with Guinea-Bissau and Angola flora

12h45 | O09 Luís Catarino
Ecology and socio-economic importance of palms in West Africa

13h00 | O10 Prishnee Bissessur
Conservation lessons learnt from research on one of the fastest declining oceanic island endemic plant species worldwide

Room D

S16: Tropical molecular ecology

11h45 | O06 Heike Pröhl
Ecological and molecular mechanisms of colour diversity in tropical aposematic frogs

12h00 | O07 Fabio Pinheiro
Genetic consequences of abiotic and biotic forces shaping the distribution limits of a neotropical orchid

12h15 | O08 Paulo de Sousa
How fragmentation impacts the population genetics of specialist versus generalist oil-collecting bees in the Brazilian Cerrado

12h30 | O09 Stefan Merker
Imperfect but improving – evolving insight into the phylogeography of Sulawesi tarsiers

12h45 | O11 Carina Moura
Effects of land-use change on above and below-ground plant phylogenetic diversity and carbon storage in soil, roots, and litter

13h00 | O12 Chris Barratt
Combining genomics and spatial modelling to make multi-species population vulnerability predictions

13h15 | **Hall** | Lunch

Eligible candidates for the Merian Award are marked with an #

PROGRAMME

THURSDAY, 15TH | AFTERNOON 2/2

13h15 | **Hall** | Lunch

Room B

S21: Ecological and social dimensions of hydropower

14h30 | O01 Isabel Jones
Interdisciplinary approaches to quantifying the social-environmental impacts of large hydropower development

14h45 | O02 Angelica Resende
Renewable but not sustainable: the environmental and social costs of hydroelectric dams in the Brazilian Amazon

15h00 | O03 Thomas Luypaert #
Extending species-area relationships to the realm of eco-acoustics: Island Soundscape-Area Relationships

15h15 | O04 Ana F. Palmeirim
Disentangling the effects of habitat fragmentation and top-down trophic cascades on small mammal assemblages on Amazonian forest islands

S20: Understory shrubs: adapting amidst change

15h30 | O01 Jonas Depecker
Unveiling the genetic diversity and structure of wild Coffea canephora populations in Yangambi (DRC) and how they are impacted by forest disturbance

Room C

S17: Current trends in tropical African plant ecology

14h30 | O11 Mohammad I.Z.A. S. Abbass
Application of spatial conservation prioritization for terrestrial ecosystem management: a tropical island oriented global systematic review

14h45 | O12 François Baguette
Review of tropical pioneer trees' roles for restoration and conservation management: Harungana madagascariensis (Hypericaceae) as a model

15h00 | O13 Susan Eshelman #
Malagasy grass flora dynamics: an exploration of environmental influences on grassy functional traits

15h15 | O14 Ghanishta Seeburrun
A review of the impact of alien species on the biodiversity of a tropical oceanic island

15h30 | O15 Peter Jörg Horchler
Invasive alien plants drive inexorable loss of native woody plant diversity in a tropical oceanic island: Insight from changes over 17 years in permanently set plots

Room D

S16: Tropical molecular ecology

14h30 | O13 Margarida Henrique
How to deal with the impact of the reference divergence in the demographic history of non-model species

14h45 | O14 Lounes Chikhi
Reconstructing the evolutionary history of species with genomic data: what can the IICR (inverse instantaneous coalescence rate) tell us ?

15h00 | O15 Ravi Vishwakarma
Life history traits predict contrasting dynamics of genetic diversity during a ca. 14,000-year glacial cycle: a spatial simulation study

15h15 | O16 Ana I. Ribeiro-Barros
Coffee agroforestry, reforestation, and landscape genomics: the successful case of Mount Gorongosa, Mozambique

S18: Tropical ecological modelling

15h30| O02 Mateus D. de Paula
Modeling the influence of herbivory on plant functional trait diversity and nutrient availability in a tropical mountain forest gradient

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PROGRAMME

THURSDAY, 15TH | AFTERNOON 2/2

Room B

S20+

15h45 | O03 Thomas Couvreur

Evolutionary dynamics of central African rain forest trees and understory plants reveal contrasting responses to past climatic fluctuations

16h00 | O04 Rémi Tournebize

Ecological and genomic vulnerability to climate change across native populations of Robusta coffee (Coffea canephora)

Room C

S17+

15h45 | O16 Cláudia Baider

Control of invasive alien plants from native forests of a tropical oceanic island improves forest biomass against a backdrop of strong benefits to threatened biodiversity

16h00 | O17 F.B. Vincent Florens

Control of invasive alien plants promotes seed dispersal mutualisms and human-wildlife conflict mitigation: Case of the flying fox Pteropus niger on tropical oceanic island Mauritius

Room D

S18+

15h45 | O05 Angelica Resende

Tracking successional stages of the Atlantic Forest through space technology

16h15 | **Hall** | Break for coffee and posters

17h30 | **Room A** | Closing ceremony + Awards + Invitation for 2025

Eligible candidates for the Merian Award are marked with an #

POSTER PRESENTATIONS

S2: Cutting-edge biomonitoring in the tropics

P01 Carolina Soto Navarro
The Osa conservation campus: protecting central America's greatest pacific lowland rainforest

P02 Claudia Viganò #
Shedding light on the dark side of the forest: using camera traps to uncover nocturnal plant-animal interactions in the canopy of Handroanthus chrysanthus, a neotropical tree species

P03 Ricardo Jorge Lopes
Automated acoustic monitoring for tropical biodiversity assessment - prospects for small island developing States

S3: Multitrophic networks in tropical forests

P01 Malika Gottstein
Seed dispersal by brown-headed spider monkeys in the Chocó biodiversity hotspot, Ecuador

P02 Patrícia A.P. Chaves
Unveiling the role of bats and birds in rice pest control: A case study in Guinea-Bissau's rice paddies

P03 Selma Kosmas
Trophic simplification of predator-prey mammal systems in postwar Angola

S4: Tropical chemical ecology

P01 Julia Witter
The role of floral scent for wasp attraction in Pityrocarpa moniliformis (Mimosoideae: Fabaceae)

S5: Adaptations of neotropical biodiversity to changes

P01 Patricia Morellato
Center for Research on Biodiversity Dynamics and Climate Change, a Brazilian center dedicated to research, innovation and science dissemination

P02 Beatriz Lucas Arida #
Different but not isolated: investigating reproductive barriers and morphological divergence between ecotypes of Epidendrum fulgens

P03 María Rita Guzman
Impacts of salinity on Guatemalan marigold (Tagetes patula L.) flowers: small and fewer flowers despite high antioxidant performance

P04 Anaïs K Tallon
A 10-year case study: How do global changes influence hummingbird survival and phenology?

P05 Luís Pedro Pratas-Santiago
Withdrawal and Expansion: A Decade of Dynamic Ungulate Distribution in Amazonian Lowland Sanctuaries (2010-2020)

P06 Sean Glynn
Impacts of small-scale artisanal gold mining on understory bird communities in Guyana

S7: Tropical forest/ tree functioning

P01 Luis Amadeu Pungulanhe
Horizontal composition of miombo species in two areas with different fire frequencies. Gilé National Park, Zambezia Province

P02 Laura Helena Porcari Simões
Functional composition in different canopy strata in unmanaged Eucalyptus plantations

S8: Free session

P01 João Albuquerque
Dietary segregation between two sympatric West-African swallows: Red-chested Swallow Hirundo lucida and Wire-tailed Swallow Hirundo smithii

P03 Megan K. Sullivan
Disturbance dynamics: abiotic understory characteristics that are altered by selective logging and elephant trails impact seedling performance in a Gabonese tropical forest

Eligible candidates for the Merian Award are marked with an #

POSTER PRESENTATIONS

S8: Free session +

P04 Diego P. Santos
The problem of conserving an ecosystem that has not been completely delineated and mapped: the case of the Cocais Palm Forest

P05 Filipe Pedroso-Santos
Vertebrate taxonomic and functional hotspots in the Brazilian Atlantic Forest

P06 Diego P. Santos
Production of Babassu Coconut Almonds in the "Core" region of the Cocais Forest

P07 Alfred Houngnon
Floristic clues to the origins of the Dahomey Gap from the Ewe-Adakplame forest (Benin, West Africa)

P08 Cláudia Ribeiro
Assessing colonization trends of translocated ungulates using camera-trapping data

P09 Jason Vleminckx
Inter-annual changes in plant phenology in a tropical ever-wet forest community of Western Amazonia

S9: Tropical biomonitoring in a molecular era

P01 Elise Sivault
Fecal DNA metabarcoding and stable isotopes shed light on the short-term and long-term diet of frugivorous bat species in Papua New Guinean rainforests

S10: Biodiversity and sustainable tropical agriculture

P01 Bruna Xavier da Silva
Consequences of replacing natural savannas with eucalyptus plantations and soybean fields for the taxonomic and functional diversity of bats in the Amazonian Savannas

P02 Inês Morais
Gleaning insectivorous bats eat seasonably on a West African rice farming landscape: implications for ecosystem services

P03 Paula Lopes
Guild-dependent patterns of bird abundance along the rice growth cycle in lowland rice fields of Guinea-Bissau (West Africa)

P04 Inês Lacerda
Sowing Seeds, Soaring Feathers: Exploring the role of temporal and spatial heterogeneity in shaping bird assemblages of Guinea-Bissau's freshwater rice fields

P05 Tiago Gonçalves
Variation of pest consumption by insectivorous bats and birds in smallholder rice fields in West Africa

P06 Eliza Van de Sande
Global variation in the flowering phenology of cacao trees (Theobroma cacao)

P07 Eliza Van de Sande
Simulating the potential effects of cocoa-related deforestation on species connectivity in a West African biodiversity hotspot

P08 Rafael António
Effects of land use change on soils from Guinea-Bissau

P10 Miguel Brilhante
African wild beans as a source of nutritional and bioactive compounds

P11 Carla Tavares
Characterization of the invasive pest fall armyworm, Spodoptera frugiperda Smith (Lepidotera, Noctuidae), populations in Cape Verde

P12 Adriana Padilha
Communities of pollinating arthropods in the agroecosystems of São Tomé

S11: Biodiversity, biotic interactions and functioning

P01 Charuta Murkute
Water and carbon fluxes induced by seasonal variations of microclimatological conditions using eddy-covariance measurements over a tropical mountain dry forest ecosystem in South Ecuador

P02 Kim Lea Holzmann #
From large mammals to small dung beetles: Diversity & abundance along a forest elevational gradient in Peru

P03 Pablo Aycart Lazo
Detecting functional rarity in a hyperdiverse Amazonian dung beetle assemblage

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POSTER PRESENTATIONS

P04 Pedro Alonso-Alonso
From Andes to Amazonia: Abundance of bees along a tropical forest elevational gradient

S14: Tropical forest management under climate change

P01 Bianca Nunes dos Reis
Forest regeneration in a chronosequence of restored areas in the Atlantic Forest of Rio de Janeiro, Brazil

P02 Madalena Matias
People, Rice and Mangroves in coastal Guinea-Bissau: modelling sea level rise and its potential effects

P03 Berihu Kahsay
Forest regeneration in a chronosequence of restored areas in the Atlantic Forest of Rio de Janeiro, Brazil

P04 Juan David González-Trujillo
Protected areas are more exposed to extreme weather than unprotected areas across Central America

S15: Ecosystem services of tropical wetlands

P01 Flavia Machado Durgante
Drought affects tree growth in two species (Nectandra amazonum and Hydrochorea corymbosa) in Central Amazonian Floodplain Forests

P02 Chung Hoai Nguyen
Late Holocene riparian vegetationB dynamics, environmental changes,B and anthropogenic impact in theB Harapan forest of Sumatra, Indonesia

S16: Tropical molecular ecology

P01 Camille Steux
A demographic model of structured populations for common chimpanzees (Pan troglodytes) to infer past changes in connectivity

P02 Ninda L. Baptista
Filling gaps in tropical Africa: the fascinating diversity of Angolan frogs

S17: Current trends in tropical African plant ecology

P01 Víctor Fernández-García
Recent fire history and plant diversity in Madagascar Central Highlands

P02 Domingos Francisco
Forest cover dynamics in Angolan protected areas between 2001-2022

P03 Tewachew Worku Kegne
Tree species diversity as a function of environmental conditions in potential seed collection areas in Amhara Region, Ethiopia

P04 Claudete Bastos
Wild edible plants in Angola: diversity, uses and properties, and socio-economic potential

P05 Vanezia Rocha
Thriving in dry tropical ecosystems: species functional adaptation

P06 Fátima José Inácio da Costa #
Mangrove restoration in Africa: case of success stories of the Western Indian Ocean

S20: Understory shrubs: adapting amidst change

P01 Thomas Nicole
Monitoring plant-animal interactions with camera trap: Heliconia model in Martinique

S21: Ecological and social dimensions of hydropower

P01 Isabel Jones
“Power Up!” A mobile phone videogame collecting big data on sustainable development decision-making: Insights from COP26

P02 Norbert Tchamadeu Ngameni
Benthic macroinvertebrates as bioindicators of water quality in view of the construction of a hydropower dam on the Dibombe River in Cameroon

Eligible candidates for the Merian Award are marked with an #

EXCURSIONS

FRIDAY, 16TH

Discovering the Tagus estuary north-eastern shores and its birds

Embark on a journey through the untamed beauty of the Tagus Estuary, where nature's spectacle unfolds in every direction. Traverse the winding paths that lead through a mosaic of habitats, each teeming with life and possibility. As you wander through the cork oak woodlands, breathe in the earthy scent of the forest and listen to the rustle of leaves overhead. Marvel at the intricate network of life that thrives beneath the canopy, from delicate wildflowers to elusive woodland creatures.

With the dawn chorus as your soundtrack, immerse yourself in the tranquil ambiance of the EVOA lagoons. Located in the heart the most important wetland of Portugal, the Tagus Estuary Natural Reserve, EVOA Tagus Estuary Birdwatching and Conservation Area, allows the visitors to know and enjoy the unique heritage that we have between the Lezíra and the Tagus Estuary. Here, the still waters mirror the vast expanse of the sky, creating a sense of boundless serenity. Keep your binoculars handy as you scan the horizon for the graceful silhouettes of herons, egrets, and other waterfowl.

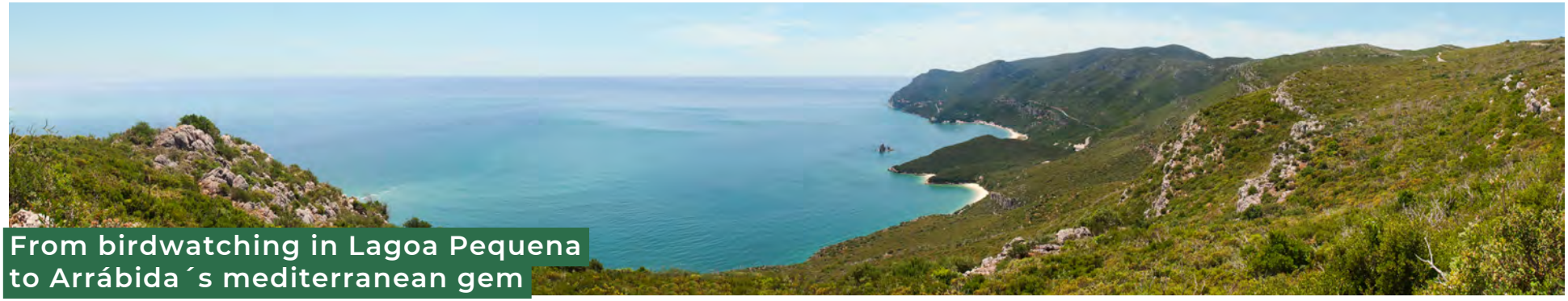
Led by expert guides, delve into the secrets of this remarkable wetland ecosystem. Learn about the importance of the Tagus Estuary as a vital stopover for migratory birds, a crucial link in their epic journeys across continents.

Facilitated by Companhia das Lezírias Portugal's grandest agroforestry domain, a mere 40-minute escape from the vibrant heart of Lisbon, the visit will include:

- Birdwatching and interpretation of the landscape (12.5 km), passage through rice paddies, Alcamé church and Leziria's pastures;
- Visiting the interpretation Center; guided tour at EVOA's lagoons, nestled within the Tagus Nature Reserve; “Ponta d’erva ” view of the Tagus Estuary;
- Visit to the Stud Farm of Companhia das Lezírias (Lusitano Pure Blood Horse);
- Stop at the cork oak " montado ": Cork production in Portugal and at Companhia das Lezírias , ongoing research projects and other forestry activities;
- Visit to the Cellar, vineyard, and olive grove of Herdade de Catapereiro

EXCURSIONS

FRIDAY, 16TH



From birdwatching in Lagoa Pequena to Arrábida´s mediterranean gem

A captivating journey that takes you from the tranquil shores of Lagoa Pequena to the rugged beauty of Arrábida's Mediterranean gem. This comprehensive tour promises a wealth of unforgettable experiences, each one revealing the rich natural and cultural heritage of this enchanting region.

Begin your adventure with a leisurely session of birdwatching at Lagoa Pequena, a haven for a diverse array of avian species. Let the soothing melodies of birdcalls serenade you as you observe graceful waterfowl gliding across the shimmering surface of the lagoon. Follow interconnected boardwalks that lead to secluded bird observatories, offering unparalleled vantage points for closer encounters with feathered inhabitants. Marvel at the intricate dance of life unfolding before your eyes, from elegant herons to vibrant kingfishers.

Next, venture to the dramatic cliffs of Cape Espichel, where the rugged coastline meets the endless expanse of the Atlantic Ocean. Stand in awe at the sheer majesty of nature's power, as waves crash against weathered rock formations, leaving behind a salty mist that hangs in the air.

Continue your exploration with a visit to the historic Sesimbra castle, perched proudly atop a hill overlooking the picturesque town below. Delve into centuries of history as you wander through ancient stone corridors and soak in panoramic views of the surrounding landscape.

Finally, immerse yourself in the pristine beauty of the Arrábida mountain range, a sanctuary for Portugal's most pristine Mediterranean forest. Lose yourself in a labyrinth of lush greenery, where sunlight filters through the canopy to illuminate a world teeming with life.

Throughout your journey, take solace in the knowledge that the areas visited are carefully protected, ensuring the preservation of their natural splendor for generations to come. Let this immersive experience be a testament to the enduring beauty and resilience of Portugal's remarkable ecosystems.

MERIAN AWARD

In 2001 the gtoe established the Merian Awards for the best contributions given by young scientists during the annual meeting. There are six Merian Awards annually, three for the best oral contributions and three for the best posters. ECOTROPICA highlights these contributions by publishing the abstracts.

The gtoe has selected Maria Sibylla Merian as the patron of the Merian Prize to commemorate her unique work as an outstanding artist and as the first female tropical naturalist who actually travelled to the tropics in order to study their fascinating diversity, in particular insects. Maria Sibylla Merian was born in 1647 in Frankfurt/Main as the daughter of the engraver, etcher, and book dealer Matthäus Merian. She died in 1717 in Amsterdam, Netherlands. Sibylla Merian's most remarkable contributions included a book on the fauna and flora of Surinam: "Metamorphosis insectorum Surinamensium", which brought her international fame even during her lifetime. She was the first scientist who recognized, and documented in her artistic work, that insects go through various developmental stages. This is particularly remarkable as the general public in her time still believed that, for instance, mosquitoes and caterpillars were generated in mud by the devil.

Eligible candidates are students and PhDs who are members of the gtö and finished their dissertation less than three years ago.

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Editorial Note

In 2023, the ECOTROPICA published for the first time the abstracts of the European Conference of Tropical Ecology and the Annual Meeting of the Society for Tropical Ecology (https://ecotropica.eu/index.php/ecotropica/article/view/117). We are pleased to also publish the abstracts of this year's conference in ECOTROPICA. They are thus available for a wider audience beyond the conference participants.

The 7th European Conference of Tropical Ecology & 35th Annual Meeting of the Society for Tropical Ecology was organized by Dr. Jorge Palmeirim, Dr. Ana Rainho and their team from the Centre for Ecology, Evolution and Environmental Change of the University of Lisbon, Portugal. The conference's Scientific Committee and the session chairs reviewed all abstracts and accepted them, where necessary after revisions by the authors. The abstracts are printed here as finally accepted by the Scientific Committee and the session chairs.

Eckhard W. Heymann & Marco Tschapka
Editors ECOTROPICA

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Plenary talk

Moving away from individual species models of biodiversity response to climate change

Miguel B. Araújo[1]

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In the past two decades, there has been a significant increase in studies using models to understand and predict the impact of environmental changes on biodiversity. Typically, these studies begin by examining the relationship between species distributions and environmental variables, based on the assumption that the environment determines the limits of tolerance for species survival. As a result, alterations in environmental conditions are expected to lead to shifts in species distributions. However, a major shortcoming of existing models is their focus on individual species. Although these models can be applied to thousands of species at once, they often treat each species as an independent entity, reacting in isolation to environmental changes. This approach neglects the complex dynamics within ecological communities, where collective species responses to environmental changes are not merely the sum of individual responses. While incremental improvements to existing models are possible, progress necessitates the development of models that capture the responses of entire communities to environmental change. I suggest a promising direction would be to shift from the traditional environmental-limiting niche theory, which is applicable to individual species, to a resource-limiting niche theory. This approach considers the impact of the environment on the coexistence of multiple species within communities, providing a more comprehensive understanding of ecological dynamics.

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Plenary talk

The role of secondary forests in mitigating fragmentation-related extinctions: Insights from an Amazonian whole-ecosystem manipulation experiment

Ricardo Rocha[1]

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Secondary forests are the predominant type of forest cover across the tropics. They provide myriad services and natural products to human populations worldwide and key habitat for countless forest-dwelling species. Although some fragmentation-related extinctions can be averted by forest regeneration, the role of second growth in biodiversity conservation remains controversial. Central to the debate is the capacity of secondary forests to preserve old-growth specialist species and to buffer the impacts of fragmentation on assemblages living in forest remnants. The Biological Dynamics of Forest Fragments Project (BDFFP) is one of the world's largest and longest-running experimental investigations. Spanning an area of ~1000 km2 in the Central Brazilian Amazon, the BDFFP was initially designed to assess how fragment size influences biodiversity and ecological processes within rainforests. However, it has transcended its initial objectives, offering a wealth of insights into the long-term ecological dynamics of fragmented landscapes and their intricate relationship with forest regeneration. This talk will provide an overview of the research conducted over the last decades at the Biological Dynamics of Forest Fragments Project (BDFFP), examining with particular detail the taxonomic, functional, and phylogenetic responses of bats, one of the richest Amazonian mammalian groups, to forest regeneration. I will explore area, edge, and matrix effects and investigate time-related complexities related to both short- and long-term responses to changes in matrix structure and composition. Finally, taking the BDFFP as an illustrative example, we will discuss the conservation implications of these findings for tropical biodiversity and propose avenues for future research in temporal ecology.

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Plenary talk

Deciphering the complexity of ecological interactions in tropical islands. A multilayer network approach

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Globally, biodiversity is rapidly decreasing, with islands, constituting about 30% of biodiversity hotspots, facing heightened vulnerability. Anthropogenic activities have led to an alarming 80% of reported extinctions occurring among island species. Despite this, island biodiversity, encompassing diverse species and their interactions, remains inadequately explored. Urgent efforts are needed to document and predict the repercussions of its decline for effective mitigation. The challenge lies in detecting and understanding ecological interactions, a task addressed by emerging theories and tools like complex network analysis. Islands, as relatively simple systems with clear boundaries, offer significant potential to enhance our understanding of nature's complexity. In this talk, I will present you data on the ecological interactions we are studying, with a large variety of methodologies, in two tropical archipelagos, the Galapagos (Pacific Ocean) and the Seychelles (Indian Ocean). We are focusing on different layers of complexity, each corresponding to a different ecological function. We are using a multilayer network approach to unveil which are the keystone species in each community, which are the main functions, and to evaluate how vulnerable the community is to disturbance, specifically to biological invasions. The biodiversity of these ecosystems is indeed unique but shows to be highly vulnerable to the introduction of invasive species. I will show you some preliminary data on the co-extinction models we are using to predict persistence and resilience of island biota to disturbances.

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Plenary talk

Local perceptions of forest ecosystem services, insights from Africa

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Human culture has an important influence on how forests are utilised, yet its influence on ecosystem service (ES) use and valuation remains underexplored. During the past 5 years, we have investigated how livelihood strategy (farmers, pastoralists, hunter-gatherers) and ethnicity affect local peoples' perceptions of forest ES in tropical Africa, relating their views to instrumental, relational and intrinsic values of Nature. I will present our findings from different socio-ecological contexts in West, Central and East Africa, and also introduce unpublished data on a recent survey carried out with 'forest experts' (scientists and practitioners working in some of these forests).

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Plenary talk

The elephant, the monks, and the topology of interaction networks

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Sometimes, in science, we get so obsessed with a particular piece of a puzzle, that we miss the big picture. The same seems to be happening in the study of interaction networks, with different schools arguing over pieces of reality. Aiming to take a step back and change our perspective, this presentation describes a novel cognitive model that provides an integrative solution to two classical dilemmas about interactions between organisms of different species. Our research team, in collaboration with other experts, embarked on an extensive investigation to uncover the underlying principles that could lead to this solution. Through a comprehensive analysis, first, we demonstrated the commonalities between the dilemmas, and employed a graphical model to better understand the theoretical connection between them. We then developed an algorithmic model that predicts the four most commonly observed network topologies in nature. Our cognitive model, initially designed for antagonisms in monolayer networks, was subjected to a series of empirical tests and logical deductions. The results show that the model can be extended to mutualisms and multilayer networks, highlighting its broad applicability. Currently, we are working to refine the model and develop it into a new semantic theory, which may have significant implications for basic and applied ecology. We invite the audience to join us as we share the journey of discovery, unveiling the exciting possibilities that this new theory presents.

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Session 1-O1 - Dogs in conservation: The nose knows

Dogs as a possible tool to improve research in the tropics

Leopold Slotta-Bachmayr[1]

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Over the last decade conservation detection dogs have been increasingly used to detect rare or camouflaged species, to find carcasses of killed mammals and birds, or to identify invasive plants. A database, including 1220 publications, shows that species detection dogs are well established in North America, Europe and Oceania. In this presentation, we will discuss the potential use of dogs in conservation and wildlife management in general and especially the possible use of detection dogs in the tropics. Species detection dogs may be used to search for the different specimen or to collect scat samples which can be used for DNA analysis. Dogs are also a valid tool to document the effect of barriers e.g. by searching for carcasses under power lines or along roads. They also have a high value as a monitoring tool, especially in answering scientific questions concerning environment (climate, parasite, disease), community and linear development. We also discuss the constraints deploying dogs in tropical environments.

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Session 1-O2 - Dogs in conservation: The nose knows

Impact of weather conditions on cheetah (*Acinonyx jubatus*) monitoring with scat detection dogs

Noreen Mutoro[1,2], Jonas Eberle[1], Jana S. Petermann[1], Gertrud Schaab[3], Mary Wykstra[2], Jan Christian Habel[1]

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Detection dogs are emerging as an effective technique in ecological monitoring due to the dog's superior olfactory system. The use of scat detection dogs in particular, has improved the success rates of monitoring rare and transient species like cheetah (*Acinonyx jubatus*). However, the rate and frequency of their success can be dependent on various abiotic factors especially in the tropics. In 2019, we conducted uncontrolled field surveys in northern Kenya using two scat detection dogs locally trained to locate wild cheetah scat. We examined the influence of temperature, humidity and wind speed on their detection rates of wild cheetah scats. The study demonstrated how scat detection dogs can be effectively used as a non-invasive sampling method in cheetah and other species surveys at a landscape level based on environmental conditions. It also provided information on the best weather conditions suited for working with scat detection dogs under certain conditions and how to improve species monitoring when using scat detection dogs.

Merian Award Applicant

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Session 2-O2 - Cutting-edge biomonitoring in the tropics

Comparative analysis of large tree segmentation in the canopy of African tropical forests

Antoine Plumacker[1], Adeline Fayolle[1], Bhély Angoboy Ilondea[2], Arthur Vander Linden[1], Jean-François Bastin[1]

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The monitoring of individuals and forest plots in Central Africa is a complex task. Establishing experimental monitoring sites and conducting inventories requires a significant amount of time, effort, and resources. One solution to reduce the effort is to summarize a forest plot by focusing on its largest trees. These trees play a crucial role in the structure, dynamics, and carbon cycle of forests. The development of remote sensing methods and deep learning enables the automatic detection and segmentation of tree crowns. We also propose an innovative method using Detectree2 for tree detection and Segment Anything Model from Meta for crown contour segmentation. The objective of this research is to compare the results obtained from commonly used detection and segmentation methods, as well as this new algorithm, in the case study of the largest trees in the Luki landscape (DRC). Validation is carried out by comparing the results with a dataset of manually segmented 500 individuals, based on on-site observations, and compared to very high-resolution ortho-images. The results aim to demonstrate an improvement in the quality of tree crown segmentation based on RGB sensors compared to LiDAR, while also considering variations in acquisition conditions. This provides new perspectives for forest monitoring.

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Session 2-O3 - Cutting-edge biomonitoring in the tropics

Drivers of deforestation and degradation of miombo woodlands in Mozambique: What is the extent and shares of forest change?

Sá Nogueira Lisboa[1,2,3], Frédérique Montfort[5], Clovis Grinand[5], Julie Betbeder[3,4], Lilian Blanc[3,4]

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The fragmented and complex landscape in the Miombo region makes it a challenge to map and disentangle the different land use drivers associated with these changes and relate them to other underlying factors. To overcome these challenges, we have developed a method to spatially disentangle the drivers of deforestation (small and large-scale agriculture, mining), forest degradation (charcoal production, wildfires, logging), forest regrowth and reforestation in Beira Corridor, central Mozambique. We identified ten potential drivers of forest change from literature and produced two land use and land cover maps for 2000 and 2020 to identify areas of forest change. We used stratified sampling based on the LULC map and visually interpreted very high-resolution satellite images and NDVI times series to label the factor of change. We derived various potential socioeconomic factors and landscape metrics and models then used the 1823 observation points of drivers with random forest algorithms to assess their relative importance and produce a driver map. Smallholder agriculture (57.7%), clear-cutting charcoal (7.5%), abandoned land (6.4%) and plantations (5.8%) were the main drivers of forest change in the study area. They are significantly related to intensity of land use change, altitude, population density and proximity to the main road. The loss of forest due to deforestation and degradation activity represents 83.6% (38,929.8 ha/yr) and gain due to plantation and natural regrowth 16.4% (7,633.7 ha/yr) of total change area for the 2000-2020 period. This study enables us to significantly improve the quantification of drivers of change with spatially explicit data. The method could help decision makers to better design land use policy and monitor their impact.

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Session 2-O4 - Cutting-edge biomonitoring in the tropics

Eavesdropping on Nature: How ecoacoustics can scale up biodiversity monitoring and inform conservation

Carly Batist[1,2], Marconi Campos-Cerqueira[1,2], Kris Harmon[1,2], Tomaz Melo[1,2], Gabriel Leite[1,2], José Ribeiro Jr[1,2], Nelson Buainain[1,2], Thiago Bicudo[1,2], Claydson Assis[1], Guilherme Melo[1,2]

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Effective conservation and management of 30% of the world's lands and the halt of human-induced species extinction are among the headlining goals of the Kunming-Montreal Global Biodiversity Framework (GBF). Multidisciplinary collaboration, innovative technology, and artificial intelligence (AI) will play an essential role in quickly and successfully achieving these goals. In this presentation, we will showcase how ecoacoustic monitoring can provide a reliable workflow and framework to understand, protect and conserve wildlife at scale. Our Arbimon team has established an end-to-end workflow for ecoacoustics, from sampling design and data collection with autonomous recorders, to soundscape analyses and ML species classification models, and finally ecological modelling with environmental covariates. We will use case studies from our global collaborative projects to demonstrate the wide variety of use cases that ecoacoustics can be applied to – tracking restoration progress, surveying for endangered species, mitigating the spread of invasive species, understanding effects of human activities on wildlife, and tracking biodiversity patterns over time. We do this through Arbimon, our free, no-code ecoacoustics platform. Arbimon has a suite of tools for data storage, file management, spectrogram labelling, supervised and unsupervised species detection models, and soundscape analysis. Arbimon now hosts the largest collection of soundscape data in the world, with 150 million minutes of recordings (119 countries) that are being used by 4,000 users. Additionally, we are actively developing regional convolutional neural networks (CNNs), with 12 already trained to automatically detect 630 species (mean average precision across classes & models = 0.89). Finally, we have developed a data visualization dashboard (Arbimon Insights), which collates maps, figures, and summary metrics for each project to facilitate biodiversity reporting to a variety of stakeholders. Our results highlight the promise of ecoacoustics as a cost-effective solution for effectively monitoring biodiversity over space and time.

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Session 2-O5 - Cutting-edge biomonitoring in the tropics

Automated monitoring of insects supports new research into flying insect populations in tropical ecosystems

Dylan Carbone[1], Tom August[1], Jonas Beuchert[1], Alba Gomez-Segura[1], Jenna Lawson[1], Abhi Ravivarma Mandela[1], Grace Skinner[1], Simon Teagle[1], David B. Roy[1], Easy RIDER (Real-time identification for ecological research and monitoring)[1,2,3,5,6]

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In a period of widespread biodiversity decline in tropical ecosystems, it is important to develop effective tools to monitor the impacts of anthropogenic drivers including climate change and deforestation. Moths, given their functional importance, diversity, and rapid response to environment changes, are regarded as important bio-indicators of wider ecosystem biodiversity. We introduce the UKCEH Automated Monitoring of Insects (AMI) system, a device that pairs traditional methods of moth monitoring with recent developments in image recognition. The AMI system attracts night-flying insects and captures images during pre-set survey periods and image-capture intervals. After the images have been collected, a species classification workflow is used to isolate and identify each moth. The AMI systems are reliant on solar power and can be deployed for months at a time, each night capturing thousands of images of individual moths. The AMI method can detect changes in species abundances at varying temporal scales. We demonstrate, using results from temperate ecosystem surveys in the UK, the impacts of a heat wave, and identify variations in species nighttime phenology. We discuss how we are improving upon the AMI system's design with the objective of introducing on-board software for classification during deployment, adding audible and ultrasound microphones to expand survey taxa to birds and bats, and automating the recording of metadata to improve data accessibility. We raise the challenges of surveying in tropical ecosystems, which include developing and implementing a species classification algorithm in environments with high insect diversity and limited training data, and maintaining device durability in extreme weather conditions, and discuss how we are attempting to overcome them. We present findings on moth nighttime activity from a survey conducted in Panama in January 2023, and announce current and planned deployments in tropical ecosystems.

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Session 2-O6 - Cutting-edge biomonitoring in the tropics

Using DNA barcoding to resolve quantitative multi-trophic interaction network response to tree identity

Massimo Martini[1], Felix Fornoff[1], Manuela Sann[2], Arong Luo[4], Jingting Chen[4], Michael Orr[3], Chao-Dong Zhu[4], Alexandra-Maria Klein[1]

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Wasps conduct crucial ecosystem functions including population control of other insects. To understand population drivers, comprehensive knowledge about top-down and bottom-up interactions, and about all interaction partners is needed. Bottom-up effects of forest tree species composition, identity, and diversity may ascend through feeding links between herbivores and predators, influencing multitrophic communities. Cavity-nesting wasps and their interactions with natural enemies have been commonly used as model system to study these trends. However, up to today, all trophic interactions have not yet been included in trap nest research because of challenges in the identification of food resources. In a forest tree diversity experiment, we connect cavity-nesting wasps to tree identity effects using DNA barcoding and a new trap nest design. We constructed quantitative multitrophic networks encompassing feeding interactions between natural enemies, wasps, and spiders/herbivores, and discuss opportunities to extend these networks to the basal trophic level of trees. Future research on bee and wasp multitrophic interaction networks will allow us to better understand relationships between biodiversity and ecosystem functions, and responses to forest tree species identity and extinctions.

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Session 2-O7 - Cutting-edge biomonitoring in the tropics

Temporal ecology of carnivorans in Palawan Island, Philippines

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In Palawan Island, Philippines, there are several carnivoran species that are known to occur sympatrically. The exact mechanisms for the co-existence of this community in this island are currently unknown, but the concept of temporal niche partitioning can be used to determine differences in activity patterns that may reflect a species' responses to different factors. From March 2022 to March 2023, data from 24 camera trap stations in Puerto Princesa Subterranean River National Park and 22 stations in Narra Municipality were analysed using non-parametric kernel density estimation and the Watson-Wheeler non-parametric test for homogeneity of circular data. Due to the low number of detections, the results of the two sites were not statistically compared and were instead pooled together. Only 4 out the 6 detected carnivore species reached the minimum sample size for analysis. The collared mongoose showed a strongly diurnal activity pattern, while the Palawan stink-badger, Philippine palm civet, and Sunda leopard cat showed strongly nocturnal activity patterns. The coefficients of overlap among the nocturnal species were significantly high to moderate and not statistically different from each other. Their different dietary habits may play a larger role in their nocturnal co-existence as the Philippine palm civet feeds mainly on fruits, the Sunda leopard cat on rodents, and the Palawan stink-badger on small insects. Meanwhile, the coefficients of overlap between the diurnal and the nocturnal species were significantly low. This may be an avoidance mechanism to decrease competition between the nocturnal carnivores and the collared mongoose, which is known to prey on both vertebrates and invertebrates. This is the first quantitative analysis of the activity patterns of a carnivoran community in the Philippines.

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Session 2-O8 - Cutting-edge biomonitoring in the tropics

Unveiling rat predation dynamics in São Tomé and its implications

Daniel Velarde Garcéz[1,2,3], Pedro Beja[1,3,4], Gege Lima[5], Lionel Viegas[5], Maria Da Conceição Neves[6], Sonia Ferreira[1,3], Vanessa Mata[1,3]

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Rodent introductions pose a substantial threat to global biodiversity, particularly in island ecosystems, where they are recognized as a primary driver of the exceptionally high extinction rates. Their remarkably adaptable and generalist diet enables them to colonize diverse environments, exerting immense pressure on local fauna. Despite their widespread impact, a knowledge gap exists regarding the specific predation pressure of rats across the wide range of species they consume, as well as how these patterns vary in response to environmental conditions. To address this gap, we conducted a comprehensive study on the island of São Tomé, combining rat-trapping and DNA metabarcoding of over 500 samples. Camera traps were also employed to estimate rat relative abundance across habitats. Sampling was conducted across nine plots, encompassing gradients of habitat transformation, from native forests to cacao plantations, palm monocultures, and local communities. Our findings reveal that, despite palm-covered areas being the smallest, they exhibited the highest rat density, followed by native forests and cacao plantations. Rats predominantly foraged on grasses, introduced fruit plants, snails, earthworms, arthropods, and some vertebrate species. The geographical origins of their food exhibited considerable variation across clades. Most plant and mollusc species were of introduced origin, whereas birds and amphibians were predominantly native or endemic. Moreover, rat diet displayed notable variations across habitats, likely in response to differences in resource availability. Understanding the variability in the density and dietary composition of rats across different habitats helps pinpoint areas with higher rat threats, enabling strategic pest control efforts to enhance conservation strategies.

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Session 2-O9 - Cutting-edge biomonitoring in the tropics

Empowering local communities for effective biomonitoring in Guinean forests of West Africa

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Habitat fragmentation poses a significant threat to biodiversity in Africa, particularly in the Guinean forests of West Africa. Renowned for their richness in biodiversity and endemism, these forests are under siege from habitat loss, degradation, and fragmentation. The size of forest patches emerges as a critical factor, with larger fragments hosting a greater diversity of species than their smaller counterparts. While protecting intact, dense forest patches remains paramount, effective forest management in areas already impacted by logging and hunting is equally imperative. This presentation underscores the pivotal role of Community Forests (CFs) in conservation efforts, emphasizing the need for a robust network promoting ecological connectivity. Despite their potential, biomonitoring in CFs faces challenges, primarily due to resource constraints. To address this, we propose the development of standardized, cost-effective biomonitoring methods that empower local communities to actively participate in conservation. Our monitoring framework advocates for a five-step approach, positioning local communities as primary agents for biomonitoring in their respective forests. By introducing a 'citizen science' model, we aim to shift the reliance on scientists and expensive equipment towards community involvement. We suggest the implementation of face-to-face interviews with key individuals in target communities to assess the conservation significance of various CFs. Biomonitoring efforts will be anchored in the RAPELD scheme, with training provided to local 'wise' individuals, thus enhancing the community's capacity to monitor their biodiversity effectively. This initiative strives to bridge the gap between scientific expertise and local knowledge, fostering a collaborative approach to safeguarding the unique biodiversity of the Guinean forests in West Africa.

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Session 3-O2 - Multi-trophic networks in tropical forests

Interactive effects of drought and deforestation on multitrophic communities and aquatic ecosystem functions – an experimental test using tank bromeliad ecosystems

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Together with the intensification of dry seasons in Neotropical regions, increasing deforestation is expected to exacerbate species extinctions, something that could lead to dramatic shifts in multitrophic communities and ecosystem functions. Recent studies suggest that the effects of habitat loss are greater where precipitation has decreased. Yet, experimental studies of the pure and interactive effects of drought and deforestation at ecosystem level remain scarce. Here, we used rainshelters and transplantation from rainforest to open areas of natural microcosms (the aquatic ecosystem and microbial-faunal food web found within the rainwater-filled leaves of tank bromeliads) to emulate drought and deforestation in a full factorial experimental design. We analysed the pure and interactive effects of our treatments on functional community structure (including microorganisms, detritivore and predatory invertebrates), and on leaf litter decomposition in tank bromeliad ecosystems. Drought or deforestation alone had a moderate to negligible impact on biomass at the various trophic level, but their combination synergistically reduced the biomass of invertebrate functional groups and bacteria. Specifically, predators were the most impacted trophic group as they were almost eliminated, while detritivore biomass was reduced by 93-95% on average. On the contrary, the biomass of fungi at the surface of the leaf litter as well as litter decomposition were not significantly affected by any of our treatments, suggesting that decomposition is mostly driven by fungal abundance and activity, and that highly resistant microorganisms such as fungi maintain key ecosystem functions in the face of drought and habitat change. We conclude that habitat destruction compounds the problems of climate change, that the impacts of the two phenomena on food webs are mutually reinforcing, and that the stability of ecosystem functions depends on the resistance of a core of group of organisms.

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Session 3-O3 - Multi-trophic networks in tropical forests

Tree diversity effects on higher trophic levels in a subtropical forest experiment of China

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Understanding how higher trophic levels communities (e.g. insect herbivores) are affected by plant diversity and the consequences of their interactions on ecosystem functioning remains a challenge in ecology. Based in the current largest tree diversity experiment (BEF-China), my previous studies show that herbivore diversity can be significantly affected by increasing multiple components of plant diversity. Moreover, herbivore turnover, co-occurrences and plant-herbivore networks were mainly determined by plant traits- and phylogeny- mediated processes. However, we still lack a clear understanding of how changes in plant diversity influence the dynamics of herbivore communities and plant-herbivore networks across spatio-temporal scales. Insect herbivore populations fluctuate over time and variability in climatic conditions might interact with plant-regulated bottom-up effects to structure herbivore communities. Our most recent results suggest that tree diversity stabilizes interannual variability of herbivore diversity. Moreover, the spatio-temporal stability of herbivore communities stability are partly determined by tree growth rates and microclimate factors.

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Session 3-O4 - Multi-trophic networks in tropical forests

Multi-trophic network properties mediate tree biodiversity effects on forest ecosystem multi-functionality

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The largely positive effects of tree biodiversity on multiple forest ecosystem functions such as primary production, carbon sequestration, and decomposition rates are well documented. In contrast, other functions such as herbivory and parasitism rates show more ambiguous patterns while also being critical components of forest multi-functionality. Together, this creates substantial variation in forest multi-functionality that cannot be explained by tree biodiversity alone but is additionally influenced by the diversity of multiple taxa and the structure of their interactions. By synthesizing data from a large tree biodiversity experiment in subtropical China, the BEF-China experiment, we aim at identifying the role species interaction networks play in the functioning of forest ecosystems. Specifically, we show the positive effects tree diversity has on forest ecosystem multi-functionality. We then separate direct effects of tree diversity on forest ecosystem multi-functionality from indirect effects, where tree diversity alters network properties and thereby modifies the energy flow throughout the system. Our findings demonstrate how species interactions modify forest ecosystem functions and are themselves driven by tree diversity. While highlighting the importance of understanding forests as a complex system of interacting species, our work additionally contributes to a more mechanistic understanding of the positive effects biodiversity has for forest ecosystems and, by extension, for human well-being.

Merian Award Applicant

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Session 3-O5 - Multi-trophic networks in tropical forests

Recovery of tree seedling-herbivore interactions along a tropical chronosequence

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Tropical rainforests are highly threatened by deforestation, yet they have the potential to regrow naturally on abandoned land. To promote natural recruitment, it is essential to explore the interplay of species and their traits within the community assembly of recovering forests. Specifically, plant-herbivore interactions are an important component of terrestrial biodiversity, especially in the tropical ecosystems where they represent one of the major conduits of energy flow. In this study, we monitored tree seedling recruitment and seedling-herbivore interactions across a gradient of tropical rainforest recovery. We focused on leaf functional traits such as thickness, toughness and specific leaf area, since these can influence the herbivory pressure. We calculated leaf area loss and the diversity of leaf damage types. We predicted that the seedling species' richness would increase, and that the seedling community would resemble more the plant species in old growth forests with forest age. We hypothesized that tree seedling-herbivore interactions networks would become more complex (increased richness of damage types, but less area lost, in oldest forests). Our results showed an increase in tree seedling species diversity with forest age, but species composition (taxonomic and functional) did not show a clear pattern in the forest chronosequence. The richness of leaf damage types decreased with forest recovery. Leaf area loss was not associated with forest age, but it was negatively related to leaf toughness and thickness, and positively to specific leaf area of seedling species. Our results provide first insights into the interactions of tree seedling communities, their traits and the invertebrate herbivores in recovering tropical forests. It shows the high recovery potential of tropical forests, which may promote natural regrowth on deforested land.

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Session 3-O6 - Multi-trophic networks in tropical forests

Bats and birds top-down regulate arthropods to a similar magnitude across temperate and tropical forests

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Long-standing ecological concepts state that the influence of top-down forces on herbivores is likely to intensify in tropical regions. However, with respect to the complexity of food webs, variations in top-down forces are highly probable from site to site due to the landscape context (e.g., local biotic and abiotic conditions). Our study represents the first comprehensive multi-site comparison across different latitudes, employing both diurnal and nocturnal predator exclusion experiments. Predator exclosures were established for one month to exclude diurnal or nocturnal predators from understory saplings in six forests, spanning temperate and tropical zones, including locations in Germany, Japan, China, Papua New Guinea and Australia. Arthropods were collected and measured, and herbivory damage was analysed at the end of the experiments. The results indicated that both bats and birds significantly reduced arthropod densities by 65% and 70%, respectively, in both temperate and tropical forests. Moreover, birds and bats appeared to mitigate herbivory damage in all forests, as protected saplings exhibited up to 50% more herbivory. Our results reveal that, regardless of the richness or productivity of the forests, both birds and bats play a pivotal role in shaping arthropod densities, consequently impacting plant biomass, to a comparable extent.

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Session 3-O7 - Multi-trophic networks in tropical forests

Insights from the canopy: Both vertebrate- and ant-mediated regulation of arthropod communities and herbivory was revealed in temperate and tropical forests

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A long-standing theory is that the strength of top-down forces on arthropods is likely to increase in tropical regions and in the forest canopy, copying patterns of productivity. However, in view of the complexity of food webs, it is likely that variation in top-down forces varies from site to site due to differences in local biotic and abiotic conditions, bridging short gradients of vertical forest strata. Further, we discuss the importance of different groups of predators, e.g., vertebrates and invertebrate insectivores. Our study is the first comprehensive, cross-site comparison at different latitudes excluding both vertebrates and ants in the canopy and understory. Predator exclosures were established twice for 4 months in six temperate and tropical forests, including Germany, Japan, China, Papua New Guinea and Australia. Arthropods were collected and measured, and at the end of the experiments the change in herbivore damage was analysed. The results show sites where arthropods and herbivory damage are strongly controlled by ants, and other sites where vertebrate insectivores control trophic cascades. The disappearance of predators usually leads to an increase in arthropod density by tens or hundreds of percent. Our results also do not support the hypothesis that the strength of trophic cascades increases towards more productive habitats and microhabitats.

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Session 3-O8 - Multi-trophic networks in tropical forests

The ecological effect of tree diversity on spider-prey interaction in subtropical forest

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Human-induced biodiversity loss negatively affects ecosystem function at higher trophic levels. While direct relationships for plant-feeding herbivores are well established, the degree to which higher trophic levels, such as predators, respond to changes in plant diversity remains a controversial issue. We conducted long-term sampling in the BEF-China experiment site to study how predatory spiders are influenced by trees, long-lived and structurally complex plants that serve as habitat for much of their prey. With an integrated approach based on multiple diversity components, we found that phylogenetic and functional diversity of trees were important mediators of plant species richness effects on multiple diversity indices of predators, while herbivores themselves were the main meditators from tree to spiders. Moreover, we further analysed the effect of tree diversity on the interactions between spiders and their prey based on metabarcoding, providing direct proof of their relationships. The results show that tree functional diversity has a significant effect on prey diversity and spider-prey interactions. Moreover, tree diversity affects spider-prey interactions differently according to their hunting modes via different pathways.

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Session 3-O9 - Multi-trophic networks in tropical forests

Thriving in Diversity – herbivory and predation rates respond to tree diversity in a subtropical forest biodiversity experiment in China

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Reduced tree diversity might significantly affect ecosystem structure, functionality, and food webs. When changes occur at this primary producer level, they may not only affect the composition and abundance at higher levels of the food web, but also influence the interactions between trophic levels, such as herbivores and predators. It is important to identify and describe these dynamics and their directions to understand the consequences of global change for ecosystem functioning. BEF-China (Biodiversity Ecosystem Functioning China) is a research platform designed for intensive study of subtropical forest ecosystems concerning the effects of changing tree diversity. Our study comprises two sites, each containing 150 plots featuring varying numbers of planted tree species, ranging from monocultures to mixtures with up to 24 species. As part of the research unit Multitroph at the BEF-China platform, this project specifically focuses on the relationships among trees, herbivorous and predatory arthropods. We started 2023 by investigating arthropod functions, conducting visual assessments of foliar damage and pathogen infestation of 3024 trees. Additionally, we measured predation rates on arthropods by placing clay caterpillars, analysing the bite marks, and classifying them according to various functional predator groups, such as rasping and biting. Our results show a significant increase in herbivory rates associated with greater tree species richness and a simultaneous decrease in pathogen rates. These results confirm previous studies and demonstrate a consistent relationship between tree diversity and herbivory which appears to remain constant with the forest's increasing age and growth. The data we gather contributes to constructing energy flow networks for the plant-herbivore-predator system. In the coming years, we will further investigate food webs, trophic rates, energy exchange between levels, and explore how these dynamics change with changes in tree diversity.

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Session 3-O10 - Multi-trophic networks in tropical forests

Tritrophic mammal dung beetle seed interactions in the Ecuadorian Choco

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In tropical forests, zoochory plays a crucial role in seed dispersal, with different primate species contributing to varying extents. Dung beetles attracted to mammal dung, act as secondary seed dispersers. When burying frugivorous mammal dung, they relocate seeds to potentially safer microclimates, possibly enhancing germination rates. Our study focuses on the Ecuadorian Choco, presenting a tripartite network involving primate dung, dung beetles, and seeds. We quantify both the number of morphospecies and seed mass of brown-headed spider monkey and mantled howler monkey dung, as well as dung balls from four dung beetle species. Howler monkeys exhibited three unique seed morphospecies, while spider monkeys had ten, suggesting potential differences in their roles as seed dispersers. This network is somewhat specialized H2' = 0.24. Howler monkey dung has less seed mass than spider monkey dung. Four dung beetle species were exclusive to howler monkey dung and three to spider monkey dung, indicating dung beetle preference and potential resource partitioning, though this is not a specialized network and not different from random (H2' = 0.049). Dung beetles' role in partitioning mammal dung resources is supported by observed primate dung partitioning and distinct volatile profiles. The dung beetles seed network is slightly more specialized, as would be expected due to seed filtering by size H2'= 0.44. Using seed mass as a proxy for seed dispersal efficiency by primates and dung beetles, we found significant differences between monkey species. Dung mass, a proxy for resource availability to dung beetles, revealed *Canthon angustatus* utilizing dung resources from both monkey species. Examining seed mass to total dung mass ratio, dung balls from howler monkey dung was 0.079 g/g, and spider monkey dung balls were 0.26 g/g (t = -3.82, df = 42.8, p-value < 0.001). This suggests that howler monkey dung provides a resource advantage to dung beetles due to higher dung quantity and fewer seeds. Additionally, seeds within howler dung may experience fewer negative consequences of conspecific proximity.

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Session 3-O11 - Multi-trophic networks in tropical forests

Impacts of carnivores on tropical forest dynamics through trophic cascades: The study case of Central African wild cats

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Carnivores, often identified as keystone species, can exert pivotal roles in ecosystems by triggering trophic cascades through density- or behaviourally-mediated pathways. Despite the documented role of carnivores in trophic cascades, the varying strength of evidence and the limited scope of studies concerning specific species and ecosystems raise questions. This study aims to fill a void in Central African tropical forests, focusing on the ecological roles of the leopard (*Panthera pardus*) and the golden cat (*Caracal aurata*) - the two largest carnivores in Central African forests. These species face imminent threats from defaunation, and their direct and indirect effects on prey and vegetation remain largely unexplored. Specifically, within three study sites characterized by varied anthropogenic pressures in south-eastern Cameroon and northern Congo, our objectives are to: (i) determine wild cat densities, diet composition, and prey abundance; (ii) evaluate the impact of herbivore and granivore populations on the regeneration of some high-value timber species; (iii) explore the indirect influence of leopard and golden cat presence/absence on vegetation regeneration. Our methodology involved deploying grids of 63 camera trap sites and collecting wild cat faeces in each study site, including a protected area and two FSC-certified logging companies. Concurrently, experimental designs targeting several timber species were set up to assess predation rates on seeds and seedlings by granivore and herbivore populations. Additionally, an experiment simulating a landscape of fear using odour cues was designed to gauge potential non-consumptive effects on prey and, consequently, impacts on vegetation. Our interdisciplinary approach aims to enhance our understanding of the ecological roles played by these Central African wild cats, informing conservation strategies amidst the escalating threats of defaunation.

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Session 3-O12 - Multi-trophic networks in tropical forests

Stable landscapes help maintain stable bird communities

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Forest conversion to agriculture remains a major threat to biodiversity conservation in the tropics. In order to expand upon our understanding of how land use practices in Central America influence avian conservation, we aimed to evaluate inter- and intra-annual avian community change over an eleven-year period in land uses predominant within the Volcanica Central Talamanca Biological Corridor in Costa Rica. We selected eight land uses following a management intensity gradient from forests to sugar cane to test impacts of land-use cascade effects. Using captured data from long-term mist-netting stations we found that the majority of monitored land uses are supporting stable bird communities. Stability understood as no changes from year to year in mean species richness and abundance of either the total population, or of resident and migratory species over the eleven-year period. We also found that the forest land use fosters a unique bird community composition when compared to the agricultural land uses. Complex agroforest land uses such as multi strata coffee agroforest and multi strata cacao agroforest showed similar composition between them, and close to forest plantations' bird community composition. Simplified coffee agroforest, which includes coffee plants interspersed by poró trees and suppose the typical coffee system found in Costa Rica, hosted a bird community whose composition was closest to forest mixed species plantations. Open and more intensively managed land uses such as sugar cane and pastures had similar bird species composition between but distinct from other land uses. Our findings provide further evidence on the land-use cascade effect as composition of bird communities changed as we moved in a gradient of management intensification highlighting the importance of forest fragments and trees remaining in agricultural landscapes, for the persistence of bird species of conservation concern.

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Session 4-O1 - Tropical chemical ecology

Species differences in foliar metabolites define fundamental niche dimensions in a tropical forest

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Fundamental hypotheses concerning the maintenance and generation of diversity in ecological communities posit a central role for the chemical differences among plants, namely in their ecological function as defences against herbivores and pathogens. Yet the vast diversity of plant chemical defences has traditionally precluded community-level studies of chemical ecology. Here, I take advantage of novel methods for untargeted metabolomics based on data generated with liquid chromatography-tandem mass spectrometry to identify, classify, and compare the structures of >10,000 unique foliar metabolites from 314 tree species recorded in the 50-ha forest dynamics plot on Barro Colorado Island (BCI) and ask whether they represent niche differences in the tree community. If species differences in secondary metabolites represent niche differences that influence demographics, community composition, and species coexistence, we expect seedling survival to decline with increasing chemical similarity to neighbouring plants. Seedling survival was greater in the presence of chemically dissimilar neighbours. The effect was stronger when chemical similarity was measured in terms of defensive chemical classes, rather than the metabolome as a whole or with respect to conserved, primary metabolites, and was pervasive among the 314 species in the BCI tree community. I used the best-fit model for survival to parameterize simulations representing the full model and a variant in which the term representing the effect of chemical similarity to heterospecific neighbours was removed to quantify the effect of chemically-mediated interactions on species richness and chemical diversity in subsequent seedling cohorts. My results suggest that secondary metabolites define niche differences at the community level, most likely by shaping host-use patterns of insect herbivores and microbial pathogens. Further, my results suggest that chemically mediated species interactions range from enemy-mediated competition to niche partitioning with the potential to contribute to species coexistence. I explore the implications of this approach for community ecology and next steps in the study of ecological metabolomics in a global network of forest plots.

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Session 4-O2 - Tropical chemical ecology

Fruit scent: An evolved signal for seed dispersal?

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Fleshy fruits have evolved to attract animals to promote seed dispersal. Several fruit traits have evolved in response to animal behavior, preferences, and sensory capacities. For example, conspicuous coloration is common in fruits whose main dispersers are diurnal and vision-oriented. Fruit scent - the bouquet of chemicals emitted by ripe fruits - has long been speculated to be a similar signal to olfaction-oriented animals, but empirical evidence has been scarce. We report work from the past 5 years investigating the role fruit scent plays in mediating seed dispersal interactions in a community of plants in Madagascar. Using a combination of field ecology, chemical analysis, and animal behaviour, I show that (a) in species that rely on dispersal by local lemurs, fruits have evolved to signal their ripeness via fruit scent; and (b) that fruit scent may be an honest signal for fruit quality. I also present preliminary results from a project examining whether fruit scent is to some degree a product of microbial activity, rendering what until now considered a bipartite system (animals and plants) a tripartite interaction network which includes microbes.

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Session 4-O3 - Tropical chemical ecology

Unveiling the scent evolution of Madagascar's figs

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Fruits have evolved to be attractive to seed dispersers, and fruit traits evolved in response to selection pressures by frugivores. Fruit scent has evolved as a signal for frugivores, signaling ripeness and potentially fruit quality. However, it is still unclear how and what parts of fruit scent have evolved as signals for frugivores and what information they contain. Unlike most chemical classes, aliphatic esters are found to be concentrated in species that communicate with seed dispersers via chemical cues and only in ripe fruits. Some evidence and theoretical basis have indicated a positive correlation with sugar content. This means that there might be a link between chemical signals and where chemical coevolution is expected for fruit dispersed in lemurs. Our research aims to identify whether aliphatic esters are indeed an honest signal for fruit quality and test whether it is an adaptation acquired by plants. We test this hypothesis on a model system of up to 20 fig species (*Ficus* spp; MORACEAE) growing in Madagascar. With collections of fruit and leaf, we intend to (1) establish an ecological network, (2) reconstruct phylogeny, (3) identify the link between chemical signal and reward by using thermo desorption gas chromatography-mass spectrometry (TD-GCMS) and high-performance liquid chromatography (HPLC) to test whether it is the unique link between species and dispersal ecology, and (4) to sequence alcohol acyltransferase (AAT) to check if the selection regimes corresponding to the dispersal mode.

Merian Award Applicant

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Session 4-O4 - Tropical chemical ecology

How do prey signals attract wasps as pollinators in two generalist plant species of the Caatinga?

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Flowering plants have evolved a set of floral traits associated with the attraction of a given group of pollinators. Traits associated with the attraction of predatory wasps have been mainly described for specialized plant species, indicating that floral scents often contain signals of food or prey to attract their pollinators. In this integrated study, we investigate the role of floral scents in the attraction of pollinators in two very generalist plant species, *Serjania glabrata* (Sapindaceae) and *Pityrocarpa moniliformis* (Fabaceae). We found that these plants are also visited by other insect groups like bees, butterflies and flies, however, the majority of visiting species were wasps. Both species evolved general traits associated with wasp-pollinated systems, including easily accessible abundant nectar and dull greenish-white coloration. We used dynamic-headspace methods to collect floral scents and analysed them with GC-MS in combination with electrophysiology (GC-EAD) to identify compounds that trigger antennal responses in wasps. In both systems we found specific compounds that have already been associated with the prey of wasps (i.e., green-leaf volatiles (GLVs), phenylacetonitrile and 2-ethylhexan-1-ol), along with very ubiquitous volatile compounds (i.e., (*E*)-ß-ocimene and linalool) that could explain the broad visitor spectrum. In particular, for *S. glabrata*, we found a temporal change in the chemical composition of the floral scent bouquet that is also reflected in the change of main visitors over the day. Moreover, Y-maze tests indicated that also visual floral cues seem to play an important role in the attraction of wasps to the flowers. Altogether, we were able to identify prey signals in the scent of generalist systems that might play a role as filter mechanism responsible for the attraction of wasps as main pollinators.

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Session 5-O1 - Adaptations of Neotropical biodiversity to changes

Diversity of frontier processes and frontier metrics to uncover major types of forest cover changes

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Deforestation and forest degradation are the major forest disturbances in tropical regions. By changing forest area and forest quality, disturbances have created a diversity of agricultural and forest landscapes. In the Amazonian region, a high diversity of landscapes (archetypes) results from the complex spatio-temporal dynamics driven by numerous underlying drivers such as small/large-scale agriculture, cattle ranching, (il)legal wood harvesting for timber or charcoal, etc. Landscapes reflect major human–environment interactions. Understanding these interactions is crucial to propose efficient policy to combat deforestation and degradation, to support context-specific land governance and to address sustainability challenges in frontier regions. This diversity of landscapes is poorly known, as most studies on frontier regions provide information on deforestation spatial extent. In order to better understand and investigate the high variability of spatio-temporal dynamics in forest frontiers, we propose to integrate the degradation disturbances and produce information on disturbance intensity, deforestation speed and development stages of forest frontiers. We produced seven metrics for three Amazonian territories (Cotriguaçu and Paragominas municipalities in Brazil and Guaviare department in Colombia). The intensity of disturbance was studied with four metrics: baseline forest, % forest lost, % degraded forest and number of degradation events. The development stages of forest frontiers were studied by crossing information on the % of forest left and the activeness of the frontier. All metrics were calculated within a 0.81 km^2 sliding window. We classified these metrics (k-means) to create five archetypes (inactive, consolidated, rampant, active and emerging frontiers) maps. The spatial organization of these archetypes and their relative importance differed in the three areas, and provide useful information to guide policies combining forest protection and regional development at the territory level.

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Session 5-O2 - Adaptations of Neotropical biodiversity to changes

Ecological legacies of past fire and human activity in a Panamanian forest

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Human activities over the past decades and centuries, including fire, cultivation, and forest opening, may have left ecological legacies that persist in modern tropical forests, particularly among palms. We investigated whether past human activities affected modern palm abundances in a well-studied plot located in a tropical semievergreen forest of Panama. We analysed soil cores for charcoal to reconstruct past fire events and phytoliths to reconstruct past vegetation changes. We dated as many charcoal fragments as possible to place a temporal framework on past fire events. Our analysis documented widespread fires that occurred 600–900 years ago across the plot. *Oenocarpus mapora* increased in abundance as a result of these fires, though other palms did not. A subsequent increase in *O. mapora* occurred later in the relative absence of fire and was likely due to game hunting during the construction of the Panama Canal. Our results showed that the enrichment of *O. mapora* was determined by disturbance characteristics (e.g., timing, type, and intensity), but the persistence of increased abundances was likely determined by traits (life history characteristics). These data highlight the complexity of human–environment interactions and how they can persist for centuries in settings with long-lived trees such as tropical forests. These data highlight the importance of adding a historical context to further understand modern ecological patterns and processes.

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Session 5-O3 - Adaptations of Neotropical biodiversity to changes

Dynamics of species turnover along a chronosequence in the Ecuadorian Chocó forest: A comparison across different ecological communities

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Knowledge of the natural recovery of tropical forests is mainly based on studies on a single ecological community. Such studies provide helpful insights of ecological process, but they give an incomplete picture of the recovery of the ecological systems since responses depend on the species traits that vary among ecological communities. A better understanding of the resilience of the natural systems, thus, requires the simultaneous study of ecological communities that capture the different characteristics of the species present in the systems. Here, we compared the species turnover dynamics of ecological communities with different mobility, behaviour, and microhabitat preferences to understand the variability in species dynamics among ecological communities during the secondary succession of a tropical rainforest in the Ecuadorian Chocó forest. We classified 7868 species belonging to birds, mammals, nocturnal insects, diurnal insects, amphibians, trees, seedlings, and soil bacteria into pioneers, intermediate, and climax species. We observed that ecological communities of the early recovery states and secondary forests are nested communities of the old-growth forest, with most communities showing no species unique to the old-growth forest. Among ecological communities, birds had the highest percentage of pioneer species. In contrast, the seedlings and trees had the highest percentage of climax species and the highest number of unique species of the old-growth forest. Our research shows that ecological communities followed different recovery trajectories; thus, strategies to accelerate the recovery based on a single community might be insufficient to recover this habitat.

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Session 5-O5 - Adaptations of Neotropical biodiversity to changes

Drivers of the density and conservation of red-handed howler monkeys, *Alouatta belzebul*, in an Amazonian savannah

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Red-handed howler monkeys, *Alouatta belzebul*, is an endemic Brazilian primate, which is threatened by habitat loss and fragmentation, and hunting. Here, we aim to identify the drivers of the density of *A. belzebul* and support the species' conservation in the state of Amapá, Northeastern Brazilian Amazon. We assessed the density of *A. belzebul* in 17 forest patches through passive acoustics. Depending on the size of the forest patch, we placed 2 or 3 observers within the forest, who recorded the starting and ending times and bearing of each vocalization they heard. Vocalizations heard by more than one observer were triangulated to assess the group's location. Each forest patch was surveyed for 4 to 8 days, depending on its size, and we defined the number of inhabiting groups through their location records. For each forest patch, we also assessed average forest height, tree diameter at breast height, canopy cover, and the number of palms typical of flooded environments. We also assessed patch size, a patch shape index, and the proportion of different environments (forest cover, savanna, water bodies, and anthropogenic cover) in the landscape. Landscape variables were assessed within buffers of 300 to 1200 m, at 100 intervals. We selected the best combination of variables that explained the density of *A. belzebul* through the Akaike Information Criterion corrected for small samples (AICc) of the ordinary least squares models. The density of *A. belzebul* was higher in sites with taller canopies, more forest and more aquatic environments in the landscape. The sites with highest density were close to each other and located in the eastern part of the study area, indicating that this region is important for the conservation of *A. belzebul*. Also, some level of protection of the area should maintain or even increase the forest height and amount of forest in the landscape, benefiting the density of *A. belzebul*.

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Session 5-O6 - Adaptations of Neotropical biodiversity to changes

Adaptive genomics of bromeliads along an elevational gradient in the mountains of the Brazilian Atlantic Forest

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The Atlantic Forest Mountains, rich in biodiversity, is a valuable model for investigating the factors contributing to communities and populations' resilience to environmental change. Integrating genomic data with functional trait information allows us to deeper understand species distribution over space and time. Here, we aim to study whether local adaptation across an elevation gradient in a hotspot of biodiversity has influenced populations' phenotypic and genetic divergences and affects their persistence to climatic changes. We studied individuals from eight *Pitcairnia flammea* (Bromeliaceae) populations across an elevation gradient (from zero to 2200 meters) in the Atlantic Rainforest in Southern eastern Brazil. These individuals were cultivated under the same conditions to assess their ecological strategies from thermal tolerance on functional traits. We observed that low-elevation individuals invest in heat avoidance by increasing water storage tissues, which likely prevents excessive water loss by transpiration during warming periods. Conversely, plants from high elevations invest in cold tolerance, increasing membrane fluidity, a possible response to the membrane stiffening induced by low temperatures. These results suggest a trade-off related to thermal strategies on populations across elevation gradients. Genomic data allowed us to detect higher genetic diversity and lower inbreeding coefficients in the high-elevation populations. We observed that the eight populations clustered into two main genetic lineages, indicating higher connectivity between low- and intermediate-elevation populations. Our results suggest that diverse functional traits have evolved in populations exposed to varying thermal conditions, where high genetic structure and

limited gene flow may have facilitated local adaptation. These findings offer valuable insights into tropical mountain plants' adaptation, diversification, and resilience in response to varying climatic conditions.

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Session 5-O7 - Adaptations of Neotropical biodiversity to changes

Palaeogene climate deterioration increased South American mammal turnover near the Eocene-Oligocene Transition

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Around 34 million years ago (Ma), the Eocene-Oligocene Transition (EOT) marked the most dramatic global climatic change episode in the last 66 million years. Palaeontological evidence suggests that this transition was associated with a major faunal remodelling among European mammal communities. In South America, concomitant biotic turnovers have been postulated at the local scale, mostly from high-latitude sites. However, to our knowledge, no integrative framework has studied the effect of the EOT on South American mammal faunas at the landmass scale. In particular, little is known about the magnitude of these possible biotic changes in the Tropics, the latter often believed as being stable regarding extinction. Here, using an unprecedented fossil dataset and fossil-based Bayesian methods of diversification inference, we explore South American mammal diversification dynamics between 56 and 23.03 Ma. We distinguish diversification histories between phylogenetic orders, based on Tropical/Extra-Tropical affinities and between the main trophic classes. We then investigate the influence of abiotic (*e.g.* Temperature, Andes Elevation) and biotic (diversity-dependence effects) factors in the inferred patterns. We find that (1) around 38 Ma, South American mammal lineages exhibit an overall increased turnover, coinciding with (2) Late Eocene climate deterioration prior the EOT. We highlight a prominent role of temperature in shaping this diversification pattern. (3) Tropical lineages appear significantly less affected by this climate transition than Extra-tropical lineages. (4) Ecologies were unevenly affected by this climate transition, with insectivorous lineages showing a sharp decline while herbivorous lineages exhibit a high turnover, which can be related to a transition from closed to more open habitats. Our results provide insights into how South American mammals responded to a drastic climate crisis, which can be of interest in the ongoing context of climate change.

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Session 5-O8 - Adaptations of Neotropical biodiversity to changes

Climate change may differently affect pest and non-pest leafcutter ants and threaten food security

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Neotropical Brazilian Cerrado seems to have played an important role in leafcutter ants' diversification as South American agriculture may have led pest leafcutters to increase population size. Climate change may interfere with both natural and agroecosystems in the Neotropics, affecting pest ants' biodiversity and geographic distribution, threatening food security. We have generated transcriptome data from pest leafcutters and found 147 variable and 105 identical orthologs in *Atta sexdens* as compared to *Atta laevigata*. In average, the ratio variable per identical orthologs was 16 times higher in genes involved with metabolic processing and catalytic activity than in genes involved with signalling, structuring and organellar functions, indicating metabolic traits as hot spots for mutations. Modifications concentrated in proteins involved with glycolysis, oxidative phosphorylation, and fatty acid metabolism, which parallels the increasing ability and plasticity these leafcutters developed for extracting and storing nutrients from plants. The acquisition of metabolic plasticity seems to have enabled the further exaptation of pest leafcutters to human-designed agroecosystems. This metabolic plasticity to exploit a wide diversity of environments and vegetal food sources is not found in other non-pest leafcutters, so rapid climate change is expected to favour pests over non-pest leafcutters, which may be risky to agroecosystems and, therefore, to food security.

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Session 5-O9 - Adaptations of Neotropical biodiversity to changes

Effects of natural hybridization on the diversity of Neotropical orchids

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Hybridization is one of the most controversial issues in plant conservation. From genetic assimilation and outbreeding depression to new adaptive genes or the creation of new lineages, natural hybridization is a complex evolutionary process where multiple, conflicting, outcomes might occur. Under climate change, natural hybridization can become more common, leading to species extinction. From a conservation perspective, it would therefore be important to identify species and populations at risk. However, new studies also suggest that hybrids may harbour gene combinations, which allow them to cope with changing climate conditions, at least much better than ancestral parental species. Here, we discuss the role of natural hybridization in the origin of novelties using several case studies in Neotropical orchids. We highlight questions associated with the origins of morphological and ecological novelties, at different biological levels, using different spatial and temporal origins of adaptive variation contributing to novelty, and connecting the outcomes for species interactions. Based on cytological, genetic, and phenotypic traits, we will discuss if this process has led to novelties or is rather a threat to orchids, and how (if at all) new adaptations are being brought by natural hybridization.

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Session 5-O10 - Adaptations of Neotropical biodiversity to changes

Species extinction in Neotropics: How far have we gone and what will future climate change bring?

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The origin of Neotropical diversity has been intriguing scientists since Humboldt and Wallace due to its exceptional levels of biodiversity. Understanding and protecting such biodiversity is an important ecological goal, as well as social and economic ones since many families live and are supported by Neotropical based-products. Using the information available for Neotropical species on the Conservation of Nature's Red List of Threatened Species (e.g., IUCN Red List), we reviewed and identified key research and conservation priorities. Specifically, we searched for threatened species listed as critically endangered (CR), endangered (EN) and vulnerable (VU) on the IUCN Red List, and applied descriptive statistics to identify the most common research and conservation actions needed, broken down by major taxonomic groups. Results included understanding threats, as agriculture, unsustainable exploitation of species and climate change. Potential measures needed include monitoring populations and habitats, species management in ex situ conservation, genome resource banks and artificial propagation, land and habitat protection and education and awareness through communication.

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Session 6-O1 - Ecology of tropical mountainous ecosystems

Ecological response on environmental change in tropical South America during the late Quaternary

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Detailed records on vegetation and environmental changes during the late Quaternary, based on pollen, charcoal and multivariate data analyses, provide insights on past ecological response on environmental changes. Several examples from South America will be presented. Studies from Brazil and the Ecuadorian Andes reflect interesting ecological responses to climate change, fire and human impact. Results from the Brazilian Atlantic and Andean Mountain rainforests indicate that the response of ecosystems on large scale climate change can be within centuries or decades. Studies from different regions show how tropical ecosystems evolved to what they are today. Furthermore, they show how sensitive ecosystems are to climate change and how ecosystems responded to natural and anthropogenic environmental changes during the past. This knowledge will help us to understand how ecosystems might change under the ongoing Global Change.

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Session 6-O2 - Ecology of tropical mountainous ecosystems

Functional properties of Andean upper montane forest trees – the role of rare species

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Ecuador is one of the most diverse countries in the world in terms of absolute number of plant species and number of plant species per unit of area. In the present project we are studying the functional composition of the upper montane forest tree community (Cajanuma, Podocarpus PN, 3000 m asl) within 3 permanent plots of 1 ha. In the permanent plots we recorded all trees (dbh ≥ 10cm) with their species and determined functional leaf and wood properties. We measured different stem traits (bark thickness, wood specific gravity, vessel diameter, vessel density, sapwood conductivity) and for leaf traits (thickness, toughness, dry matter content, nutrient contents, leaf area, and specific leaf area). Our hypothesis is that common tree species differ from rare tree species in their functional properties. The preliminary results show that within the upper montane forest community a wide range of tree strategies is present. We found that some tree species have very specific trait combinations, and further analysis will give us more information about specific tree strategies. This knowledge will contribute to our ecological understanding of how plant community structure affects ecosystem functioning, as well the results will contribute to a better-informed conservation of the endangered Andean forests of South Ecuador with their wealth of rare tree species.

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Session 6-O3 - Ecology of tropical mountainous ecosystems

Climate-driven loss of plant diversity in African mountains

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Mountains host some of the most diverse and vulnerable communities of plants in Africa. With the 1.5 to 5 ºC increase in temperature projected for the upcoming decades, it is hypothesised that plants will shift their distribution to track their environmental constraints along elevation and latitudinal gradients depending on their dispersal capacity. Responses like upslope and poleward shifts may result in accelerated rates of species turnover and amplified habitat loss in high elevations, with different responses between tropical and temperate regions. Little is known about how such processes will transform the floristic composition of African mountains. Here, we apply a community-scale modelling approach to quantify and map how different climate change scenarios (SSP) may affect species ranges and community richness of vascular plants in African mountains. Using niche models and dispersal buffers, we project the distributions of 416 species to three climate and land use change scenarios for the late century. Our comparisons between predicted ranges indicate that, without

dispersal, species will lose an average of 22–52% of their suitable areas, depending on the SSP. Comparatively, these numbers will be as low as 10–15% under their maximum dispersal potential. We also observed a pattern of upslope elevational shifts and higher suitability losses for species occurring in higher elevations. Higher proportional losses are projected for ferns, herbs, and shrubs than for trees. The projected dissimilarity between current and future species composition for each mountain region ranged from 0.04 to 0.70, with the highest differences projected for Southern Africa and Madagascar. Our results provide novel evidence for the disproportional impact of climate change on mountains and highlight target regions and species requiring more intensive conservation efforts and reforestation strategies, which need to improve the coverage of other life forms than trees. Furthermore, our findings emphasise that the current rate of change may be too rapid for some species to track based solely on their natural dispersal capacity, and alternatives like assisted migration must be carefully considered.

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Session 6-O4 - Ecology of tropical mountainous ecosystems

Warming responses of growth and mortality of tropical montane tree species in relation to functional traits

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The responses of tropical montane forests to climate change depend on the ability of trees to acclimate to warming, as well as how interspecific variation in these responses affect tree community composition. In this study, we established a field experiment along a 1300 - 2400 m elevation gradient in Rwanda to expose trees to different growth temperatures. Twenty tree species native to montane forests in East and Central Africa were planted in multispecies plots at three sites along the gradient. The elevation ranges of the species are overlapping but are centred in either transitional rainforest (1600 - 2000 m a.s.l.) or tropical montane rainforest (2000 - 3000 m a.s.l.), with both early- (ES) and late-successional (LS) species represented in each elevation origin group. Tree growth (diameter and height) and survival were monitored regularly over six years. Additionally, several functional traits (gas exchange physiology, heat tolerance, water use and status, leaf nutrient content and morphology and wood density) were characterised. We found that ES species, especially from lower elevations, grew faster at warmer sites while several of the LS species, especially from higher elevations, were unaffected or grew slower. Moreover, a warmer climate increased tree mortality in LS species, but not much in ES species. ES species with mid elevation origin strongly increased in proportion of stand basal area at warmer sites, while high elevation montane species declined, suggesting that lower-elevation ES species will have an advantage over higher-elevation species in a warming climate. The different growth and mortality responses will be discussed in relation to the responses of different functional traits. Overall, the responses to warming were highly species specific with large potential effects on forest tree community composition, biodiversity and carbon storage.

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Session 6-O5 - Ecology of tropical mountainous ecosystems

Heat and drought plasticity in hydraulic traits of Afromontane tree species from contrasting successional types

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There are indications that tropical montane forests (TMFs) are experiencing shifts in tree communities, notably due to an increase in mortality of high-elevational species. Drought- and heat-induced tree mortality is known to be triggered by a catastrophic failure of the vascular system due to high embolism levels. The risk of hydraulic failure depends on several traits such as leaf turgor loss point (π_{TLP}), leaf and stem xylem vulnerability to embolism (Ψ_{50}), leaf and bark residual water losses (g_{min} and g_{bark}) and experienced water potential. However, knowledge on these traits and their plastic responses to heat and drought, remains limited for TMF tree species. In this study, we took advantage of the Rwanda TREE project, consisting in multi-species tree plantations along an elevation gradient in Rwanda. We focused on the high- and mid-elevation sites, the latter representing a +5°C warming and 25% reduction in precipitation compared to the former. At each site, we measured the aforementioned hydraulic traits together with dry-season water potentials in two early- and two late-successional montane tree species, which have different growth rates, defoliation strategies during the dry season and show contrasting mortality rates under heat and drought stress. Finally, in order to determine the influence of traits plasticity on heat- and drought-survival, we applied a simple model computing desiccation time, defined as the time between stomatal closure and hydraulic failure. First results from this ongoing study revealed a weak to an absence of plasticity in π_{TLP} while g_{min} was consistently lower at lower elevation, indicating an ability to reduce leaf water losses under warmer and drier growth conditions. Further data analysis and modelling will reveal if adjustments in hydraulic traits may minimize TMF tree species' vulnerability to climate change, and whether they may underly observed changes in community composition.

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Session 6-O6 - Ecology of tropical mountainous ecosystems

The effects of lightning on tropical forests in Central Africa

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Every year, an average of 1.4 billion lightning strikes impact the Earth's surface, with the majority occurring in the tropics, leading to an estimated 832 million trees being struck by lightning in tropical forests annually. What is the impact of this phenomenon in terms of tree mortality, forest dynamics, and species composition? In forest ecology, lightning has traditionally been considered too rare to play a significant role in shaping tropical forest dynamics. However, recent studies conducted in Central and South America suggest otherwise, demonstrating that lightning has a major influence on tree mortality and canopy gap formation, supporting its role in shaping these ecosystems. Despite these advancements, we still lack a comprehensive understanding of the phenomenon. Specifically, knowledge on the ecological impact of lightning in African tropical forests remains rudimental, which is surprising since lightning frequencies in central Africa are the highest in the world. My PhD research addresses this gap, focusing on understanding lightning's impact on forest dynamics in Central Africa. Specifically, I am currently investigating the traits that make trees more likely to be struck by lightning and more vulnerable to lightning-caused damage. In this presentation, I will describe the characteristics of lightning-caused damage in African tropical forests, outline the field-based methods employed in my research, and present preliminary results from two fieldwork campaigns conducted in Uganda. Understanding the ecological impact of lightning in Central African forests not only expands our understanding of tropical forest dynamics but also underscores the need for a pantropical perspective on the impact of this phenomenon.

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Session 6-O7 - Ecology of tropical mountainous ecosystems

Partial thermal acclimation of the photosynthetic heat tolerance in tropical trees

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Climate warming increases the risk of harmful leaf temperatures in terrestrial plants, causing heat stress and loss of productivity. Heat sensitivity may be particularly high in tropical tree species adapted to a thermally stable climate. Heat tolerance thresholds of photosynthetic reactions were investigated in sun-exposed leaves of 12 tropical montane tree species with different growth and water-use strategies. Chlorophyll *a* fluorescence, leaf gas exchange, leaf morphology and lipid composition were measured at three common gardens along an elevation and temperature gradient. Photosynthetic heat tolerance partially acclimated to increased growth temperature; on average 0.31°C increase in heat tolerance per 1°C increase in growth temperature. Consequently, thermal safety margins were narrower for species at the warmer, lower-elevation sites. Moreover, although tree species with traits that predispose them to higher leaf temperatures (low stomatal conductance and big leaves) had higher photosynthetic heat tolerance, their thermal safety margins were smaller. Heat tolerance and its acclimation was linked to the adjustment of fatty acid composition and membrane fluidity. Our results suggest that tropical trees have some capacity to thermally acclimate to increasing temperatures, but not strong enough to prevent increased heat stress in a warming climate.

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Session 7-O1 - Tropical forest/tree functioning

How seasonal is tropical forest/tree functioning?

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Tropical moist forests form a closed canopy with a complex vertical structure under warm and wet environments. In the wettest forests, rainfall is evenly distributed across the year and never limiting, but in many places, rainfall shows strong seasonality and water is limiting during the dry season. As a result, the functioning of tropical moist and dry forests is also highly seasonal. In this talk, we will review the current knowledge on the mechanisms developed by tropical forests/trees to cope with seasonal drought, and their evolutionary history, with a strong focus on trees and on the African continent, because the tropical forests in Africa are fund under drier and more seasonal climates than that of the tropical forests in the Neotropics and south-eastern Asia. We will also describe the current technical advances that allowed investigating the seasonal functioning of tropical forests/trees and the various approaches that have been implemented across the global tropics, including crown and cambium phenology, stem growth monitoring, functional ecology, tree ecophysiology, and high-resolution remote sensing.

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Session 7-O3 - Tropical forest/tree functioning

How tropical trees in Africa adapted to cope with seasonal drought? Exploring the phylogenetic and climatic distribution of the species leaf habit, maximum height, and wood density

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How tropical trees have evolved to cope with drought is still poorly known, especially in tropical Africa, which experiences a drier and more seasonal climate compared to other tropical regions. To address this gap, we characterized the phylogenetic and climatic distribution of three key traits associated with desiccation avoidance or tolerance, focusing on self-supporting forest and savanna species. We assembled a large database with newly compiled data on species leaf habit (evergreen *vs* deciduous) and maximum height, along with data on wood density, climatic niche, and phylogenetic relationships. Bayesian phylogenetic mixed models were used to assess the phylogenetic signal in niche and traits, to explore individual trait responses to climate and to investigate trait covariations, both in general and for each climatic niches. We identified significant phylogenetic signals, specifically for biome and leaf habit, and also major evolutionary changes. Relying solely on climate was ineffective for the prediction of wood density and insufficient for accurate predictions of species leaf habit or maximum height, despite the higher abundance of small deciduous trees in savannas than in forests. However, the effect of climate on leaf habit became evident when considering covariation with maximum height or wood density. We modelled the shift in species traits across forest layers, from an abundance of drought-tolerant evergreen species with dense wood in the understorey to drought-avoidant deciduous species with softer wood in the canopy. This pattern varies according to aridity as in the wettest African forests, it tends to be more common to find evergreen species that reach the canopy. This study represents a pioneering effort to model the leaf habit in tropical Africa for numerous species, considering the phylogenetic structure. Our models could be used to create detailed maps of leaf habit, leveraging phylogenetic relationships to fill missing data in existing datasets.

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Session 7-O5 - Tropical forest/tree functioning

Climate & tree crown phenology in Nyungwe National Park, a montane tropical forest in Rwanda

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Tropical forests have been seen as relatively stable ecosystems comparative to temperate forests. In this context, tropical forests have been thought of as having abundant unconstrained resources and little biologically important variation in climate. However, recent studies on tropical tree phenology provide evidence that tropical forests do exhibit important variation both in their climate and phenology, and that climate and phenology are inextricably linked. Here, we explore the relationship between seasonal climate and reproductive phenology in a diverse montane tropical forest in Nyungwe National Park, Rwanda. Nyungwe forest has a bimodal seasonality and asynchronous annual reproduction between species, and tree crown phenology has been monitored in 66 tree species in Nyungwe forest since 1996. Because tropical forests increasingly display the effects of climate change, it is critically important to understand these climate-phenology interactions to be able to understand and predict the cascading impacts of key climatic shifts on tropical tree species.
Overall, our study highlights how studying phenology patterns can (i) inform key ecological theory about tropical forests and (ii) can help us better predict key impacts of climate change on tropical forest ecosystems.

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Session 7-O6 - Tropical forest/tree functioning

Tracking the seasonal rhythm of tropical forests and savannas with phenocams in Lopé NP, Gabon

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While phenology is an essential biodiversity variable to monitor ecosystem response to climate change, land surface phenology (satellite observations) is difficult to implement in cloudy tropical regions and field phenology (crown observations) is generally limited to a few species monitored at low frequency, (bi)monthly. Time-lapse phenological cameras, or PhenoCams, offer new opportunities that were yet barely explored in Africa, allowing the estimation of the frequency, length and intensity of canopy deciduousness, an important mechanism for canopy trees to cope with seasonal drought. Here, we present the early results of a PhenoCam network installed in the forest-savanna mosaic of Lopé NP, Gabon, and the analytical framework developed for deciduousness detection. Regions of Interest (ROI), including individual tree crowns and forest/savanna extents, were manually digitized for a reference image used to align all daily images. For each ROI, phenological cycles were estimated using variations in the Green Chromatic Index (GCC) and Red Chromatic Index (RCC) among the daily images. The three years of images taken by three PhenoCams show that forest canopy seasonal functioning is bimodal, mirroring rainfall seasonality, with two peaks in the GCC corresponding to rainy seasons. Conversely, savanna shows a unimodal pattern, with a minimum GCC during the long dry season. Leaf loss and leaf growth in the tree crowns are brief events, typically lasting less than 10 days for most deciduous species. We detected more leaf flush or greening events than leaf loss events indicating leaf renewal without leaf loss. This work is encouraging but the challenge is to maintain the long-term monitoring of tree phenology. In terms of analytical perspectives, we aim to enhance the processing of PhenoCam data and specifically the detection of phenological patterns at the crown scale using deep learning techniques.

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Session 7-O7 - Tropical forest/tree functioning

Are intra-annual responses of subtropical trees to climatic variation consistent across species?

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Understanding how intra-annual stem growth and sap flow respond to atmospheric and soil conditions is essential to assess the effects of climate on forest productivity and water dynamics. Studies evaluating these links are often limited to a few dominant species. However, it is unclear whether these responses are consistent across species in highly diverse forests. We monitored intra-annual stem growth and sap flow with high–resolution dendrometers and sap flow sensor for 14 - 20 species over five years in a species-rich montane subtropical forest. We quantified diel and seasonal dynamics in stem growth and sap flow, verified whether observed stem growth and sap flow patterns coincide across species and analysed their main climatic drivers. We found highly consistent intra-annual growth patterns across species. Species varied in the rate but little in the timing of growth. Diel growth patterns revealed that – across species – trees mainly grew before dawn when vapour pressure deficit (VPD) was low. Within the year, trees mainly grew between May-August driven by temperature and VPD, but not by soil moisture. In terms of sap flow, we found consistent diel pattern in sap flow across species with most sap flow in the afternoon when temperature and VPD were high. Sap flow in the year showed marked seasonal variations across species. Our study reveals highly consistent stem growth patterns, marked sap flow variations and consistent climatic drivers at community level. Species strongly converged in intra-annual responses to climatic variation in this tree community, implying that our community-approach may help to understand intra-annual dynamics at the forest scale.

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Session 7-O8 - Tropical forest/tree functioning

Forming leaves does not mean no grow: Dendrometer records reveal growth failure of dry tropical forest tree species in extreme years

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Deciduous tree species in dry tropical forests form leaves in every rainy season. We installed self-registrating electronic dendrometers on 43 tree individuals belonging to 5 tree species belonging to different tree functional types in the Laipuna forest reserve in South Ecuador. We monitored stem diameter variations during up to 8 years in 30-minute intervals and observed tree growth behaviour in climatically contrasting years. We found that in some years, all trees were forming secondary xylem, while in other years no trees were growing at all. However, in some years, there were specific differences in growth behaviour between tree functional types. This points to the fact, that although all trees were forming leaves during the rainy season, which lasts from December to April, not all of them were able to form wood. On the one hand, this points to a species-specific response to the annually varying rainfall patterns determining thresholds of soil moisture, enabling some trees to have a positive carbon uptake balance. On the other hand, it points to the fact that modelling a forest's productivity just from foliage data may lead to an overestimation of its carbon sequestration potential. Thus, on-site monitoring of xylem anatomy and wood formation is needed to derive reliable growth estimates of seasonal tropical forests.

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Session 7-O9 - Tropical forest/tree functioning

Seasonality of tree growth and carbon uptake through assessments of the cambial phenology in the Biosphere Reserve of Yangambi in the Democratic Republic of the Congo

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Tropical forests play a significant role in the global carbon cycle. The carbon is taken up through the xylogenesis, a key mechanism resulting from the division, differentiation, and lignification of tree cells in the cambial zone. This periodic process depends on environmental and genetic drivers that influence wood structure and anatomy. Yet patterns of seasonal cambial growth remain poorly understood for tropical forests, especially for those experiencing low seasonality. However, detailed information on the xylogenesis complements assessments of radial growth, measured through on-the-ground inventories, and the quantification of ecosystem carbon sinks and sources, assessed by eddy-covariance sensors. This is gaining relevance in the context of Congo Basin forests, because of the operationalization of the first flux tower (Congoflux) in semi-deciduous African forests and the increasing number of classic, intensive, and large-scale permanent inventory plots. Cambial phenology monitoring is therefore mandatory to link effective tree growth and permanent carbon sequestration. To meet this goal, we first need to better understand the tree growth cycles. For this purpose, we monitored the cambial phenology of six representative species of Yangambi forests (Democratic Republic of Congo) over the seasonal transition for which we suppose the onset of cambial activity. We characterized the cambial phenology among and within species through a study of the cells and tissues in the cambial zone over time. The description of xylogenesis phases over climatic variations is required to grasp how environmental changes affect ecosystem dynamics and their ability to provide ecosystem services. Studying the cambial phenology is therefore essential for a better understanding of the carbon cycle in a forest ecosystem.

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Session 7-O10 - Tropical forest/tree functioning

Foliar water uptake: A seasonal drought mitigation strategy of central African canopy tropical trees

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Western central African climate is progressively becoming drier and is marked by its intense cloudiness during the main dry season. This cloud cover potentially influences trees' physiological adaptations to cope with seasonal drought stress. In this study, we focused on foliar water uptake (FWU) involving the direct absorption of atmospheric water by leaves. This mechanism allows trees to mitigate drought-induced leaf dehydration caused by drier soils and limited soil moisture availability. We measured FWU capacity during the dry season on a selection of ten canopy tree species in Gabon's La Lopé National Park. FWU capacity was quantified by measuring leaf weight before and after submersion in water. We then studied the relationships between FWU capacity and species' deciduous versus evergreen leaf habits, leaf hydraulic properties (i.e., relative water content, midday water potential, hydraulic capacitance) and drought tolerance (i.e., turgor loss point). FWU capacity varied between 0.15 ± 0.09 and 2.14 ± 0.88 mg $H_2O.cm^{-2}.h^{-1}.MPa^{-1}$ among the sampled trees. Evergreen species showed higher FWU capacity compared to deciduous species, potentially linked to a lower specific leaf area, and thicker leaves observed in evergreens. We found strong correlations between FWU capacity and leaf hydraulic properties such as initial relative water content, initial water potential and hydraulic capacitance. Tree species with higher FWU capacity showed increased drought tolerance, evident from their lower water potential at turgor loss point, and a larger difference between water potential measured at midday and turgor loss point. The study highlights the significance of FWU as a putative drought mitigation strategy for canopy trees in Central African forests, with a greater capacity in evergreen species compared to deciduous ones. However, exceptions were observed among species, indicating the necessity for additional validation of the proposed link between cloud cover and FWU.

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Session 7-O11 - Tropical forest/tree functioning

How does water-table depth affect the physiological status of a tropical dune forest?

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In seasonally flooded tropical dune forests, like restinga forests in Brazil, groundwater availability can have a great effect on water-use and eventually on the physiological status of the woody species. In this study, we aimed to explore whether and how *restinga*'s woody vegetation experience variations on physiological condition in response to water-table depth. By exploring functional responses (i.e. variations in a suite of physiological parameters) of the dominant trees and shrubs during a less-wet period, we focused on understanding the direct and indirect effects of environmental factors (such as water-table depth and light accessibility) and of biotic factors (such as plant water-uptake depth and stand structure) on shaping vegetation physiological condition. We found that the physiological status of the woody community (15 species) was mainly explained by the direct effect of light access, with a great differentiation between trees and shrubs, and by the indirect effect of lowering water-table mediated by belowground water-uptake adjustments towards deeper soil layers. Even at a fine-scale, greater depth to groundwater significantly influenced plants' water-uptake depth towards deeper soil layers in both trees and understory shrubs. Trees showed higher photosynthetic capacity compared to understory shrubs but did not show a more favorable water status nor vitality when using deeper soil layers. Instead, trees presented lower physiological status when belowground investments were made to reach deeper soil layers. Besides underpinning the great importance of light on shaping the physiological performance in restinga forests, particularly partitioning over and understory species, our results highlight the importance of groundwater availability under rainless periods on plant water-sources use and on belowground differential investments. In turn, these adjustments have a significant negative influence on restinga tree species' physiological performance.

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Session 7-O12 - Tropical forest/tree functioning

Patterns and drivers of herb biomass in a Caatinga dry tropical forest

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Aboveground biomass is a critical feature of tropical forests, demonstrating a direct correlation with ecosystem productivity and providing various ecologically significant services, including carbon storage. Despite their limited spatial extent, tropical forests, comprising only 7-10% of the terrestrial surface, contribute significantly, constituting 35% of the land net primary productivity and 25% of the biomass. Moreover, a substantial portion of plant biomass serves as forest products (e.g., timber, charcoal, fodder), impacting people's livelihoods through subsistence and commercial exploitation. In this study, we accessed the distribution of herbaceous biomass and examined potential drivers of this herbaceous biomass in a 670 km^2 landscape covered by the dry forest of Caatinga, including remnants of primary forest and areas of secondary forest at different stages of regeneration. Herbaceous biomass in our study, averaging 0.47 tons/ha (± 0.26), emerges as a significant component within the aboveground biomass of the study area. This proportion, representing 1.6% of the total aboveground biomass, aligns with findings from other studies. Notably, similar percentages have been reported in the literature, such as in Singh's (1993) study, which identified a herbaceous biomass contribution of 0.6%. The consistency of these proportions across different studies highlights the recurring pattern of herbaceous biomass playing a relatively modest yet consistent role in the overall dynamics of aboveground biomass in diverse ecosystems. Regarding concentrations and stocks of herbs biomass: (1) follow the pattern of C > N > K >Mg>Ca> P, (2) are more correlated with rain and dry season, and type of forest, instead of environmental variables like livestock pressure, and (3) nutrient stocks and concentrations are mainly affected by variation in precipitation into the year, than spatial precipitation variation.

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Session 8-O1 - Free Session

Fish community composition in the tropical archipelago of São Tomé and Príncipe

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Understanding species distribution across different environmental conditions, such as habitat or depth, is important to inform area-based management. However, observational data is often lacking from coastal regions, particularly in emerging economies, making design of effective conservation strategies challenging. One such data-poor region is the Gulf of Guinea, a marine biodiversity hotspot whose waters play a critical role in coastal livelihoods. Here, we describe the results of the largest national scale Baited Remote Underwater Video (BRUVS) survey across the region to understand the effect of several environmental variables on fish community composition and diversity indicators (species richness, abundance, and evenness). From July 2018 to July 2020, we deployed 498 BRUVS in the coastal waters of São Tomé and Príncipe (STP) archipelago. Depth and slope had a positive, significant effect on species richness and relative abundance. Habitat type had a significant effect on all diversity indicators, with higher richness and abundance on rocky reef than on maerl or sand, including higher abundance of species important to artisanal fisheries (such as red African snapper). Nevertheless, maerl and sand also hosted specialist species, including species of local economic and cultural importance, such as flying gurnard. Whilst there were no differences in diversity between islands, fish assemblages differed significantly. São Tomé had a higher abundance of small planktivorous species and lower abundance of the commercial species blue runner, which may be reflective of increased fishing pressure. Finally, our survey recorded an extremely low abundance of

sharks in both islands, which may be due to the effect of long-term fishing pressure. Our results provide crucial information that will inform the designation and ongoing monitoring of Marine Protected Areas in STP.

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Session 8-O2 - Free Session

Reassessing the conservation status of the Príncipe's Island endemic shrew *Crocidura fingui*, Central Africa

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The Fingui white-toothed shrew (*Crocidura finguil*) is the only non-volant terrestrial mammal endemic to Príncipe Island, Central Africa. The species was only described in 2015 and its conservation status is currently assessed as Data Deficient due to large knowledge gaps in its distribution, ecology and potential threats. In our work, we integrated camera-trap data, field observations and previously published and unpublished sightings to reveal the species island-wide presence, from native forests to urban areas, nocturnal habits and a significant spatiotemporal overlap with the island's introduced mammal species. Notably, encounters with potential competitors/predators such as rats, cats and civets, pose a threat to the species. Black rats have been linked with the extinction of other species of shrews in small islands and anecdotal evidence suggests that free-ranging cats frequently hunt shrews in Príncipe Island. Based on our findings, we recommend elevating *Crocidura fingui* conservation status to Endangered, underscoring the urgent need for further research into the species ecology and conservation strategies.

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Session 8-O3 - Free Session

Postwar defaunation in Angola: Mammal assemblages in Bicuar National Park

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Armed conflicts have profound social, economic, and ecological impacts wherever they occur, leaving lasting imprints on habitats and wildlife populations. Having endured decades of civil unrest (1961-2002), Angola stands as a post-conflict region marked by extensive wildlife exploitation. Empirical and anecdotal evidence emphasizes broad impacts of wildlife harvesting for bushmeat, trade, traditional use, trophy hunting, and retaliatory killing, facilitated by widespread availability of military firearms and limited protected area management capacity. However, the absence of research and monitoring initiatives has hindered comprehensive assessments of postwar wildlife status and trends. Our research delves into the defaunation of Angolan protected areas, utilizing six years of continuous camera trapping surveys and dietary analyses of faecal DNA in Bicuar National Park (BNP) to characterize the composition, structure, and functionality of the extant mammal assemblage. Our findings reveal significant defaunation, with approximately 40% of historically occurring mammal species seemingly lost, particularly large ungulates, and multiple others persisting at diminished abundances. Limited evidence for post-war recovery trajectories suggests that historical extinction debts and ongoing disturbances may have stabilized extant mammal populations at novel depleted baselines. Trophic simplification further characterizes the restructuring of the mammal assemblage, as extant large predators predominantly focus on a single primary prey. Despite conflict resolution and formal protection reinstatement, our collective findings emphasize that extant mammal assemblages in BNP remain incomplete, apparently depleted, and functionally altered, requiring active restoration efforts. The continuation of our research program aims to provide evidence for effective conservation strategies, empower local practitioners, and identify pathways towards the functional recovery of postwar ecosystems.

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Session 8-O4 - Free Session

Angola as a pivot to promote wildlife ecology research and capacity building opportunities through the establishment of a dynamic collaboration network

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In line with its strategy for internationalization, which focuses on expanding research collaborations through sustainable and innovative initiatives, CIBIO-InBIO has established a global network of TwinLabs, with a particular emphasis on Portuguese-speaking countries in Africa, with the main aim of collaborating on research, advanced training and capacity building. In recognition of the importance of this collaborative endeavour, UNESCO awarded the University of Porto (UP) the Chair Life on Land in November 2017 to promote and coordinate interactions among the TwinLabs. The Lubango Twinlab in Angola is the initial focus, where the Wildlife Conservation Ecology Research Group (WILDEcol) has established, since 2017, the largest long-term wildlife monitoring stations of the region, with the aim of making significant contributions to wildlife conservation and restoration in the region. Other biomonitoring networks are being developed, including in Cabinda region, where new records of threatened species have been unveiled by CIBIO teams, and efforts will align with a wider research initiative in the Gulf of Guinea. Through the Lubango Twinlab, CIBIO aims to contribute to the training of a new generation of local ecologists through conservation theory and practice, in a joint Master program between the UMN (Universidade Mandume ya Ndemufayo) and UP from 2024. The network of collaboration and information exchange will extend to key local stakeholders to ensure that the knowledge generated is widely accessible to the public and will contribute to actionable long-term strategies for wildlife conservation and restoration. The TwinLabs initiative contributes to the establishment and strengthening of perennial relationships, forming a strong network of collaboration between European & African Research Institutions, starting with Angola and the Gulf of Guinea as models to expand by building communities of practice for Ecology & Conservation from and for Africa.

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Session 8-O5 - Free Session

Unveiling the impacts of fire severity on herbivore occupancy patterns

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Fire plays a pivotal role in shaping savannah ecosystems and is frequently used by managers to induce the growth of nutritious fresh grass for herbivores. However, fire severity shapes the structure, diversity and post-fire regrowth of vegetation in burnt areas, potentially leading to variable but largely unexplored responses of herbivore species with different dietary preferences. We applied dynamic occupancy models to camera-trapping data from two southern Angola conservation areas to estimate the trends in occupancy probability (ca. six months after fire) of herbivores from different dietary guilds in areas affected by 'mild' and 'severe' fire intensity. Consistent with the hypothesized increase in foraging opportunities, our results depict an immediate rise in the occupancy probability of grazer species in burned areas during ca. two months, particularly following 'severe' fires. Short-term occupancy increase of mixed and generalist feeders were only detected in areas burnt at 'mild' intensity, suggesting these species may also benefit from vegetation regrowth (fresh grass, woody plant shoots, post-fire roots) while being vulnerable to woody-vegetation loss after more 'severe' fires. In contrast, the occupancy of browser species decreased monotonically following fires, irrespective of severity, likely reflecting more direct impacts of fire on browse vegetation. Notably, at the end of the study period, the occupancy of most species was lower than their pre-fire state, potentially due to the observed short fire intervals (2.08 ± 1.46 years) which ultimately promote the growth of more homogeneous, tall grass patches. Collectively, our research emphasizes the significance of assessing pyrodiversity—specifically, changes in both fire severity and periodicity—as crucial factors in evaluating the effectiveness of fire as a tool to enhance foraging opportunities for functionally diverse herbivore assemblages.

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Session 8-O6 - Free Session

Exploring the relationships between fire regimes, plant diversity, and carbon stocks in African savannas

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African savannas are the most fire-prone biome on Earth. There, fire might influence aspects relevant to local managers and the international community, such as carbon sequestration and biodiversity conservation. Within this context, the long-term experimental burns carried out in Kruger National Park since the 1950s provide a unique laboratory to study the influence of different fire regimes on plant diversity and carbon stocks. In this study, we analysed the influence of different fire regimes on these variables, as well as their potential interactions in three savanna types (Sourveld, Combretum, and Mopane) in Kruger National Park. In each savanna type, we distributed 20 plots, with four plots for each of the fire treatments: annual, biennial, and triennial burns during the fire season; triennial burns out of the fire season, and unburned. In each plot, we sampled different ecosystem compartments to estimate the total ecosystem carbon storage (aboveground vegetation, litter, roots and soil from a 5 cm depth). Additionally, we sampled vascular plant species, differentiating trees, shrubs, grasses, and forbs to calculate overall species richness and species richness by biotypes. The effects of fire on carbon storage were more significant in the Sourveld savanna, and the effects on plant richness were more pronounced in Mopane. Despite this variability of responses among sites, we conclude that, generally, the highest carbon storage and plant diversity were found in unburned situations and after triennial burns. However, the effects of fire on plant richness were not uniform among biotypes, with some groups being favoured by frequent burns (e.g., grasses in Sourveld and forbs in Combretum), and others by less frequent fires or fire suppression (e.g., trees and shrubs in Sourveld and Combretum systems, and grasses in Mopane). Significant relationships between species richness and carbon storage were not detected.

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Session 8-O7 - Free Session

Withdrawal and expansion: A decade of dynamic ungulate distribution in Amazonian lowland sanctuaries (2010-2020)

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Neotropical ungulates favour undisturbed habitats. Forest conversion to agriculture is the main driver of the contraction of tropical large mammal distributions. In the Amazon, although Protected Areas (PAs) effectively reduce forest loss, deforested area has been growing inside within their boundaries in recent decades. Here, we aimed to study variations on ungulate distribution inside and outside PAs of the Amazonian lowlands over the last decade. We used data on ungulate presence, climate and landscape to predict species presence and absence in 2010 and 2020 through Maxent. Overall, rainfall and primary habitats positively influenced ungulates. Generally, distribution expansion and contraction were both predicted to be the highest in unprotected lands. Range contraction was higher in PAs established before 2010 (PA2010), whilst greater expansion was, in general, predicted in PAs created between 2010 and 2020 (PA2020). Results in PA2020 suggest that those PAs are more effective than PA2010 at preventing habitat loss and/or are yet to be exposed to heavy environmental deterioration. Further, our findings also suggest that PA2010 still retain elements important to ungulate conservation; however, there is a possibility that their adequacy for these species could be gradually diminishing. In turn, ungulate distribution may drift towards locations apparently more suitable in unprotected lands, where extinction risk may be greater.

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Session 8-O9 - Free Session

Sounds of survival: Impact of vessel traffic on endangered Ganges river dolphins in the Hugli River

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The Hugli River is a vital waterway and habitat for the Endangered Ganges River dolphin. This species faces numerous challenges for survival. They possess a unique adaptation as they are almost blind and therefore heavily rely on echolocation to navigate and locate prey in their environment. However, the waters of the Hugli River are subjected to heavy vessel traffic, which poses a significant threat to the well-being of the dolphins. Historically, the Hugli River was a crucial trade route during colonization, facilitating commerce and connecting various regions. Unfortunately, the increase in vessel traffic over time has led to disturbances in the behaviour and acoustics of the Ganges River dolphins. However, documentation on these changes remains relatively scarce. We conducted a research study to compare the sound profiles generated by vessels and corresponding dolphin acoustic response. The study aimed to measure the differences in sound pressure levels between high-traffic areas and those with little to no vessel activity and the difference in dolphin acoustic behaviour in the two regions. The study findings revealed the frequency usage of Ganges dolphin echolocation clicks increases by 10 kHz and inter-click interval increases by 1000 microseconds with different boat size categories. With the increasing popularity of using waterways as greener transportation, there is a pressing need for conservation efforts to mitigate the adverse impacts of vessel traffic on the endangered Ganges River dolphin population.

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Session 8-O10 - Free Session

Sisi e'u ("food of the tamarins") – plant-frugivore interactions of the Neotropical understory tree *Leonia cymosa* (Violaceae)

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Many tropical woody plants depend on vertebrates for the dispersal of their seeds. Usually, seeds of a single plant species are dispersed by several to many species of vertebrates. Here I report on the plant-frugivore interaction of a small (mean height 6-7 m, maximum height 12 m) Neotropical understory tree, *Leonia cymosa* (Violaceae), based on studies at Estación Biológica Quebrada Blanco (EBQB; Peru) and data from the literature for Laguna Grande de Cuyabeno (LGC; Ecuador). Camera-trapping and focal tree observations revealed tamarins (*Leontocebus nigricollis*, *Leontocebus nigrifrons*, *Saguinus mystax*) and squirrel monkeys (*Saimiri cassiquiarensis*) as the only frugivores visiting and consuming the pulp of the mainly 1-2-seeded (max. 7 seeds) berries of *L. cymosa*. Behavioural observations of *L. nigrifrons* and *S. mystax* at EBQB revealed that tamarins swallow seeds and void them with their faeces, thus acting as dispersers of *L. cymosa*. In contrast, camera-trapping and ground surveys after feeding visits by *S. cassiquiarensis* at LCG indicate that these primates mainly spit the seeds. The observed restriction of frugivorous visitors to small primates concurs with ethno-biological knowledge, particularly the naming of *L. cymosa* as sisi e'u – "food of the tamarins" or "food of small monkeys" – by the Siona ethnic group in Ecuador. The observations also raise the question of how such a seemingly very specific interaction evolves despite the absence of any specialized fruit or frugivore traits.

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Session 8-O11 - Free Session

Human visitation alters the behavioural response of wildlife: A study on vigilance behaviour of Japanese pika at Mount Highashi-nupukaushi-nupuri

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Humans are often perceived as a threat that can affect the behavioural ecology of wildlife, significantly affecting their fitness and survival. Examining the behavioural responses of animals to human disruptions serves as a valuable approach to evaluating the impacts of human activities on wildlife. To understand the impact of human presence on vigilance behaviour, we studied the Japanese pika *Ochotona hyperborean yesoensis*, a shy mammal that inhabits rocky montane environments, at two different sites at Mount Highashi-nupukaushi-nupuri in Daisetsuzan National Park, Hokkaido, Japan. We measured the calling and flight initiation distance in response to an approaching human. Additionally, we examined the correlation between these behaviours and the distance from the trail, along with the frequency of human visitation. Spearmen's correlation coefficient (Shapiro–Wilk normality test $P < 0.05$) was used to analyse the association between calling and flight initiation distance and location distance. Results revealed a significant positive correlation between the calling initiation distance ($r = 0.731$, $P < 0.001$) and flight initiation distance ($r = 0.860$, $P < 0.001$) of Japanese pikas and the location distance. It was also observed that pikas showed reduced vigilance and tolerance distances when facing potential predators at the impact site. Additionally, they displayed a shorter corrected flight distance and produced fewer calls when encountering a predator at that site. Our research contributes to the ability of pika to anticipate the potential consequences of heightened human visitation on the local wildlife community in the forthcoming periods.

Merian Award Applicant

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Session 8-O12 - Free Session

Applied palaeoecological and molecular methods in the studies of material codicology: New aspects of known techniques used for palm-leaf manuscript studies

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Classical methods of palaeoecology include the studies of plant macro- and microremains, such as investigations on the fragments of tissues, pollen, spores, non-pollen palynomorphs (NPPs: e.g. fungi spores, algae cells and cysts, phytoliths studies, biogeochemical profiling, and charcoal analysis. Initially all these methods were developed for applied palaeovegetation studies, reconstructions of the past landscape and environment patterns. Thus, their application appeared to be not limited to their primary research fields. In this presentation we would like to demonstrate the power of 'old good' palaeoecology applied to some unusual study cases. In combination with modern methods of molecular biology (e.g. metabarcoding, studies of molecular markers) and mathematical data analysis palaeoecological approach expands its traditional meaning and contributes into material codicology. The question of manuscript provenance, including its origin and production, has become prominent in the field of material codicology over the last two decades. Manuscript archives may keep accurate records of the provenance of the artefacts they contain, but there are often large gaps in these. The manuscripts themselves do not always bear explicit information about the time and place of their production and circulation. All this makes it difficult to track the origin of the manuscripts, in particular when it comes to the studies of palm-leaf manuscripts. Our project attempts to reconstruct the recipes of the palm-leaf manuscript production, that includes intensive studies of the plant tropical ecology, regional floristic diversity and ethnobotanical practices in the various regions from the tropical India to the Insular SE Asia. We attempt to study palm-leaf manuscripts as the palaeoecological archive those potentially may help us to lit more light on the ancient (and mainly lost) cultural practices of the plant use as well as to the manuscript's provenance. With this contribution we would like to discuss potential benefits, challenges, constrains and uncertainties of applying methods of palaeoecology and molecular biology for the needs of the manuscript studies with the unclear provenance.

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Session 8-O13 - Free Session

Consequences of floral colour polymorphism on the reproductive success of a Neotropical deceptive orchid

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Plant species with deceptive pollination strategies often exhibit elevated rates of polymorphism. These strategies have been associated with the maintenance of floral variation, which can hamper pollinators' learning, and thus reduce the avoidance of rewardless flowers. However, floral polymorphism might also be maintained through a fluctuating selection mechanism, as pollinator-mediated selection can act on distinct floral traits over time due to fluctuations in the pollinator community. *Epidendrum fulgens* is a Neotropical deceptive orchid, with an unexplored floral colour polymorphism, pollinated by butterflies. In this study, we explore the role of pollinator-mediated selection on the maintenance of this polymorphism. We performed field activities and a manipulative experiment. On the field, we monitored reproductive success and morphological floral traits (using geometric morphometry) of 60 individuals over two flowering periods and carried out selection gradient analyses to assess the differences in fitness among colour morphs and morphology. In the manipulative experiment, we settled up clusters of cultivated plants and left them available to pollinators. We made clusters with homomorphic and heteromorphic floral colour and monitored their reproductive success in order to investigate the effect of colour heterogeneity on reproductive success. Overall homo- and heteromorphic clusters performed equally and their reproductive success was highly variable over time, indicating a possible fluctuating selection. As for the field, we detected a different selection gradient for the colour morphs, with thinner petals being under selection on yellow flowers and longer petals on red flowers. Indeed, morphometric analysis revealed significantly longer petals in red flowers and thinner petals in yellow flowers. Our results represent evidence of disruptive selection on colour morphs driven by a diverse pollinator community with different preferences and abundances over time.

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Session 8-O14 - Free Session

Leaf litter decomposition along a chronosequence in the Ecuadorian lowland Choco' forest

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We studied leaf-litter decomposition along a chronosequence in the Ecuadorian lowland Choco tropical forest in Esmeraldas. The experimental design was a time-based approach with litterbags and teabags with three replacements every 45 days. Litterbags facilitated the entry of arthropods (≤0.5 cm), while teabags exclusively supported microbial or fungal decomposition. Both contained a standardized mix of leaves from five common local trees. Litterbags were singularly placed above ground, and teabags were both duplicated and positioned above and below ground. We investigated decomposition on thirty-two plots, representing diverse stages of forest development - from active cacao plantations and pastures (age 0) to old-growth forest. The experiment consisted of four treatments: disturbance (complete removal of litter and small plants), disturbance-fenced (removal and exclusion of animals), control, and control-fenced. Key research questions addressed in this study include the variability in decomposition along the chronosequence and among different treatments and collection rounds. Furthermore, we explore the driving forces behind decomposition, investigating whether it is primarily steered by decomposing small arthropods (litterbags-teabags) or by microorganisms (teabags). We extend our inquiry to the relationship between decomposition rates and geo-spatial data. Our approach involved modelling decomposition rates as a function of plot-specific environmental parameters such as temperature, humidity, terrain, canopy closure, precipitation, altitude and season. Preliminary analyses disclosed a robust correlation between decomposition rates and canopy closure. Noteworthy differences in measurements at various collection rounds post-disturbance indicated a dynamic recovery of the main drivers of litterbags' and teabags' decomposition. Despite these insights, discerning the primary forces driving decomposition, whether small arthropods or microorganisms, proved challenging.

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Session 8-O15 - Free Session

Diversity of frontier processes and frontier metrics to uncover major types of forest cover changes

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Deforestation and forest degradation are the major forest disturbances in tropical regions. By changing forest area and forest quality, disturbances have created a diversity of agricultural and forest landscapes. In the Amazonian region, a high diversity of landscapes (archetypes) results from the complex spatio-temporal dynamics driven by numerous underlying drivers such as small/large-scale agriculture, cattle ranching, (il)legal wood harvesting for timber or charcoal, etc. Landscapes reflect major human–environment interactions. Understanding these interactions is crucial to propose efficient policy to combat deforestation and degradation, to support context-specific land governance and to address sustainability challenges in frontier regions. This diversity of landscapes is poorly known, as most studies on frontier regions provide information on deforestation spatial extent. In order to better understand and investigate the high variability of spatio-temporal dynamics in forest frontiers, we propose to integrate the degradation disturbances and produce information on disturbance intensity, deforestation speed and development stages of forest frontiers. We produced seven metrics for three Amazonian territories (Cotriguaçu and Paragominas municipalities in Brazil and Guaviare department in Colombia). The intensity of disturbance was studied with four metrics: baseline forest, % forest lost, % degraded forest and number of degradation events. The development stages of forest frontiers were studied by crossing information on the % of forest left and the activeness of the frontier. All metrics were calculated within a 0.81 km^2 sliding window. We classified these metrics (k-means) to create five archetypes (inactive, consolidated, rampant, active and emerging frontiers) maps. The spatial organization of these archetypes and their relative importance differed in the three areas, and provide useful information to guide policies combining forest protection and regional development at the territory level.

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Session 8-O16 - Free Session

Summarizing two decades of research on *Scalesia* (Asteraceae), the most endemic and iconic plant genus radiated in the Galapagos Islands

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Darwin's daisies (*Scalesia*, Asteraceae) form an iconic radiation of 15 species endemic to the Galapagos Islands, which are distributed throughout this tropical archipelago. Among them, eight species are endemic to a single island, with small populations distributed across only tens to hundreds of hectares. Our oral presentation will describe an overview of unique findings related to the phylogeny, ecology, distribution and conservation of this emblematic group, summarizing more than 13 years of research. Diversification of extant *Scalesia* species and active phenotypic and genomic evolution appear to have occurred in recent times, specifically in the late Quaternary. However, the present survival and conservation of *Scalesia* species are at high risk, as shown by establishment rates reduced to 5% when competing with invasive plant species. We will finish by presenting ongoing research and future avenues for the study of this unique plant group. With this presentation, we hope to fill an important gap of information regarding Galapagos plants, particularly for one of the least studied groups of these iconic islands, which will serve to create new international collaborations and attract more botanical research on one of the most interesting daisy groups.

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Session 9-O1 - Tropical biomonitoring in a molecular era

Ecosystem monitoring powered by eDNA surveys in megadiverse areas: Challenges and perspectives

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In the past 15 years, the use of environmental DNA (eDNA) for species detection and biodiversity monitoring has seen a sharp increase, with a significant number of studies conducted worldwide. From land to aquatic environments, spanning from heavily urbanized areas to remote locations, and comprising a variety of samples (e.g., water, soil, ice, and air) eDNA data has contributed to deepening environmental monitoring across the globe. Yet, a discrepancy is seen when comparing the amount and scope of studies conducted in the global north compared to the global south. In Brazil, eDNA applications are still in their infancy, with several hindrances halting the potential of these to be used on a wider scale. Whilst the use of eDNA in temperate countries is moving forward addressing more complex ecological and methodological questions, in Brazil there is a priority to work towards understanding the eDNA ecology, optimisation of sample collection and processing protocols, and establishing a collaborative effort in improving reference databases. A comprehensive framework should be proposed to obtain genomic data for a wide variety of species, creating databases that accurately represent the complex and diverse biodiversity. As demonstrated in our studies addressing the current taxonomic challenges associated with marker choice and reference datasets available for fish species, using eDNA to uncover fish, mammal and invertebrate diversity in Brazil and optimising the collection and use of eDNA data generally, there is a significant potential for implementing routine eDNA surveys in much larger spatiotemporal scales fitting to the rich biodiversity present in the country. These surveys can contribute to overcoming the challenges of sampling remote and difficult-to-access areas and helping management and conservation actions through the understanding of species distributions and ecosystem monitoring.

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Session 9-O2 - Tropical biomonitoring in a molecular era

Application of eDNA for species conservation: The case of *Harttiella* (Siluriformes, Loricarridae)

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Environmental DNA is now widely used for the detection of freshwater fish. Nevertheless, the eDNA origin, state, transport and fate in the environment can highly influence its detection. This is why further development is needed to use eDNA to effectively monitor populations and provide information directly suitable for conservation planning. Here, we used the study case of an endangered tropical fish genus (*Harttiella*) to investigate the applicability of eDNA for conservation. Most *Harttiella* species are listed as threatened by the IUCN and all species are confined to small streams that are often threatened by anthropic activities (e.g. mining activities, deforestation). Due to the rarity of most of the *Harttiella* species, their low fecundity, and dispersal capacities, this genus is targeted by a French National Action Plan that aims to ensure their conservation. In this context, we investigated how eDNA methods could answer some of the objectives of this National Action Plan. We specifically evaluated the ability of eDNA to provide meaningful information on the spatial distribution of the species and the temporal monitoring of identified populations. We developed a targeted digital PCR (dPCR) approach for two *Harttiella* species and calculated probabilities of detection as a function of distance from the population. We provide advice to managers on the best way (optimal sample number and sampling distance) to implement eDNA monitoring. We also performed a comparison between multispecies metabarcoding and targeted dPCR for *Harttiella* species to inform about the costs, benefits, and drawbacks associated with these two approaches. Our studies provide new insights into the development of eDNA as a conservation tool in tropical ecosystems by offering a concrete response to the challenges of the National Action Plan. Moreover, we also address broader issues concerning the ecology of eDNA such as the detection distance in small tropical streams.

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Session 9-O3 - Tropical biomonitoring in a molecular era

Environmental DNA (eDNA) in the French West Indies: A non-invasive molecular method to monitor the biodiversity of mobile marine species

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In the current context of biodiversity loss [1], it is essential to carry out biodiversity inventories in the marine environment in order to measure spatial and temporal variations and inform public policies for management and conservation purposes [2,3]. To carry out these biodiversity inventories, molecular approaches may provide a wide range of information, and require collecting biological samples. Recent developments implementing environmental DNA (eDNA) analysis, i.e. DNA extracted from an environmental sample [4], offers both new possibilities and, more importantly, non-invasive sampling. Sea water-eDNA coupled with metabarcoding enables several taxa to be detected simultaneously. Here we present a study carried out in the French West Indies within the Agoa Sanctuary, a marine protected area for marine mammals. A first eDNA-sampling campaign was performed in the Martinique Natural Marine Park inside the Agoa Sanctuary. The aim of this campaign, called An Ba d'lo, was to draw up a comparative inventory of biodiversity in different areas. It covered 13 sites (6 coastal and 7 oceanic). One hundred and ninety-three teleost taxa were detected, representing more than half of the species expected in the area. Three cetacean species were also detected. Chondrichthyans were detected only in the bay of Fort de France. These analyses have highlighted several sites that are remarkable for the biodiversity they host, but the results in the

pelagic domain for cetaceans and chondrichthyans suggested a low offshore abundance. A second sampling campaign targeted a single site sampled on a recurring basis: the same transect was collected over several separate successive days. Seventy tree vertebrate taxa (63 teleost taxa, 7 mammal taxa and 3 bird taxa) were identified and samples showed strong dissimilarities according to Jaccard's index, revealing significant differences in taxonomic composition between samples from one day to the next. This campaign also tested the detection power of different primers (teleost-specific, mammal-specific and cetacean-specific), confirming that they provided consistent and complementary results. The study of eDNA using metabarcoding therefore offers prospects for studying marine biodiversity in a non-invasive way, particularly in tropical ecosystems, where biodiversity is rich and sometimes poorly understood.

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Session 9-O4 - Tropical biomonitoring in a molecular era

Flies as tools for studying disease ecology in tropical ecosystems

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Metabarcoding of invertebrate-derived DNA (iDNA) is increasingly used to describe vertebrate diversity in tropical terrestrial ecosystems, representing a cost-effective tool for biomonitoring of mammals. Using hybridization capture, it is now even possible to generate complete mammal mitogenomes from flies, opening the possibility of using iDNA for widespread population genetic studies. Flies have also been implicated in the transmission of many pathogens making them a potentially value tool for detecting pathogens as well. Combining these fly iDNA based datastreams has the potential to make for a promising tool for understanding the ecology and distribution of novel pathogens or emerging infectious diseases. Here, I will present studies from two tropical ecosystems, Taï National Park, Côte d'Ivoire and Kibale National Park, Uganda, that used fly iDNA to explore the geographic distribution of pathogens along gradients from the forest to surrounding villages, as well as within specific groups of non-human primates. For some pathogens, it was possible to culture them from flies, both confirming their positivity and infectivity, while facilitating sequencing of their whole genomes to reveal considerable genomic diversity of these pathogens. Combining data on pathogen positivity with mammal detections from specific flies allows for an estimation of the host ranges of pathogens from fly iDNA, that we show are largely identical to the results of long-term carcass monitoring efforts in these regions. Our results highlight the power of fly iDNA for mammal biomonitoring and pathogen surveillance at diverse scales, which we hope will continue to join the toolkit of tropical biologists.

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Session 9-O5 - Tropical biomonitoring in a molecular era

A dive into landfill ecology: The role of New World vultures in the dissemination of anti-microbial resistance

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Since the discovery of the penicillin, the development of antibiotics has significantly improved human and animal health. Yet, the intensive use of antimicrobials results in the accumulation of bacteria with antimicrobial resistance (AMR) properties in the environment. Moreover, waste management practices in certain human-made habitats (e.g., landfills) create the ideal conditions for AMR development. To complicate matters, landfills provide endless and predictable resources for wildlife to feed, reproduce and live, and consequently attract a plethora of wild birds, such as New World vultures (*Coragyps atratus* and *Cathartes aura*) in much of the Americas. In this context, we investigated the role of landfill ecosystems in the potentiation of vultures to amplify and disseminate AMR in the environment. We collected 107 samples (soil, water, and feces) between May and December 2023, in 2 different types of habitats (roosts and landfills) located in Mississippi, U.S.A., an area defined as humid-subtropical. We isolated and identified *Enterococci* (EN), *Escherichia coli* (EC), and *Salmonella* (SM), and performed antibiotic susceptibility tests. Environmental DNA was extracted and used to quantify the presence of antibiotic resistance genes (ARG) and the class 1 integron. We isolated EN, EC, and SM, in 41, 25, and 23 samples, respectively. We found a prevalence of multi-drug resistance with 92.7% (EN), 64% (EC), and 73.9% (SM) samples being resistant to more than half of the antibiotics tested. AMR was mainly to aminoglycoside (33.9%) and cephalosporin (15.1%), which was corroborated by ARG analyses. We described variations in the abundance of microorganisms and the patterns of AMR based on the season, habitat, and sample types. Our study may suggest that landfills constitute a source of zoonotic pathogens and AMR for wildlife, due to readily available refuse input. Using non-invasive molecular methods, we highlight an often-ignored ecosystem within the One Health paradigm.

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Session 10-O1 - Biodiversity and sustainable tropical agriculture

Interacting effects of local and landscape factors shape bird and bat diversity in Amazonian cacao agroforestry systems

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Cacao agroforestry systems, in which cacao trees are grown together with shade trees, can buffer biodiversity loss in tropical agricultural areas by providing more niches and resources than simplified land-use systems. Several studies have shown that bird and bat diversity in agroforestry systems depends on the local management and the landscape context, but little is known about their interactive effects on these vertebrates. Moreover, some of the most important areas for bird and bat conservation, such as the western Amazon, remain understudied in this regard. We sampled birds and bats in 28 cacao agroforestry systems (plots) located in two different agricultural areas of the Peruvian Amazon differing in the degree of agricultural intensification at the landscape level. In each area, we selected 14 plots representing a gradient in shade tree diversity and structure and percentage of tree cover surrounding the plot and used mixed models to study the interactive effects of local management and landscape variables on bird and bat communities. We found positive effects of shade tree diversity on bird diversity in areas dominated by intensive agriculture, with insectivores and frugivores benefiting the most. In addition, the effect of shade cover in the plots on bird diversity varied depending on the surrounding tree cover. Bird diversity was higher in cacao agroforestry systems similar to the matrix in which they are embedded, meaning that high percentages of canopy cover are necessary to preserve bird diversity in agroforestry systems located in forested areas. Bats were less influenced by local management but were affected by agricultural intensification at the landscape level. Our results highlight the importance of considering the interactive effects of local and landscape factors on the flying vertebrate community in Amazonian cacao agroforests and serve as a basis for the development of landscape-dependent, biodiversity-friendly management recommendations.

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Session 10-O2 - Biodiversity and sustainable tropical agriculture

Assessing cacao pollination: Impact of landscape and farming practices on pollinator diversity and fruit yield in Northern Peruvian Amazon

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Cacao stands as a vital tropical crop primarily cultivated within agroforestry systems, which play a crucial role in supporting and preserving varied ecological habitats within the cacao plantation. Despite its importance, uncertainties persist regarding cacao pollination. Understanding how landscape and management practices influence the diversity of potential pollinators and their impact on fruit yield is pivotal for both farmers and ecologists. Additionally, the identity of possible cacao pollinators remains unclear. While the diptera Ceratopogonidae and Cecidomyiidae are often considered primary pollinators, they are not consistently available. Other taxa, such as Hemiptera, Hymenoptera, and Thysanoptera, have been suggested to play a role in this important task. Our research unfolds in Northern Peruvian Amazon, in two valleys that present different degrees of agricultural intensification at landscape level. We intend to investigate how landscape features and management practices impact the diversity of cacao pollinators and, subsequently, their influence on cacao yield, especially during the initial stages of maturation post-pollination. To do so, we selected 28 organic cacao agroforestry systems following a gradient of management and landscape intensification. In these plots, a total of 124 trees were assessed by performing focal floral observations. We registered not only the presence of individuals within flowers but also factors like size, behavior, functional groups, and their specific location within the flower at different times of the day. This comprehensive analysis aims to distinguish potential pollinators among flower visitors and analyze the effect of local and landscape features on the diversity and abundance of these potential pollinators. Our study aims to advance our knowledge of the cocoa pollinator community and develop management recommendations to improve its ecosystem services and sustainable cacao production.

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Session 10-O3 - Biodiversity and sustainable tropical agriculture

Solving the cacao pollinator puzzle: New insights into pollinator identity and ecology

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Cacao (*Theobroma cacao*) is an important tropical cash crop, sustaining the livelihood of 40-50 million farmers globally and driving a $10 billion cacao bean industry. Recent work has shown that pollination is a limiting factor for production. However, current attempts to enhance pollination have remained unsuccessful since the exact identity and breeding habitats of the pollinator species involved in the three global cocoa production areas remain controversial, and the factors that determine their abundances unknown. This hinders the development of effective management strategies for increased pollination. Our proposed conservative approach aims to confirm the identity of cacao pollinators. Given the high cryptic diversity, DNA barcoding is the only way to pin down which species pollinate and find out where they reproduce. Additionally, we seek insights into pollinator ecological niches by analysing phenology and environmental requirements. Field surveys in Nicaragua, Peru, French Guiana, and Malaysia have provided valuable data. Our findings reveal midges as the primary insect group visiting cacao flowers, displaying remarkable diversity across families. We successfully identified micro-habitats within plantations where these flower visitors emerge. We found substantial differences in the pollinating potential between the different groups of flower visitors. In conclusion, our study challenges prior research, uncovering a more restricted range of taxa involved in cacao flower pollination. This discovery lays the groundwork for sustainable management practices to enhance cacao pollinator presence and abundance in plantations.

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Session 10-O4 - Biodiversity and sustainable tropical agriculture

Restoring biodiversity to oil palm plantations in Sumatra, Indonesia: Can riparian buffer restoration treatments support Anuran populations?

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The expansion of oil palm (*Elaeis guineensis*) has led to rapid deforestation in Southeast Asia, threatening biodiversity and ecosystem functions. However, there is a growing awareness of these impacts and a desire to increase sustainability of within-plantation management. A key recommendation is the preservation of riparian buffers – strips of conservation-focused land beside waterways – within plantations. Riparian buffers could provide valuable benefits for freshwater and terrestrial ecosystems. In Indonesia, the leading producer of palm oil, national law mandates that 50m-wide buffers should be left, but specific management guidelines remain limited. In the long-term, collaborative Riparian Ecosystem Restoration in Tropical Agriculture (RERTA) Project, run with the SMART Research Institute in Sumatra, Indonesia, we examine the effects of riparian tree-planting and mature palm restoration treatments on biodiversity and ecosystem functions. We focus on Anurans (frogs), a taxon that relies on freshwater and terrestrial systems, and so provides a valuable indicator for assessing the benefits of riparian buffers. To assess changes in Anuran abundance and diversity in response to each treatment, we conducted night surveys before the treatments were established, and two-, and four-years post-treatment for both streams, and six-years for one stream. Recent surveys also examined microhabitat availability and habitat use. We found greater Anuran abundance in the 'passive restoration with maintenance of palms' treatment, six-years post-treatment, than the oil-palm control. Richness was lower in the 'tree-planting with maintenance of palms' treatment than the control during the same period, which may reflect shifts in community composition. These results suggest that riparian buffer restoration, even in large-scale plantations, may provide valuable habitat for Anurans. Thus, we provide evidence supporting restoration methods that may contribute to sustainability guidelines.

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Session 10-O5 - Biodiversity and sustainable tropical agriculture

Conserving biodiversity and enhancing food security: Understanding small mammal diversity patterns in mosaic landscapes of Guinea-Bissau (West Africa)

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The need to meet human population increasing requirements while ensuring biodiversity conservation has challenged current land management practices and called for nature-based solutions. This is particularly relevant in the understudied Afrotropical landscapes where food insecurity meets high levels of biodiversity. Land-use change stands as the primary driver of global biodiversity loss, with Guinea-Bissau witnessing an unprecedented conversion of native forests and traditional rice fields into cashew monocultures, with unknown impacts to biodiversity. This study investigates small mammal diversity patterns (species richness, Shannon diversity index, abundance and composition) in rural landscapes of Guinea-Bissau at the local and landscape scales considering three habitats: forests, rice paddies and cashew orchards. Small mammals were sampled across five sites centred in each of the habitat types using Sherman live traps. At a local scale we considered the habitat type in which the sampling took place and at a landscape scale we considered the habitat composition within a certain buffer size. We captured 230 individuals belonging to 11 species. At a local scale, species composition differed in the rice paddies, while species richness and the Shannon index remained similar across the three habitat types. At a landscape scale, both species richness and abundance were higher in landscapes with higher proportion of rice paddies. Conversely, abundance was lower under higher proportions of cashew orchards. Overall, our results support the idea that mosaic landscapes are beneficial for small mammals, particularly those with a reasonable coverage of rice paddies and reduced proportions of cashew orchards. This study provides baseline knowledge to propose guidelines to maximise biodiversity persistence in rural landscapes across the tropics while concurrently addressing pest-related challenges and enhancing crop productivity and food security.

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Session 10-O6 - Biodiversity and sustainable tropical agriculture

Bats and rice: Contribution of insectivorous bats to pest suppression services in Mexican rice fields

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Rice is one of the most important crops for humanity, since more than half of the world population depends on it as their main source of nourishment. One of the main pests affecting this crop worldwide are stem borers nocturnal moths, that feed upon tillers during larval stage and cause grain loss. Bats are major predators of nocturnal arthropods and have been described as efficient insect pest suppressors. However, many estimates of the value of this ecosystem service assume that bats consume enough of these insects to impact their population sizes and, in consequence, crop damage. We used six large nocturnal exclosures on rice fields in Mexico to assess the effect of insectivorous bats on rice stem borers abundances and rice crop damage. Then, we used this data to estimate the ecological value of this effect and extrapolate it to scenarios of medium and high borers infestation levels. Our experiments demonstrated an average reduction of 58.3% in crop damage due to the presence of insectivorous bats. From these results, we estimated an average economic value of US$3.39/ha/year of unmilled rice or US$8.03/ha/year of milled rice for bats pest suppression ecosystem service in our experimental fields, and a potential of that value to increase to between US$279,342 to US$21'115,610 at country level. Our results provide the first evidence that bats significantly reduce rice stem borers abundances and crop damage based on experimental field exclosures, and the first economic estimate of the ecosystem service, in the American continent for rice. These findings represent valuable information to promote the implementation of conservation plans for bats in agroecosystems and to include them in integrated pest management plans in Mexico and the world.

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Session 10-O7 - Biodiversity and sustainable tropical agriculture

Nature-based solutions to increase rice yield: An experimental assessment of the role of birds and bats as agricultural pest suppressors in West Africa

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Rice is widely consumed as a staple food, being cultivated worldwide. However, in West Africa, production is not enough to satisfy demand. Rice often suffers from intensive damage by herbivorous arthropods that affect quality and quantity of the grain. Birds and bats have been shown to suppress arthropod pests, potentially enhancing rice productivity and food security. However, the degree to which these taxa represent nature-based solutions for mitigating pest-induced rice losses is poorly known, especially in West Africa. Here, we used experimental exclosures to investigate whether birds and bats can reduce plant damage and boost rice yield by suppressing arthropod abundance. We established 14 sets of paired experimental exclosures and control parcels in a rural area in northern Guinea-Bissau to preclude access of birds and bats to rice plants. We then quantified how birds and bats' absence influenced arthropod communities, plant damage, and rice yield over a full rice cycle (six months). Arthropod numbers in exclosures (10.1 ± 9.1) were nearly double those in control plots (5.8 ± 3.0 ind./plot), a result greatly due to spider abundance. The percentage of leaf and grain damage showed no difference between exclosure and control, as well as rice yield. Using Structural Equation Models, we identified that (1) the exclusion of birds and bats boosted spider abundance, which reduced the insects' presence, and (2) higher insect abundance resulted on a decrease of pecky rice. Our findings imply that the absence of birds and bats may have initiated a mesopredator release among spiders, offsetting the role of top vertebrate predators in regulating common arthropod prey. This phenomenon could potentially obscure the pest suppression capabilities of these top predators in closing yield gaps in West Africa. Further studies delving into the intricacies of trophic interactions within these agro-ecosystems are essential to develop strategic and sustainable measures for enhancing rice productivity, minimizing the need for costly intensification or heavy pesticide reliance.

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Session 10-O8 - Biodiversity and sustainable tropical agriculture

Patterns and predictors of insectivorous bat activity around isolated trees in rice fields of Guinea-Bissau (West Africa)

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The need to sustainably feed a rapidly growing human population has never been higher, especially in some tropical regions, where food security is presently not guaranteed. Ecological intensification strategies in agricultural management might help achieve this goal by including ecosystem services and using nature-based solutions. Integrating landscape elements such as isolated trees can play a crucial role in enhancing productivity while preserving biodiversity in agricultural landscapes, particularly since these trees may support organisms like insectivorous bats that provide valuable pest control ecosystem services. Therefore, there is a need to understand how isolated trees, based on their characteristics and the surrounding landscape, may drive the foraging activity of bats in staple tropical crop fields. We acoustically sampled bats at 28 isolated trees to evaluate how (a) tree characteristics, (b) insect abundance and richness, and (c) landscape features around isolated trees drive bat foraging activity within lowland rice crops in West Africa. Twelve bat species or sonotypes were recorded and classified into three foraging guilds. Our results show that bat activity increases with tree size and distance to the nearest wooded edge. Conversely, total bat activity, sonotype richness, and the activity of open space foragers declined with the increasing distance to neighbouring trees. Insect abundance affected bat activity, increasing the activity of edge foragers, while insect richness showed no effect. This study highlights the importance of isolated trees as agents of heterogeneity in agricultural landscapes, emphasising that the potential benefits for bat populations stem from ecological processes operating at both tree and landscape levels. Preserving or allowing the growth of numerous large trees spread throughout the rice fields will benefit the two most abundant bat guilds within this crop, enhancing the benefits these predators may bring by suppressing insect pests.

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Session 10-O10 - Biodiversity and sustainable tropical agriculture

The benefits of eco-certification for biodiversity

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Agricultural land use and exploitation and are among the main drivers for global biodiversity loss. Eco-certification programs that encourage farmers to meet certain production standards are supposed to mitigate the loss of biodiversity. However, we know only very little about the extent to which eco-certification benefits biodiversity. We conducted a meta-analysis to study how eco-certification criteria are associated with biodiversity of birds and bats, insects and woody plants in coffee and cacao cultivations. We found that eco-certification can benefit biodiversity. However, these positive effects on biodiversity were particularly strong and consistent across taxa for criteria defined at the landscape-scale. Our meta-analysis demonstrates that biodiversity-friendly actions should be certified and encouraged not only at the farm-scale, but should also comprise measures at the adjacent landscape scale.

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Session 10-O11 - Biodiversity and sustainable tropical agriculture

Friend or Foe? Attitudes of rice farmers towards wild animals in West Africa

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As the global human population continues to grow and the demand for space and resources increases, human-wildlife conflicts are expected to rise. Most studies focus primarily on human-wildlife interactions within or around protected areas. This leaves a significant gap in understanding these interactions in agroecosystems worldwide, where farmers and wildlife coexist and share land and other resources with fewer restrictions. We investigated the attitudes of farmers towards rice production, their knowledge of, interactions with, and attitudes towards wildlife associated with rice fields, while documenting the measures they employ to mitigate wildlife damage to rice crops. Using individual interviews and focus group sessions, we assessed the responses of 269 female farmers from six villages in the Oio region of Guinea-Bissau, West Africa. Farmers cultivate rice solely for sustenance (100%), and their high dependence on the crop presents challenges such as animal pests or the lack of proper work tools. Farmers displayed a comprehensive knowledge of local wildlife, accurately identifying various insects, reptiles, birds, amphibians, and mammals. Negative attitudes towards wildlife were two times more prevalent among farmers than positive attitudes, primarily due to perceived crop damage (31%). However, there were also animals that were associated with positive attitudes due to their link with water (13%), food (4%), and cultural beliefs 30%). Farmers employed various strategies to mitigate wildlife damage and field guarding (92%) was the most common approach. Farmers did not know or chose not to answer (89%) when asked about having beneficial animals in their fields. These findings highlight the complex relationship between rice farmers and wildlife in West Africa. Understanding these dynamics is crucial for promoting coexistence between

farmers, wildlife, ultimately contributing to biodiversity conservation and to the sustainability of agricultural systems.

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Session 10-O12 - Biodiversity and sustainable tropical agriculture

Agroforestry for food security, biodiversity, and climate resilience

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Today, we are witnessing a humanitarian crisis, due to extreme weather events such as floods, droughts, and increased frequency and intensity of dry spells in many African countries. This will continue to have a devastating impact on agriculture which is the main livelihood source in Africa. Trees serve as safety nets in times of emergency such as natural disasters (e.g., floods and droughts). Moreover, up to ninety percent of the biodiversity in the tropics is in human-dominated landscapes. Protected natural areas are essential but insufficient to maintain biodiversity especially since protected areas tend to be isolated. It requires both a combination of sites and conservation action in the wider landscape. The long-lasting conservation of indigenous plant and animal diversity will depend on our ability to design and manage agricultural landscapes so that they conserve the original biodiversity as much as possible, while still sustaining agricultural production goals, indigenous cultures, and local livelihoods. We will present the multiple roles of agroforestry in contributing to the conservation of biodiversity, climate adaptation and local livelihoods in fragmented landscapes from our studies in Africa both from traditional agroforestry practices, the Gedo home garden cultural landscapes, and introduced agroforestry practices in Eastern Africa.

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Session 10-O13 - Biodiversity and sustainable tropical agriculture

Influence of household livelihood assets on agrobiodiversity and food availability and accessibility outcomes along urbanisation gradients in tropical smallholder agroforestry systems

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Threats of urban expansion in biodiverse tropical regions persist, with 70% of the global population expected to reside in urban areas by 2050. Therefore, we need to identify how ongoing urbanization can align with concurrent demands for biodiversity conservation and food security with the help of agroforestry practices such as homegardens. Since livelihood assets constrain the sustainability potential of homegardens, we examined the variations in influence of household livelihood assets on homegarden agrobiodiversity and food availability and accessibility outcomes along urbanisation gradients in India. We find different types of homegardens exist along urbanisation gradients, particularly with regard to plant composition, indicating the need to devise specific incentives targeting different livelihood assets based on our preferred outcomes from these systems. With regard to agrobiodiversity outcomes, homegarden size is consistently negatively associated across varying distances to urban centre. Additionally, more livelihood assets are associated with homegarden agrobiodiversity closer to urban centres suggesting the potential for establishing biodiversity patches in urban areas through incentives that support these assets for creating sustainable and resilient landscapes. Meanwhile, farming experience and farming association membership are consistently positively associated with food availability and accessibility of homegardeners themselves indicating the relevance of farming support to ensure food security. In general, along urbanisation gradients, policies and incentives targeted toward natural and social livelihood assets could be complementary for both agrobiodiversity and food availability and accessibility outcomes in homegarden agroforestry systems.

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Session 10-O14 - Biodiversity and sustainable tropical agriculture

Impacts of agribusiness expansion on territorial development in the Savannas of Amapá

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A large part of the human population lives and works in tropical savannas, which have a significant impact on the global economy. In South America, islands of savanna of varying size occur throughout the Amazon biome, known as Amazonian savannas, and have generally been under-studied and are highly threatened mainly by the expansion of agribusiness, as is the case in the Savannas of Amapá in northern Brazil. Planting of commodities has intensified in the state of Amapá over the last decade and strips of land along the BR 156 highway have become the target of the grain sector, who have been pressing the government for land legalization. Such legalization will directly affect traditional populations, such as Quilombolas, whose traditional land rights have not yet been formally recognised. Given this, unchecked expansion of commodity plantations would negatively impact both biodiversity conservation and the well-being of traditional peoples and small-scale farmers along these savanna areas. Here we present preliminary results of a participatory research project being carried out with Quilombolas in four communities in the Savannas of Amapá, at different points along the process of formal recognition of land rights and with differing socio-ecological contexts, to: 1) understand the importance of the savannas and their associated fauna to the communities, 2) characterise the ways in which land-use change and particularly the expansion of agribusiness has impacted these communities and their territorial development, and 3) identify the limits to and possibilities for cooperation between the various interested parties for effective and equitable conservation and sustainable development of the Savannas of Amapá.

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Session 10-O15 - Biodiversity and sustainable tropical agriculture

Assessing Fairtrade feasibility for sustainable practices in Guinea-Bissau's cashew agroecosystems

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Sustainable practices in the cashew industry are important for improving the livelihoods of cashew farming families, protecting biodiversity, and promoting a continual cashew nuts supply chain in Guinea-Bissau. Fairtrade as a voluntary certification system has influenced farmers' practices towards sustainability in some countries. The existing literature focused on its impact on small-scale producers and on coffee, but there is a research gap in analysing its feasibility in countries where it does not operate to determine if it can be a solution in promoting sustainable practices in the cashew supply chain. The adoption of Fairtrade for cashew cooperatives is feasible (i) if cashew cooperatives' operating conditions meet the set of standards established by Fairtrade International and (ii) if socio-economic and environmental benefits established by Fairtrade International are better compared to those obtained by cashew farmers within the existing agroecosystems. The study considered four cooperatives covering four different regions of the country and used a mixed approach with a quantitative and qualitative structured questionnaire to cashew farmers. The findings indicated that cashew cooperatives meet some of the Fairtrade standards such as consisting of smallholder farmers and not using any synthetic agri-chemicals, but there are behaviours which don't align with Fairtrade Principles such as hired child labour. Adoption of Fairtrade would contribute to the sustainability of the supply chain through increasing farmgate prices, reliable market, and agricultural training that emphasises environmentally friendly practices. Results can be used by organizations seeking to improve the living standards of cashew farming families, and future research should include other players of the supply chain such as traders and exporters to have an overview of the entire value chain in promoting sustainable practices.

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Session 10-O16 - Biodiversity and sustainable tropical agriculture

Nuts for cashews: Achieving sustainable production in Guinea-Bissau (West Africa)

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Cashew nuts are among the most highly valued nuts in global markets, with rising worldwide consumption leading to increased market demand, mainly driven by the rising awareness of nuts' health benefits. World cashew production traditionally dominated by India and Viet Nam, are dominated by West Africa region. In these countries, cashew is not only an important agricultural commodity, contributing to both gross domestic product and export exchanges at the country level, but also an essential resource for the smallholder farmers livelihoods. To meet economic needs, cashew has dominated the agricultural landscapes of West African cashew-producing countries, such as Guinea-Bissau, a small country ranked 10th at world production. Cashew was engaged as a commercial crop due to agricultural policies in the 1980s and has become a key agricultural commodity accounting for 90% of the country's exports and having a direct effect on the household income of 85% of the rural population Nowadays, old and low-productive monospecific orchards prevail, with no varietal selection and few management practices. At present, a large proportion of arable land in Guinea-Bissau is dedicated to this single cash crop, raising food insecurity issues. In this communication, we provide an agro-historical overview of the agricultural changes on Guinea-Bissau, highlighting cashew as the main driver of recent agro-economic transitions. Research conducted along the years will be highlighted on the topic of the sustainable production of cashew covering areas as agro-economy, cashew genetics/genomics, field-based surveys for assessing current

constraints affecting current sustainability of the agroecosystem, all undertaken across Guinea-Bissau. West African agriculture is at a turning point in terms of adopting a transformative approach towards inclusive growth and sustainable development, and cashew crop should be seen as a mean for achieving a sustainable and durable production system.

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Session 10-O17 - Biodiversity and sustainable tropical agriculture

Sweet beekeeping from the middle of the world

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Stingless bees are effective pollinators of native flora in the Tropics. They provide the environmental service of pollination through pollen flow, increasing reproductive success and genetic variability in plants. The management of stingless bees, Meliponiculture, is an economic activity for family support, limited to rural areas in Ecuador. Stingless bee breeding is used in sustainable agricultural systems, part of the 9.5% of global agricultural production for human consumption. The present study has the objectives to describe stingless beekeeping systems in three different climatic zones in Ecuador, to determine the floral origin of stingless bee pot-pollen in rainy and dry seasons, to characterize biosecurity, and health risks aspects of meliponiculture practices. The integration of Meliponiculture in systems such as the pollination of polyculture fruit crops, the construction of a bee hospital (Amazon region), scientific tourism, and a living bee museum (coastal region), as well as the successful commercialization of honey through associative work (southern highlands region), have proven to be successful examples of this activity in sustainable Ecuadorian agro-systems and cultural heritage. While main pollinic species determined were *Prockia crucis, Coffea canephora, Miconia nervosa, Laurus nobilis*. Regarding management practices, hand washing, material sterilization, and personal protective equipment use, were the main biosecurity aspects accomplished. Possible causes of losses (15% nest death rate) include nest invasion, nearby sources of pollution, and unusual behaviors in bees. Meliponiculture in Latin America, with a focus on Ecuador, continues to proliferate, and support from academia has generated useful information for beekeepers, as well as an acceptable diagnosis of nest management practices. However, some points need to be addressed from a One Health perspective, to ensure aspects such as food safety, bee conservation, and environment preservation.

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Session 10-O18 - Biodiversity and sustainable tropical agriculture

Cashew field prospection in Guinea-Bissau: Characterization of the production system and pest occurrence

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The global production of cashew (*Anacardium occidentale* L.) reached 3,708,153 tons of nuts in shell in 2021, underscoring its pivotal role as a crucial crop across tropical countries. In Guinea-Bissau (West Africa), cashew plays an essential role in the country's economy, with 90% of its exports relying on this single crop. Given the susceptibility of cashew production to many abiotic and biotic threats, understanding, and characterizing them is crucial for the effective intervention of the government and agricultural experts. This study aimed to perform a comprehensive characterization of the cashew production system in Guinea-Bissau and assess the prevalence of pests across different seasons. The data were collected through field surveys carried out at the national level in 2021-2023 involving 152 producers, and the production system was characterized using descriptive statistics, including different components, such as social, geographical, productive, and post-harvest aspects. The occurrence of pests was recorded in 21 farms during both the dry (May) and wet (October) seasons. Field observations of presence and associated damage were statistically compared. The main results revealed that 96.1% of respondents were male, with an average age exceeding 41 years old. The cashew farms were predominantly small, covering less than 5 ha. Notably, 53.9% of the producers did not use the cashew apple, and the majority reported a decline in cashew yield between 2019 and 2020. Moreover, statistical analysis indicated a higher incidence of pests during the dry season (42.91% ± 4.07) compared to the wet season (24.23% ± 3.95). Termite (Isoptera) was recorded as the most prevalent pest in both seasons (>90%), followed by the branch girdler (Coleoptera) (81.25%) in the dry season and leaf miners (Lepidoptera) (91.66%) in the wet season. This characterization of the cashew agroecosystems is a valuable tool, contributing to the implementation of sustainable practices to improve cashew crop productivity in Guinea-Bissau.

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Session 10-O19 - Biodiversity and sustainable tropical agriculture

Discriminating cashew varieties from Guinea-Bissau through agromorphology, nutritional, and allergen analysis

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Cashew (*Anacardium occidentale*) is one of the most popular nuts in the world, being largely produced by West African countries. One of these is Guinea-Bissau, an underdeveloped nation whose economy and population relies enormously on this crop, accounting for about 90% of the country's yearly exports. Local producers commercially differentiate two types of cashew nuts easily distinguishable by their apple colour, which can be red or yellow. The yellow type is considered to have a relatively higher nut quality and therefore is sold at higher prices; while the red type is the most cultivated and recognized by its outturn rate and nut quality, despite being smaller in size. Due to the importance of this crop to Guinea-Bissau we are characterizing the yellow and red "varieties" in a multidisciplinary approach. Hundreds of individual cashew nuts from more than 50 fields across Guinea-Bissau from both the red and yellow "varieties" are being characterized using agro-morphological traits (nuts and leaves), nutritional content (e.g. fatty acids, proteins, micro and macronutrients, primary metabolism as vitamins and amino acids), and allergen analysis. Preliminary results indicate some patterns that can be used to differentiate the two "varieties", such as grain quality, weight distribution, and some other qualitative morphological traits. Similarly, immunoblotting with monoclonal antibodies against the Ana o 3 cashew allergen indicate variation in allergen content among the "varieties". Completion of this research will provide unique characteristics that can be used to differentiate cashew 'varieties' from Guinea-Bissau.

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Session 10-O22 - Biodiversity and sustainable tropical agriculture

Groundwater Quandary of Bathinda, Punjab: A balance between sustainable agriculture and ecology

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The Green Revolution in 1960 transformed Indian agriculture, enhancing productivity but causing groundwater quality issues in Punjab due to unsustainable practices. The cultivation of water-intensive commercial crops, such as high-yielding varieties of Wheat, Rice, and Cotton, coupled with the extensive use of Nitrogen-Phosphorus-based fertilizers, has contributed to the emergence of numerous cancer cases, earning the region the moniker "Cancer Capital of India. "This study focuses on the groundwater quality of Bathinda district in Punjab, revealing elevated concentrations of Lead, Cadmium, Chromium, Nickel, and Iron. Notably, these concentrations were found to be above the permissible limits set by the Bureau of Indian Standards (BIS). The study underscores the urgent need for a sustainable approach to mitigate potential detrimental effects on groundwater ecology. The findings emphasizes the incorporation of organic materials such as green manure, farmyard manure, rice, and rice straw emerges as a scientifically supported sustainable approach for the study area. This paradigm shift not only addresses groundwater quality concerns but also aligns with broader environmental and health considerations. The study highlights the significance of adopting ecologically responsible agricultural practices to ensure a balanced coexistence between agricultural productivity and environmental well-being.

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Session 10-O23 - Biodiversity and sustainable tropical agriculture

Characterization agroforestry systems based on cocoa and oil palm on the outskirts of a forest concession in southern Cameroon

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Traditional production systems, agroforestry systems (SAFs) in southern Cameroon combine various types of trees of socio-economic interest which can contribute to the conservation of biodiversity. The objective of this work is to analyse the contribution of these agroforestry systems based on cocoa and oil palms in the sustainable development on the outskirts of a forest concession in southern Cameroon. The methodological approach adopted consisted of carrying out socio-demographic surveys with 66 SAF operators using survey forms. A sampling rate of 10% was applied in seven villages in the Commune of Djoum. These interviews were supplemented by floristic inventories carried out on 66 plots of 40 x 60 m for a total area of 15.84 ha. The data collected allowed us to calculate various diversity and ecological indices, woody biomass and carbon stock, to which various statistical tests and analyses of variance were applied. The floristic potential is made up of 8430 individuals divided into 179 species, 160 genera, 49 families, and classified into 3 woody groups, namely introduced, preserved and perennial species. The Shannon diversity index is 3.39 bits, supplemented by the Simpson indices (0.92) and the Piélou fairness (0.85). We obtain an average DBH of 16.25 cm and an average height of 6.44 m. Cocoa plantations store more carbon (148.02 tC/ha) than palm groves (14.04 tC/ha). Three architectural profiles (simple, medium, complex) characterize the SAFs of this area, and the heat map shows 2 groups of interactions between structural factors and 4 groups of SAFs. Gradients of diversity, density and complexity vary with proximity to the forest concession. These results could be considered as effective and quantifiable tools for the certification of numerous cash crops such as cocoa and oil palm, which will make it possible to promote this local knowledge scientifically and in the development of various programs and writings technical notes.

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Session 11-O1 - Biodiversity, biotic interactions and functioning

Hyperspectral sensing of functional traits in tropical mountain forests for the parameterization and validation of a biodiversity-informed land model

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Functioning of tropical mountain ecosystems is threatened by climate change. Functions which might become impacted are climate regulation, esp. changes in evapotranspiration, and carbon sequestration. This might be concomitant with changes in tree functional traits and biotic interactions. While functional traits of the tropical mountain rain (MRF) and dry (MDF) forests are hardly known especially in its area-wide distribution, knowledge about their future development in the context of climate change is even more deficient. Therefore, central aims of the program RESPECT working in the South Ecuadorian Andes are to (i) determine functional traits along altitudinal gradients and (ii) to develop a biodiversity-informed land surface model HUMBOL-TD (Hydroatmo Unified Model of Biotic interactions Organic Matter and Local Trait Diversity; Bendix et al. 2021) which can be operated with climate change scenarios. The presentation shows how traits are determined by proximate and remote hyperspectral sensing on leaf and forest level and will compare the results for MDF and MRF. On leaf level, hyperspectral models to calculate traits are derived from field spectrometry. On forest level, we used the DESIS (DLR Earth Sensing Imaging Spectrometer) instrument on the ISS. One reason of the retrievals is to provide data which can be used to validate the vegetation submodel of HUMBOL-TD. In addition, traits that play a role in the biodiversity-informed parameterization of the atmospheric submodel were collected. These are VIS and NIR leaf albedo and transmission, derived from field spectrometry. They play an important role in the partitioning of incident radiation and thus for ET and photosynthesis. The talk will discuss the extent to which these parameters differ between the a priori tree functional types of the study area.

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Session 11-O2 - Biodiversity, biotic interactions and functioning

Drivers of tree diversity in Andean forests: Comparing species richness, phylogenetic diversity and functional diversity

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The Andes are characterized by high levels of biodiversity, including many different tree species. Several factors can act as drivers of tree diversity in Andean forests. Different elevations provide distinct temperature niches, influencing which tree species can thrive at each elevation. Climate plays a significant role in shaping the distribution of tree species in Andean forests. Precipitation varies with elevation, creating diverse microclimates that support a wide array of plant species adapted to specific conditions. In addition, different soil types and changes in nutrient availability, often related to topography, influence which species of trees are most likely to colonize a particular area. In the presented project, we explore different measures of tree diversity comparing tree inventories from 15 permanent 1-ha forest plots at various elevations and climates in southern Ecuador.

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Session 11-O3 - Biodiversity, biotic interactions and functioning

Root sap flow measurements reveal different plant water uptake strategies in a seasonal tropical dry forest in southern Ecuador

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As a consequence of global climate change, the frequency and intensity of drought events affecting tropical forest ecosystems is expected to increase in the future. Tree species exhibit a variety of strategies to withstand periods of drought and water limitation such as leaf-shedding or stem succulence. However, little is known about the contribution of belowground plant organs to tree species drought adaptation to the environmentally harsh conditions in tropical dry forests. We measured root sap flow by using a recently developed technique based on the external heat ratio method to shed light on the seasonal variation of water uptake as a response to prevailing climatic and soil hydrological conditions. In-vivo measurements were conducted by externally mounted self-crafted miniature gauges to small-diameter roots (3-8mm in diameter) of different common tree species in the Laipuna seasonal tropical dry forest reserve in southern Ecuador in May 2022. After one year of monitoring, first results indicate that the deciduous tree species *Eriotheca ruizii* (Malvaceae) started water uptake at the beginning of the rainy season at the end of February 2023 shortly after leaf flushing and as soon as rain events became more frequent and soil moisture content had substantially increased. In contrast, stem-succulent *Armatocereus laetus* (Cactaceae) took advantage of even small amounts of rainfall in the transition period between dry and wet season starting in December 2022 and roots immediately took up high amounts of water. The findings of our study will contribute to the understanding of how different water uptake strategies enable tree species to perform in increasingly drier environments in future decades.

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Session 11-O4 - Biodiversity, biotic interactions and functioning

Abiotic and biotic filters shape seedling recruitment in a tropical dry forest

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Seedling recruitment is a crucial step for plant regeneration. Germination, seedling growth and survival are determined by several abiotic and biotic filters, such as water, light or litter. Species-specific functional traits, such as seed size, can shape species' responses to these filters. To understand the assembly of plant communities and the recolonization of disturbed habitats, it is essential to comprehend how plant functional traits shape seedling recruitment under different environmental conditions. In our study we asses, how abiotic and biotic filters shape seedling recruitment in a tropical dry forest in Southern Ecuador. Tropical dry forests are of special interest, as these highly specialized ecosystems only occur in small areas and are strongly affected by human activities. We conducted a one-year seed-sowing experiment with eight native semi-deciduous and deciduous tree species of different seed sizes and manipulated shade and litter depth. Experimental sites covered both natural forests and silvopastures disturbed by humans at two elevations (600 m and 1200 m asl). Preliminary results show that seedling establishment generally increased with seed size. Shade application increased seedling establishment, but decreased both seedling height and seedling weight. The manipulation of litter depth had no significant effect on seedling establishment or growth. Seedling height and -weight both were higher in silvopastures compared to natural forests. Our experiments contribute to a mechanistic understanding of the limiting factors of seedling recruitment in tropical dry forests. The findings of our study will help to make predictions of seedling recruitment under altered environmental conditions in response to human disturbance.

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Session 11-O5 - Biodiversity, biotic interactions and functioning

Do leaf traits of tree canopies shape herbivory in tropical montane rainforests?

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The interactions of plants and arthropod herbivores lead to a co-evolutionary arms race forcing plants to evolve protection strategies by changing the structure and chemical composition of plant components attacked by the herbivores. These changes have consequences for processes controlled by the entire plant community. Thus, measuring plant- especially leaf traits is an important step towards understanding the dynamics of plant populations and communities. They can be measured using conventional lab-methods or recently developed spectral sensing techniques. We examined whether leaf traits of tree communities are related to herbivory and whether leaf traits characterized by spectral sensing provide similar relations to herbivory as lab-based leaf traits. We established nine 1 ha square plots evenly distributed over three different forest types in Ecuadorian tropical montane rainforests where we estimated herbivory as the leaf area loss [cm^2] of 20 (+/- 5) leaves sampled from the canopies of 380 trees belonging to 51 tree species (8 +/- 1 trees/species) and several leaf traits using lab- and spectral sensing-based methods. For each methodological approach, we ran 100 linear mixed-effects models with all respective leaf traits as predictor and herbivory as response variables for data subsets containing one randomly selected tree of each species to estimate the range of the regression coefficients for each trait. Automated stepwise backward selections determined the frequency of each trait having a significant influence on herbivory. We found no consistent relations between leaf traits and herbivory for neither lab- nor spectral sensing-based traits. A nested variance component analysis demonstrated that the observed variability was mainly due to the variation between tree individuals of a species. Our results suggest that herbivory was not driven by leaf traits of trees but by environmental conditions or processes along the food web.

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Session 11-O6 - Biodiversity, biotic interactions and functioning

Environmental heterogeneity consistently increases diversity effects on ecosystem functioning in tropical mountains

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Experiments revealed a positive relationship between biodiversity and ecosystem functioning. However, we have limited understanding how the diversity components species richness and turnover, i.e. the diversity effect, influence the functioning of natural ecosystems. For this we use seven ecosystem functions across six ecosystems in two tropical mountain regions and introduce an analytical framework, combining a variant of the Price equation with the concept of β-diversity to quantify the diversity effect on ecosystem functioning in heterogeneous environments. We found a consistent increase in the diversity effect with environmental heterogeneity. While this heterogeneity effect was solely mediated by differences in species richness, species richness and turnover contributed similarly to the diversity effect. Our study shows that the framework can quantify the contributions of species richness and turnover to ecosystem functioning in heterogeneous environments and that environmental heterogeneity is essential to sustain biodiversity-ecosystem functioning relationships in natural ecosystems.

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Session 11-O7 - Biodiversity, biotic interactions and functioning

Fear or food? Prey availability is more important than predation risk in determining aerial insectivorous bat responses across a disturbed tropical forest landscape

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Habitat disturbance affects, directly or indirectly, the predation risk and food available to animals. One group of animals that may be negatively affected by habitat disturbance are forest-dependent aerial insectivorous bats, especially in the Amazon rainforest, where forest clearance and degradation continue unabated. However, we still have a limited understanding of the mechanisms underlying the negative effect of habitat disturbance on forest aerial insectivorous bats. Evaluating the changes in prey-predator interaction in disturbed habitats can provide helpful information for protected area management. We evaluated how predation risk, insect biomass, and moonlight intensity affect bat activity levels in continuous primary and disturbed forests (fragments and secondary forest) at the Biological Dynamics of Forest Fragments Project, Central Amazon, Brazil. We sampled bats using autonomous ultrasound recorders in continuous forest, forest fragments, and secondary forest. To assess insect biomass, we placed malaise traps close to the recorders and conducted a playback experiment consisting of owl calls to assess the influence of increased predation risk by natural predators on bat activity. We found that continuous forest had higher bat activity than fragments and secondary forest, probably reflecting higher insect biomass in continuous primary forest compared to secondary forest. Insect biomass was the best predictor of activity in disturbed habitats compared to predation risk and moonlight. Predation risk did not modulate bat activity in any habitat type. The effect of moonlight intensity on activity was only apparent in three species in different habitats. Our results suggest that these responses were related to the abundance of specific insect orders and not predation risk. Overall, our findings emphasize the importance of evaluating the effects of prey-predator interactions on the distribution of bats in disturbed tropical forests, as habitat disturbance can negatively affect lower trophic levels and consequently influence not only bats but other insect consumers.

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Session 11-O8 - Biodiversity, biotic interactions and functioning

Understanding the functional dynamics of Plant-Avian Frugivory in novel urban ecosystem of Delhi

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Plant-frugivore interactions constitutes essential ecological processes which significantly play an important role in maintaining ecosystem dynamics. Birds are very important frugivores and very little is known about the plant-avian interaction matrix in the urban ecosystems of India. The present study tries to comprehend novel avian feeding interactions with the exotic and native fruit-bearing tree species within urban green spaces. An attempt has been made to address the relationship between urban ecosystem functionality and novel adaptations if any, in frugivore-plant networks that drives the seed dispersal process. This investigation aims to elucidate the impact of distinct fruit traits-specifically encompassing attributes such as fruit diameter, type, and colour-on the discernible shifts in the fruit handling behaviour exhibited by frugivorous avian species. A total of thirty avian frugivore species were recorded feeding on twenty-two focal tree species using phyto-centric approach. It was observed that planted native *Ficus* (fig) trees in Delhi urban areas supported diverse avian frugivores, thereby providing evident proof of being an important food resource for avian disperser communities. The study provides empirical evidence of increasing adaptability among avian frugivores in effectively managing fruits within the rapidly evolving dynamics of the urban novel ecosystems.

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Session 11-O10 - Biodiversity, biotic interactions and functioning

Movement behaviour of a cooperatively breeding bird scales to the level of habitat degradation in Afrotropical cloud forests

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Animal movement is essential for survival and may be influenced by habitat degradation, resource availability and social dynamics. The link between habitat degradation, movement and sociality (group sizes) has been explored extensively in mammals, but little research has been conducted on cooperatively breeding birds in degraded tropical environments. We studied the impact of forest degradation on the movement behaviour of the placid greenbul *Phyllastrephus placidus*, a cooperative breeder in Kenya's Taita Hills cloud forest fragments. Radio-tracking of dominant breeding pairs in forest fragments with varying degradation levels revealed that placid greenbuls covered greater distances and occupied larger home ranges in the heavily degraded forest than in the near-natural forest. Our data suggest that this is because of decreased canopy cover in the heavily degraded forest because travel distances and home ranges were also inversely related to canopy cover within territories. Furthermore, greenbuls were found in areas with a higher average tree height than the average tree height within the territory during tracking. Results also suggest placid greenbuls' group sizes do not determine their movement behaviour, but they rather seem to limit their group sizes to a certain threshold. The study underscores the need to develop strategies preventing additional forest degradation to ensure the survival of animals adapted to moist tropical forests.

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Session 11-O11 - Biodiversity, biotic interactions and functioning

The queens of the Congo rainforest and their loyal subjects: *Dorylus* driver ants and the specialized birds that follow them

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Though their ecological importance is enormous, driver ants (*Dorylus sp.*) are among the most poorly understood ecosystem engineers on Earth. In Central Africa, *Dorylus* colonies can contain more than ten million individuals and swarm over every patch of the forest floor every 8 weeks. *Dorylus* are considered the most important arthropod predators in the tropics, as they systematically consume and create a massive front of fleeing arthropods that presents a bounty for primates, pangolins, and specialized ant-following birds. We know little about Afrotropical ant-following birds aside from that they are arguably the rainforest guild most vulnerable to forest degradation. In our seven-year study in mainland Equatorial Guinea (the future site of a new national park), capture rates of two main ant-following species in primary forest were more than twice as high as in selectively logged forest. 360-degree (VR) GoPro cameras revealed that at least five ant-following bird species regularly check driver ant nests for activity. Further, 10 bird species responded to recorded vocalizations of specialized ant-following species—suggesting a complex and interdependent relationship among *Dorylus* ants and birds. Finally, we found that the home ranges of specialized ant-followers (in the dozens of hectares) are roughly five times larger than those of less specialized insectivores—probably to follow more nomadic ant colonies. Afrotropical ant-following birds are not hunted, have large home ranges and are clearly reliant on *Dorylus* ants, which in turn depend on in-tact forest, making both groups honest sentinels for rainforest degradation.

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Session 11-O12 - Biodiversity, biotic interactions and functioning

Animal carrion decomposition and decomposers are influenced by canopy cover, topography, ants and tree species richness in a subtropical forest biodiversity experiment

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In forest ecosystems, tree diversity often positively influences the diversity of higher trophic levels and their ecosystem functions. Tree diversity may thus also promote communities of insect decomposers, and accelerate the decomposition of animal carrion. However, tree diversity effects on animal decomposition and decomposers have rarely been tested, and may be controlled by other (non-)trophic factors. In this study, we examined the interplay of forest canopy cover, slope steepness, ant presence, and tree species richness in relation to animal carrion decomposition and the diversity of insect decomposers. For this, we (1) placed 855 mice and monitored their decomposition for up to seven days, and (2) captured insect carrion fauna with mouse-baited traps across 96 plots in a subtropical forest biodiversity experiment in southeast China. Initial findings suggest that animal carrion decomposition was accelerated under open forest canopy and alongside steep slopes. Ants protected the carrion against other insects, and slowed down rates of decomposition. While tree species richness increased the diversity of insect decomposers, its positive influence on carrion decomposition was evident only in forests with shallow slopes. This study promises to improve our understanding of the nuanced impact of environmental factors and tree diversity on animal carrion decomposition and decomposers, underscoring the context-dependency inherent in biodiversity-ecosystem functioning relationships in tropical forests.

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Session 11-O13 - Biodiversity, biotic interactions and functioning

Plant-animal interactions in restoration ecology: Insect pollinators and other floral visitors in the semi-arid savannas of the Ferlo region in Senegal

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Most research in restoration ecology has focused on plants and the restoration of vegetation. However, animals play crucial roles in many aspects of ecosystem functioning and in the provision of ecosystem services to humans, not least through their interactions with plants. Through herbivory, seed predation and dispersal, pollination and other interactions, animals have a major impact on ecosystem dynamics. However, the roles of these interactions in ecosystem restoration are little studied. Here, we focus on plant interactions with pollinators and other floral visitors. In addition to pollination, flower-visiting insects provide many other ecosystem services, such as regulating pest populations, because nectar, pollen and other floral rewards are essential resources for many insects that are parasitoids or predators of other insects. We are studying the interactions between flowers and their insect visitors in the Ferlo region, a semi-arid savanna in northern Senegal, focusing on two tree species (*Balanites aegyptiaca* and *Vachellia tortilis* subsp. *raddiana*). Like all other tree species in this ecosystem, the two are dependent on animal pollinators for reproduction. Among our preliminary results, a key finding is the extraordinary diversity of insects visiting the flowers, compared to the low species richness of the trees. For example, we have recorded a total of at least 300 morpho-species of insects visiting the flowers of *B. aegyptiaca* and *V. tortilis*. This rich entomofauna offers abundant material for deciphering the roles these insects play in ecosystem functioning. We show how studying the diversity of life histories of these insects, and the interaction networks in which they are entangled, will help us devise strategies for harnessing these interactions to maintain and restore healthy ecosystems.

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Session 11-O14 - Biodiversity, biotic interactions and functioning

Functional and phylogenetic correlates of invasion risk across tropical biomes

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Invasion risk is increasing globally, affecting several tropical biomes. To become invasive, a species must first be transported, then introduced in a new environment, establish and spread. Transport and introduction are often driven by human demand, as invasive alien species' (IAS) geographic patterns follow human trade and transport. However, invasion success also depends on ecosystem, alien and native species characteristics. We tested Elton's diversity–invasibility and Darwin's naturalization hypotheses using functional and phylogenetic diversity differences for terrestrial mustins across all tropical biomes.

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Session 11-O15 - Biodiversity, biotic interactions and functioning

When lizards shift to a plant-based lifestyle: The macroevolution of mutualistic lizard-plant-interactions

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Reptiles such as lizards are well-known seed dispersers of plants. More recently, records also started to accumulate on lizards visiting flowers and serving as pollinators of those plants. Some lizard species can even provide both mutualistic functions, pollination and seed dispersal, thus acting as 'double mutualists', suggesting a potential link between the evolution of pollination and seed dispersal. In this study we investigated the macroevolution of mutualistic plant interactions in lizards (Lacertilia) by applying comparative methods to a phylogeny comprising 2,838 Lacertilia species. Our results revealed that both flower visitation (potential pollination; recorded in 64 species [2.3% of total] in 9 families) and seed dispersal (recorded in 382 species [13.5% of total] in 26 families) have evolved repeatedly in Lacertilia. Seed dispersal activity appears to predate flower visitation and the evolution of both behaviours, seed dispersal activity and flower visitation, was correlated across Lacertilia. Moreover, evolutionary transition rates to flower visitation behaviour in seed dispersing lizard lineages were more than 10x higher compared to non-seed dispersing lineages, suggesting that seed dispersal behaviour might have facilitated the evolution of flower visitation and thus the emergence of double mutualisms. Finally, our analyses hinted at higher diversification rates in lineages with flower visitation or seed dispersal activity than in lineages lacking these behaviours. Overall, our study is the first to address the macroevolution of mutualistic lizard-plant-interactions and illustrates the repeated innovation of and evolutionary link between those two mutualism types, which may persist in Lacertilia over macroevolutionary timescales only under specific ecological (e.g. island) conditions.

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Session 12-O1 - The place of ethnoecology in tropical ecology

Enhancing collaboration among scientists and traditional peoples for biodiversity research: Identifying and addressing diverse interests in biodiversity monitoring programs

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Monitoring the environment helps us understand how we humans interact with earth's systems. Science is implemented primarily by professional scientists, and they conduct most environmental monitoring. Indigenous, traditional and other local peoples who live in natural areas spend their entire lives studying natural history relevant to their livelihoods. They have a deep and detailed knowledge of the biodiversity and geography on their lands. Combining such deep local knowledge with standardized monitoring protocols is a powerful tool for generating knowledge useful to local, national and international stakeholders. Many professional scientists and environmental managers, however, believe local peoples cannot adhere to the standardized scientific protocols necessary for reliable, intercomparable monitoring data. When projects are improperly implemented, such adherence can in fact be challenging. But many publications attest to the high quality of data when local people are empowered to follow standard scientific methodologies and rigorous protocols. Such empowerment goes beyond training and requires understanding of the multiple and often conflicting demands that stakeholders in monitoring projects in remote natural areas—local families, community associations, supporting NGOs, government agencies, and the researchers themselves—place on monitoring initiatives. There are many stages in the scientific process where problems that affect data quality and project achievement can occur. Based on our personal experience and the literature, we developed a model of how such projects are structured, identify best practices for identifying and resolving problem areas, and illustrate this with projects designed to understand the relationship among biodiversity, frugivory, and carbon cycling.

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Session 12-O3 - The place of ethnoecology in tropical ecology

Tell me what you do in the park and I'll tell you who you are: Exploring human-nature interaction in the Obô Natural Park (São Tomé Tropical Island)

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Protected areas (PAs) are important tools for protecting biodiversity and contributing to human well-being. By providing opportunities for livelihood generation, recreation, research and many other cultural practices, PAs generate tangible and intangible value for society. Our interest in nature's contributions to people has increased, fostering the integration of social and conservation sciences. However, although much research applied social science techniques to study how PAs are contributing to people, our understanding about the relationship between what people do in PAs and contributions they perceive from PAs is still overlooked. In our study, we conducted 210 semistructured interviews with local residents living in 13 local communities situated in the surrounding of the Obô Natural Park in São Tomé. This tropical island is located in Western Africa, hosting unique biodiversity and high levels of endemism. Natural habitats have been increasingly modified by human interventions for centuries and today only 55% of the island is covered by forest. Deforestation, logging, encroachment, overexploitation of natural resources, among others, are threatening island ecosystems. To quantify people-park interaction and contributions perceived from PA we calculated basic statistics, while to explore relationships between these variables we combined multivariate and clustering techniques. The main contribution perceived from the park is "natural resources" (30.3%), although many intangible benefits have been also recognized. Five clusters of people interacting with the park were uncovered, reflecting combinations of: who people are (e.g. man and farmer), what people do (e.g. collecting medicinal plants) and contributions they perceive (e.g. health provisioning). Our study not only reveals local perceptions, but further explores multiple associations between perceptions and behaviours, an essential prerequisite to face on biodiversity loss in fast-changing times.

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Session 12-O4 - The place of ethnoecology in tropical ecology

Which species do children prefer to protect and why? Exploring wildlife knowledge and conservation preferences in two African tropical sites

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Conservation initiatives relying on public support must be designed with a clear understanding of the species that people know about and are willing to protect. It is, therefore, crucial to assess people's perceptions and knowledge of wildlife, especially in areas with high rates of threatened species. We used game-based surveys in two African tropical locations, São Tomé Island (São Tomé and Príncipe) and the Morogoro and Pwani regions (Tanzania), to assess children's ability to identify animal species, their stated conservation preferences, and factors influencing wildlife knowledge and willingness to protect. We also explored how wildlife knowledge and conservation preferences changed after outdoor environmental education activities, compared to baseline data. Our findings reveal that, on the island of São Tomé, children who were poor, male, or from rural schools were more likely to identify species correctly. Urban children in São Tomé were less successful than rural children in the identification of endemic species. Conservation preferences were not related to species identification but were instead justified by subjective species-specific traits, such as attractiveness or profitability. Despite the low identification rates for endemic (10% correct identifications) and threatened birds (2%), children were keen on preserving endemic species, suggesting these could become effective flagships for the unique biodiversity of the island. We discuss the efficacy of our methodological

approach, address existing knowledge gaps, and compare the results with the preliminary findings in the Tanzanian location. Finally, we provide recommendations to guide future conservation actions tailored to each of the study areas.

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Session 12-O5 - The place of ethnoecology in tropical ecology

Confronting forest dweller local ecological knowledge and eDNA measurements of biodiversity

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Biological sciences provide the foundations for understanding species distribution and identifying the most vulnerable species and ecosystems. However, there remains a gap between our biological knowledge and the success of conservation efforts. This is partly because conservation is as much about people as it is about species and ecosystems. While social science offers insights into the instrumental value of nature for humans, biology demonstrates the limits to the sustainable use of natural resources. Nature ecological and ethnoecological knowledge are both particularly relevant when the use of natural resources is conflictual between different beneficiaries. In this study, we conducted a comparative analysis between scientific knowledge of biodiversity distribution and the biodiversity local ecological knowledge (LEK) of the Wayãpi Amerindians. We conducted aquatic eDNA-based inventories and gathered biodiversity LEK along the Oyapock river in French Guiana. This region is home to diverse ethnic groups that vary significantly in their utilization of natural resources and their relationship with nature. A strong congruence between scientific measures of biodiversity and LEK suggests that LEK reflects both species and resource distributions, while a mismatch indicates that both perspectives represent distinct yet complementary aspects of biodiversity. Contrary to recent literature, our study revealed significant disparities between Wayãpi perceptions of biodiversity distribution and eDNA-based species distributions. This comparative analysis illustrates that biodiversity LEK can encompass various types of information, including perceived species distribution but also resource distribution influenced by foraging strategies and practises. Conciliating this information with nature's needs is crucial for developing more socially equitable conservation strategies tailored to diverse social, economic, and cultural contexts.

Merian Award Applicant

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Session 12-O7 - The place of ethnoecology in tropical ecology

Local ecological knowledge enhances our understanding of Afrotropical frugivory networks

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Afrotropical forests are undergoing massive change caused by defaunation i.e. the human induced decline of animal species, because most animals are frugivorous species that take part in interactions networks. Frugivores' depletion and their functional disappearance is expected to cascade on tree dispersal and forest structure via interaction networks, as 50 to 80 percent of tree species depend on frugivores for their dispersal. However, frugivory networks remain largely unknown, especially in Afrotropical areas, which considerably limits our ability to predict changes in forests dynamics and structures using networks analysis. While the academic workforce may be inadequate to fill this knowledge gap before it is too late, local ecological knowledge appears as a valuable source of ecological information and could significantly contribute to our understanding of such crucial interactions for tropical forests. To investigate potential synergies between academic and local ecological knowledge, we compiled frugivory interactions linking 286 trees to 100 frugivores species from the academic literature and from local ecological knowledge coming from interviews of Gabonese forest-dependent people. We showed that local ecological knowledge on frugivory interactions was substantial, with as many ecological interactions known by informants than by current academic studies, and original, with 39% of these interactions unknown from science. Further, we evidenced that combining academic and local ecological knowledge affects the functional relationship linking frugivore body mass to seed size, as well as the network structure. Our results highlight the benefits of bridging knowledge between academics and local communities for a better understanding of the functioning and response to perturbation of Afrotropical forests.

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Session 13-O1 - Wildmeat: Opportunities and risks

Towards the conservation and sustainable use of Yellow-Spotted River Turtle (*Podocnemis unifilis*) in the Rupununi region, Guyana

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The yellow-spotted river turtle (*Podocnemis unifilis*) is a species native to the Amazon, Orinoco, and Essequibo River basins, holding significant importance for local communities in terms of food, subsistence income, and cultural heritage. This study, conducted from 2020 to 2023 in Rupununi, Guyana, provided valuable data as part of a community-driven conservation program. We found a nest density of 6.68 nests per beach (~14.2 nests per hectare). Nesting locations are predominantly within 1-20 meters from the river, near vegetation, and on fine sand, with temperatures ranging mainly between 27-29ºC. All nests in potentially flooded sites were moved to a community hatchery, achieving an 83% hatching success rate. Data revealed that 12.0% of households practiced egg harvesting, with an average of 41.87 eggs per household per year. Additionally, 22.4% of households captured an average of 3.5 turtles per year. The study unveiled that households with more children tend to consume more turtle eggs and meat, and those engaging in frequent turtle hunting exhibit higher levels of turtle meat consumption. Turtle capture is primarily motivated by consumption, cultural events, local trade, pets, and shell use. Our results revealed that the estimated annual consumption of 921 eggs at the community level per year is 2.36 times lower than the estimated 2,178 eggs that would be flooded in average per year. By salvaging flood-threatened nests, we can meet local egg demand and save 1,356 eggs for *ex-situ* hatchling. In average, 180 turtle individuals are captured per year and to cover this harvest, we recommend preserving a minimum of 204 rescued eggs for hatchling and extensive farming, reducing adult turtles harvest from the wild. Our study suggests that monitoring of nests coupled with a rescue program during the floods can help in shift turtle harvesting from the wild to ex-situ hatchling and extensive turtle farming.

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Session 13-O2 - Wildmeat: Opportunities and risks

Reducing wildmeat sales and promoting local food security: Lessons learnt from a behavior change campaign in Yangambi, Democratic Republic of Congo

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Marketing strategies to promote behavioural change are increasingly used to reduce the unsustainable use of wildmeat. One of the mayor keys for success of behavior change campaigns lies in the choice of the channel for communication and the messaging. In this research, we present a behavioural change campaign implemented in Yangambi, Democratic Republic of Congo framed around an integrated conservation and development objective: improve food security in rural communities, reduce the unsustainable use of wildlife for food and promote locally grown pork and chicken. The campaign was co-developed based on the research team's knowledge of the hunting system in the study area and the participation of key local stakeholders (village leaders, hunters and their families). It used participatory community theatre, various printed materials, radio and face-to-face interactions. We evaluated the efficiency and clarity of messaging for channels used through semi-structured interviews with hunters, households and wildlife traders. We found that participatory community theatre resulted in increased clarity and understanding among hunters and households. Moreover, community theatre promoted word-of-mouth communication that reached an audience well beyond the location where the theatre was held. Messages that were framed positively and used amusing channels of communication triggered positive receptiveness by our audience. Using local languages, avoiding written materials for illiterate audiences, and using repetitive means of communication may be among the strategies that could help increase the clarity of communication messages, particularly for sensitive topics such as this one. Our work calls for more lessons learnt from the ground about the most appropriate communication channels and messages, keeping in mind the social and cultural background of the audience, and ensuring that messages trigger emotions that lead to the desired changes.

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Session 13-O3 - Wildmeat: Opportunities and risks

Uneven transmission of traditional knowledge and skills in a changing wildmeat system: Yangambi, Democratic Republic of Congo

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Indigenous communities typically hold diverse traditional ecological knowledge (TEK) of their social-ecological system. Ways of knowing often reflect the different activities traditionally undertaken by men and women. Knowledge can be lost as culturally significant environments degrade or species become extirpated. Lack of opportunity to develop traditional knowledge and skills can diminish feelings of place and identity, and thus capacity for local environmental stewardship. The Yangambi region, Democratic Republic of Congo is a hunting territory of the Turumbu ethnic group. We used questionnaires to explore how levels of wildmeat knowledge and skillmay have changed over time among the Turumbu. The responses showed lower levels of self-reported skill among women who started to participate in the last 10-15 years. This pattern partly reflects the period of 'apprenticeship' but may also suggest diminished learning opportunity in recent years. Skills in cooking, smoking, and selling wildmeat persisted at a higher level than skills in curing disease and gathering wild produce. There was a much more marked pattern for men, with diminishing levels of wildmeat skill reported for around 35-40 years, and even earlier for knowledge of traditional medicine and wildmeat taboos. Questions about mentoring suggested that women have maintained knowledge pathways between mother and daughter,

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Session 13-O4 - Wildmeat: Opportunities and risks

Monitoring frog meat harvesting and population estimation as a key step to sustainable wildlife utilisation in Ghana

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In many parts of the world, demand for frog meat is on the rise, yet the few available studies on frog meat focus mainly on trade dynamics and volumes. Few studies have attempted to establish the linkages between socio-economic factors and frog meat demand. Furthermore, in West Africa where frog exploitation is widely reported, there have not been any attempts to study the impacts exploitation is having on hunted species, hence, there is no information on the sustainability of the practice. Using a combination of citizen science, semi-structured questionnaires, and visual encounter surveys to monitor harvested species within three sites (two collection sites and one control site), we aimed to: assess the socio-economic drivers influencing the demand for frog meat in northern Ghana; and estimate the relative abundance of harvested species within collection sites as a predictor of their long-term survival. We established that frog meat is an important protein in the diet of the Builsa tribe found in the Upper East Region of Ghana. Many frog consumers, 82% (N = 216) earn less than $150/month. We also documented for the first time, the consumption of toads in Ghana by the Badomsa community in Builsa South District. Within this semi-arid area of Ghana, the frog species *Hoplobatrachus occipitalis*, *Pyxicephalus edulis*, and *Ptychadena trinodis* are heavily exploited. The abundance of *H. occipitalis,* the most harvested species, was highest at the control site. There was a significant difference (H (2) = 9.9988, p-value = 0.006742) in abundance between the three study sites. By documenting these disparities in abundance, we have provided the first evidence of the potential impacts of excessive collection of frogs for consumption on species population in West Africa. This calls for long-term monitoring protocols to initiate the first steps towards the establishment of harvest regulations within the subregion.

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Session 13-O5 - Wildmeat: Opportunities and risks

Is place at the foundation of Indigenous Stewardship for wildlife: Case studies from Guyana and DRC

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Numerous examples across the world attest that the old conservation approach often ignored historical injustices and perpetuated colonial values and beliefs by imposing a conservation culture and practice over lands without consideration for the people that were part of that environment. The realization that such command-and-control approaches lead to severe limitations on achieving desired conservation outcomes paved the way for more integrated forms of conservation – including various forms of co-management of landscapes and resources between government agencies, conservation NGOs and communities. Even though practitioners now fully recognize that including communities in the management of natural resources yields improved conservation outcomes, in practice, several community-led conservation efforts have also proved to fail. To understand such failures, many studies derived by Ostrom's work, have brought to light the importance of governance structures of commonly owned resources in determining community led conservation outcomes. These studies have stressed the need for national regulations to recognize community tenure rights over land and resources, as a determinant of agency in territorial management and conservation. More recently, literature on Socio-ecological systems (SES) suggested that sense of place and care were at foundation of local stewardship over natural resources from a cognitive-emotional perspective. Here we introduce a conceptual framework which suggests that both agency and care constitute the necessary conditions for wildlife stewardship in community led conservation efforts. The application of this conceptual framework is demonstrated through two case studies in Guyana and the Democratic Republic of the Congo (DRC), examining the foundations of wildlife stewardship among the Wapichan people in the South Rupununi and the Turumbo People in the Yangambi Biosphere Reserve respectively. This study highlights that successful wildlife conservation initiatives should view wildlife management as an integral part of the wider territorial management, where the notion of "territory" is understood as a multi-dimensional biocultural landscape.

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Session 13-O6 - Wildmeat: Opportunities and risks

Alternative livelihoods to reduce reliance on wild meat in the Yangambi landscape, DRC

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Bushmeat consumption in Central Africa is closely linked to food security, health, livelihoods and species conservation. Hunting provides about 30 to 80% of animal protein in rural households in Central Africa. Bushmeat is not only a protein source but also a source of income for hunters and bushmeat sellers. The growing demand from urban areas for bushmeat is the main drivers of decreasing or depletion of wildlife, with negative effects on both ecosystems and livelihoods. This study shares lessons learned from the development and implementation of alternatives to hunting and bushmeat commercial trade and reducing the reliance on wildlife in the Yangambi landscape (DRC). Alternative activities were carried out by 41 hunters and 5 bushmeat sellers since 2020. These activities consist of rice and African pistachio growing, the breeding of pigs and egg-laying hens. Activities of rice and African pistachio growing in Yangambi as alternative to hunting and bushmeat trade are not profitable as the cost production is very high than benefit. People do not have enough capacity to follow up all necessary steps (sewing, hoeing and harvest) when the field becomes large than half of a ha. In local culture, the owner of the farm, has the moral obligation to give a small quantity to people who helped in harvesting even if they were paid. Farmers consume important quantity (subsistence agriculture) and they sell on local market where the price is low as roads are non-existent. On the other hand, the pigs and the egg-laying hens breeding is one of the alternative activities to hunting and bushmeat trade in Yangambi landscape. The zone presents opportunities to breed pigs and the egg laying hens as fodder is available (maize, soya bean, bran of rice, etc.). Maintaining the breeding of egg-laying hens requires a lot of effort in preparing the hens' ration (ration well balanced in term of protein and energy sources, several veterinary products and attention to the chickens' behaviour).

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Session 13-O7 - Wildmeat: Opportunities and risks

Are tropical countries prepared to guaranty food safety in wild meat use: A comparative analysis of legal frameworks across different countries

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Wildmeat plays a key role as a primary food source for numerous Indigenous Peoples as well as local communities globally, contributing significantly to local livelihoods and cultural identity. After the Covid-19 pandemic, some national legal frameworks moved towards stricter regulations on wildmeat use, including general bans on wildmeat consumption. However, general bans ignore the relevance of wildlife for local livelihoods and may increase food insecurity and poverty among rural communities. Moreover, insights from various studies after Covid and experiences from former outbreaks have cautioned against the potential pitfalls of broad prohibitions as such measures may also inadvertently elevate the risk of spillovers by driving the trade underground. A different approach to prevent future outbreaks without jeopardizing right to food should instead build on participatory law reform processes that aim at filling existing gaps. Indeed, regulatory frameworks in tropical countries frequently lack provisions addressing food safety and animal health of wild animals intended for human consumption, unlike the specific regulations governing food systems based on domestic animals. In this study, we analysed and compared the relevant regulatory framework on wildmeat use in several countries across Africa and South America to reflect on existing legal gaps along the wild-meat value chain (from wildlife offtake to consumption) and effective measures aiming at supporting right to food through a sustainable wildlife use while mitigating the risks of zoonotic outbreaks. In this regard this study highlights how a One Health approach could be incorporated in national laws applicable to wildlife management. We call for frameworks differentiating subsistence uses as well as small-scale trade from large-scale trade, recognizing the importance of safe wildmeat to local livelihoods.

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Using Local knowledge and camera traps to assess and monitor hunting systems in the Democratic Republic of Congo

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Assessment and monitoring of hunting systems are generally generated on the basis of field surveys integrating both the use of sampling tools such as camera traps (CT) coupled with local ecological knowledge (LEK). Baseline population data are fundamental to the development of wildlife management plans. However, this method can be costly and ineffective with rare species or in wildlife-depleted areas. An alternative is to complement baseline wildlife population data with Local Ecological Knowledge (LEK)-based methods. We used LEK and CT surveys in terms of their ability to assess the status of terrestrial mammal species (richness, abundance, distribution) and monitor hunting systems in the Yangambi landscape in the Democratic Republic of Congo. This region is heavily hunted and wildlife population densities are low. Species not captured by CT included naturally rare and endangered species that were instead recorded by interviewed hunters. LEK and CT abundance metrics were positively related for all species. For all medium- and large-sized species, the number of positive sites from LEK outnumbered the number of positive sites from the CT survey, indicating that hunters detected species over larger areas. Overall, the two methods LEK and CT can be used interchangeably to provide reliable information on relative abundance. Nevertheless, the LEK method appears as a more cost-effective alternative to camera trapping, particularly for hunted and depleted tropical forests.

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Session 13-O9 - Wildmeat: Opportunities and risks

The legal game meat value chain in Zambia: Lessons learned for supporting the socio-economic and sustainability potential of wild meat economies

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Recognising the ecological, economic, criminality and public health challenges of wild meat consumption and trade, the Zambian government has sought to strengthen and support the legal wild meat value chain. We analyse the evolution and structure of the legal wild meat value chain in Zambia, along with the potential and challenges this chain faces in supporting equitable and sustainable livelihoods and consumption. The article describes the legal framework enabling the wild meat sector, maps the structure of the value chain, identifies the handling and processing practices at key levels of the chain, discusses the scale and the evolution of the sector through estimates of the number of stakeholders involved and the level of wildmeat supply and demand, and discusses its competitivity vis à vis the illegal trade. Next, we identify and analyse key challenges and opportunities facing the sector. Specifically, we find that realising the legal wild meat sector's full potential for supporting sustainable and equitable consumption requires overcoming barriers linked to: production and supply; regulatory clarity; and the inclusion of rural communities. Informed by a political ecology approach, we argue that Zambia's wild meat sector has made important strides in supporting sustainable consumption of wild meat but is still contending with thorny questions related to equitable access – particularly for often marginalised rural populations who depend on wild meat for food security. We conclude by reflecting on how lessons and experiences from Zambia's legal wild meat sector may help inform effective wild meat policies and interventions elsewhere. Our findings are based on semi-structured interviews with stakeholders in the legal wildmeat value chain in Zambia, site visits to wildmeat producers and retailers, and a workshop with key stakeholders in Zambia's wild meat value chain.

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Session 13-O13 - Wildmeat: Opportunities and risks

Assessing the impact of traditional hunting on mammal populations in the buffer zone of Salonga National Park, DRC

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Hunting for bushmeat consumption in African tropical forests poses a substantial threat to wild terrestrial mammal populations. Uncontrolled increases in hunting not only drive species to extinction, but also jeopardise the livelihoods of local people, who rely on wild meat and fish as their main sources of protein. Ensuring that communities can hunt animal populations sustainably, without resorting to blanket bans or legally protecting areas, should therefore be a key goal of community conservation projects. Using a combination of line-transect surveys and camera trap videos, we investigated mammal abundance, density, diversity and species-specific occurrences in hunted vs. non-hunted areas in the buffer zone of Salonga National Park, Democratic Republic of the Congo. Preliminary results suggest hunting substantially impacts these aspects of mammal species' populations, as well as mammal community composition. Our study provides insights into subsistence hunting in both our study area and the wider Congo Basin, and will inform conservation specialists working in the region. With detailed population and ethnographic data, we can develop novel management strategies that address both species conservation and the livelihood of the people in protected area buffer zones.

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Session 13-O14 - Wildmeat: Opportunities and risks

Wild foods are less important for those who farm for sedentarised Baka in Cameroon

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The sedentarisation of Pygmy communities in the Congo Basin has instigated profound transformations in their traditional lifestyles, particularly influencing dietary habits and food consumption. This study focuses on 10 sedentarised Baka Pygmy villages in southeastern Cameroon, employing 24-hour dietary recalls to assess changes in diet composition, diversity (Household Dietary Diversity Score, HDDS), and macro- and micro-nutrient intake per Adult Male Equivalent (AME) from 67 homes (28% of all households). Our findings reveal a notable shift, with 62% of consumed foods being agricultural produce, 29% manufactured or purchased products, and the remaining 9% sourced or hunted from the wild. The average HDDS per village was low (4.1±1.56) and mean total energy intake was 1,734.9±1,031.8 kcal/AME, primarily from cultivated foods. A negative correlation between the consumption of cultivated and wild foods was observed, with households relying more on cultivated foods exhibiting altered nutrient intake and consuming fewer wild foods. Significantly, a large proportion of households (78.7%, ranging from 22.4% to 97%) demonstrated nutrient consumption below the lower 95% uncertainty interval found in a Cameroonian nutrient supply study. Moreover, 78.3% fell below WHO/FAO recommendations for 21 distinct nutrients, even after adjusting for the Baka's shorter stature. This high prevalence of insufficient nutrient intake underscores the urgent need for targeted interventions to address nutritional deficiencies within this population. The observed shift towards cultivated foods and reduced dependence on wild sources highlights the importance of understanding and addressing changing dietary profiles in the context of sedentarisation.

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Session 13-O15 - Wildmeat: Opportunities and risks

The impact of local market access on wildmeat consumption in Gabon

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Many subsistence communities across central Africa are reliant on wild meat harvesting for their own protein needs and to generate income from sales. As human populations grow and wildlife areas reduce, keeping this traditional practice at sustainable levels has become more challenging for hunter families. The challenge is increasingly recognized as an issue for national policies, as electorates demand urban access to legal wild meat markets, but also secure and sustainable rural food security and livelihoods. Understanding how demand for wild meat is changing across space and time in the region in response to economic and cultural drivers is an important contribution to developing effective policies to reach the goal of ultimately managing a sustainable subsistence harvest, which also supports a legal urban supply. We looked at how consumption of wildmeat and alternative proteins in Gabon changed over time and space between 2002 and 2022. Taking advantage of the recently compiled WILDMEAT Use Database (https://www.wildmeat.org/database/) we obtained data on wild meat consumption in 94 settlements and ~6700 households, with nationwide coverage. Using the full database, we produce an overview of wild meat consumption in Gabon, in terms of consumed species diversity, functional traits and conservation status and the use of wild meat alternatives. We then relate trends in wild and alternative meat consumption to empirically measured socio-economic characteristics of consumer communities and their market access. We also describe temporal variation in patterns of wild and alternative meat consumption over the previous 20 years. Our results will enhance understanding of the socioeconomic drivers of bushmeat consumption in Gabon and may be used to inform the development of policy interventions related to food systems and wildlife conservation.

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Session 13-O16 - Wildmeat: Opportunities and risks

The impacts of subsistence hunting on local wildlife communities

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Hunting of wildlife for subsistence is a tradition and a necessity for forest dwelling people in Central Africa. However, iconic wildlife populations which are globally endangered and important to urban Gabonese people and to the international community, are impacted by subsistence hunting. This is a difficult challenge for socially equitable and sustainable wildlife management. Here, we look at the wildlife communities found local to different subsistence communities and under a gradient of trade opportunities for both the export of wildmeat and the import of alternative meats. We analyse changes in diversity, relative abundance and functional groups under different hunting pressures and discuss the relative importance of demand for consumption or trade of wildmeat in determining the impact on local wildlife.

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Session 13-O17 - Wildmeat: Opportunities and risks

Access, technology, and urbanization drive wild meat trade dynamics in Guyana, at the heart of the Guiana Shield

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The Guiana Shield is at the interface between the Amazon and Caribbean regions. While the region shares a similar wildlife species composition as the Amazon, the social and cultural composition is a blend of Caribbean and Amerindian cultures, with a majority of the population descending from Indian workers and African slaves whom the English colonial government forcibly relocated to work on cash crop fields. This unique history makes the country very distinct from the rest of South and Central America in terms of socio-cultural background. While wildmeat is known to be well appreciated in the Caribbean and Amerindian culinary cultures, there is very little understanding about the wildmeat sector in general and particularly the trade in wildmeat to urban areas. In this study, we provide a comprehensive overview of the wildmeat trade chain across Guyana (structure, flows, species etc) and analyse whether the level of access to hunting grounds, access to technological assets (motorized transportation, electricity, freezer etc.) and human population density and income in the different regions in Guyana influence the volumes and species of wildmeat traded. We found the most traded species include paca, white-lipped peccary, deer, tapir, and capybara. Commercial hunters living in urban areas or in mining towns and dedicated meat vendors, are the main actors involved in wildmeat trade. Access to freezers and motorized transportation is largely associated with higher volumes of wild meat traded monthly. Higher income levels lead to better transportation options and advanced preservation methods, which, in turn, facilitate a more significant volume of meat traded. Also, regions with higher urban population density are associated with higher demand for wild meat, setting off a chain reaction. Our projections based on available plans for infrastructure development and projected increase in wealth, indicate that in the next decade, if environmental public policies remain unchanged, the quantities of wild meat traded is likely to increase from approximately 1,000 tons (1.2 Kg/person/year) in 2023 to much higher numbers in 2033.

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Session 14-O2 - Tropical Forest management under climate change

Will there be any suitable habitat left for African great apes by 2050?

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Studies modelling the distribution of African great apes have so far focused on current conditions, whilst future scenarios remain unexplored. Using an ensemble forecasting approach, we predicted changes in taxon-specific distribution outside protected areas (PAs) only (assuming complete management effectiveness of PAs), and across the entire study region under global change scenarios. For that we compiled species occurrences from the A.P.E.S. Database and extracted relevant human-, climate- and habitat-related predictors representing current and future (2050) conditions from publicly available databases. Our ensemble models suggested that the current distribution of all taxa is strongly determined by all predictors, particularly by human-related variables. If no dispersion occurs, future scenarios agree that, on average, more than half of current species range outside PAs will be lost (50% best scenario, 61% worst scenario), with a more severe decline predicted if the entire study region is considered (85% best, 94% worst). However, if dispersal occurs, new suitable areas are likely to become mostly available outside PAs (52% best, 21% worst), with a slight increase expected across study regions (66% best, 24% worst). Range loss and gain are processes which operate at very different time scales, and hundreds to thousands of years can be expected for a great ape to disperse into new suitable areas given its limited dispersal capacity, migration lag and ecological constraints.

Given that African great ape populations will find most suitable areas outside PAs, and that the existing network of PAs is inadequate for ensuring their long-term conservation, we support the argument that effective conservation strategies require taxon-specific conservation planning that focuses on existing and proposed PAs, the creation and/or management of which can be informed by our habitat suitability models.

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Session 14-O3 - Tropical Forest management under climate change

Vulnerability of African tropical rainforest to projected climate change

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Climate is the main factor influencing tree species distribution. Across Africa global climate projections predict significant and rapid changes in the coming decades and these changes could affect the composition, structure and functioning of tropical African forests. Here, we used occurrence data from the RAINBIO database for native plants in Africa, combined with climatic layers, to infer the climatic tolerances of tropical forest tree and shrub species. This enabled us to assess the vulnerability of African tropical forests to changes in mean annual temperature, precipitation, and water deficit by 2080 under different climate scenarios. We formed communities (tree and shrub species coexisting in a pixel) using a multiple-resolution mask covering the tropical forests of the Congo Basin and West Africa. The climatic vulnerability was assessed using three parameters: the exposure (anomaly between current and future climate conditions), the safety margin (potential tolerance to changing climate conditions of species) and the risk (potential negative consequences of climate change on species). A total of 1009 communities were created, with resolutions ranging from 0.125 to 1°C, incorporating 3536 forest tree and shrub species. Under the RCP 4.5, a general warming trend is predicted in the tropical African forest, with over 73% of communities projected to be at risk from temperature increase by 2080. Around 11% of communities are projected to be at risk from increase in water deficit, while the risk from precipitation decrease is negligible. In terms of perspectives, we will include forest plot data in the vulnerability framework and investigate shifts in the floristic composition. This approach holds promise for understanding the complex dynamics of tropical African forests in the face of climate change and provide critical information for conservation and management strategies integrating future environmental challenges.

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Session 14-O4 - Tropical Forest management under climate change

Unravelling the effects of market-based conservation on the sociocultural capital of indigenous peoples in the Western Amazon

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Tropical forests are home to a unique biological diversity, are essential sinks of CO2, and provide ecosystem services that support the livelihoods of 1.6 billion people. However, they are under threat from the intense exploitation of natural resources. To counteract this, market-based instruments such as payments for ecosystem services (PES) were developed to support the traditional conservation of biological diversity based on protected areas. PES are economic incentives for local population to compensate them for preserving nature. As in other countries, research in Ecuador, one of the pioneers of PES and REDD+ programs, has focused on the analysis of their political consequences or financial and ecological effectiveness. Far less attention has been paid to the impact on local cultures, although this issue is crucial for the development of effective conservation tools without negative impacts. We argue that PES may revert deforestation being cost-effective and inclusive, but at the same time such programs may erode cultural practices and functionality of the participating communities. In our presentation we show results of a study conducted between 2020 and 2023 that aims to unravel the effects of market-based conservation on the sociocultural capital of the Indigenous groups (nacionalidades) in the Ecuadorian Amazon rainforest.

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Session 14-O5 - Tropical Forest management under climate change

Community perceptions of dry forest change in Tigray, Ethiopia: The role of local perspectives for governance and policy

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This paper discusses findings from focus group discussions conducted in three tabias (wards) in the Tigray district of Ethiopia, exploring the use of dry forest ecosystem services. The three tabias were selected because of their different elevation and related diversity in local environment (geographical and natural variation). Three villages, one from each tabia, were selected due to their closeness to the Desa'a forest and their accompanying dependence on the forest for economic activities as well as relatively closer relations to the forest in their daily lives more broadly. Separate focus group discussions were conducted with men and women to also investigate gendered perceptions and aspects of forest use. We present results on how communities perceive changes in the forest, its role in their lives, how they adapt to change, and how this might affect their daily lives and livelihoods. With this in mind, we discuss how local cultural, social, and economic perspectives might be included and contribute to improving dry forest governance and policies.

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Session 14-O7 - Tropical Forest management under climate change

The AmistOsa lifeboat: Building resilience to climate change through nature-based solutions in one of Central America´s last great forests

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The AmistOsa climate lifeboat connects the Costa Rica´s biological hotspot of Osa Peninsula's lowlands to the high elevation wilderness of the transboundary Amistad International Park. It represents one of the most important areas for actively restoring forest connectivity along elevational gradients across central America. This landscape underwent >50% of tree cover loss over the last 30 years due to rapid encroachment by sun coffee farms, cattle pastures, and industrial-scale pineapple and oil palm plantations. To re-establish connectivity in the AmistOsa lifeboat by 2030, Osa Conservation is leading its own programmatic efforts through its conservation hub located in the Osa Peninsula – the Osa Conservation Campus – on rebuilding functional habitat connectivity through NbS across 6,000 sq km of the landscape. Over the last 8 years, we have built a network of >400 cattle, silvopastoral, and agroforestry farms to restore forest within agricultural landscapes by planting over 380,000 trees and implementing innovative market-based solutions (e.g. the *Farms for Nature* initiative introduces a novel debt for biodiversity swap for small- and mid-sized farms); restored over 120 ha of mangrove forest across the Terraba-Sierpe National Wetland; built baselines for signals of ecosystem health through the largest altitudinal monitoring transect in Central America; increased forest canopy connectivity for dispersion of isolated arboreal wildlife populations; led rewilding initiatives to reintroduce key species such as white-lipped peccaries; and created a landscape-scale community of naturalists, citizen scientists and the next generation of conservationists engaged in local biodiversity monitoring initiatives (the *AmistOsa Nature Youth Club* and *Forest Protectors*). This 'climate lifeboat for nature' model in Costa Rica can be applied elsewhere regionally. Here, we also present insights into the landscapes of Central America which harbour the greatest potential to restore ecological connectivity across elevational gradients as climate shifts throughout the region.

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Session 14-O8 - Tropical Forest management under climate change

A 2300 year perspective on land-use change in the Andes biodiversity hotspot

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Humans have been in South America for more than 12,000 years and have been managing ecosystems using fire throughout. During this period climate conditions in South America have warmed and moisture availability has fluctuated. Consequently, human populations have needed to adapt their land-use practices in response to climatic change. Here we reconstruct past vegetation and land-use change from Laguna de los Condores (Peru) for the last c. 2300 years on the basis of micro-fossils recovered from a sedimentary core. We use pollen and phytoliths to reconstruct past vegetation (including crops) and new approaches to generate a complete understanding of the past fire regime from charcoal (severity, intensity, and frequency). Our data indicate a >2000-year history of humans' occupation of Condores; however, how humans used fire to manage that landscape changed. Between c. 2300 and 800 years ago frequent, severe (high biomass consuming), and relatively high temperature (500-600 oC) fires to open up the landscape for maize agriculture. After 800 years ago the climate got wetter, and the area was for ceremonial (funereal) practices. The wetter climate and the switch to funeral practices are concomitant with a shift to less frequent, lower biomass consuming and lower temperature fires. The multi-millennial record of past vegetation and land-use change at Laguna de los Condores demonstrates the longevity of human impacts on shaping the biodiverse ecosystems of the eastern Andean flank, and the synergistic link between humans, vegetation, and climate.

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Session 14-O9 - Tropical Forest management under climate change

14,000 years of climatic and anthropogenic change in the Afromontane forest of São Tomé Island, Gulf of Guinea

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History suggests that the native vegetation of São Tomé Island (Gulf of Guinea) has been heavily impacted since human arrival (1470 CE) due to monoculture economies and the introduction of mammals and plants. Its Afromontane Forest is rich in endemic plant species and has remained relatively unaffected by direct human impacts. We explored how environmental changes influenced this forest through the study of a sedimentary sequence from the volcanic crater of Lagoa Amélia (1340m a.s.l.), a palustrine system located at the boundary between submontane (800–1400 m a.s.l.) and mist forest (above 1400m a.s.l.). We used fossil pollen, non-pollen palynomorphs, sedimentology and charcoal to determine forest dynamics from the Late Pleistocene to the present. From 14,000 to 12,500 cal yr BP the forest was dominated by taxa from higher altitudes, adapted to cooler and drier climates. After 12,500 cal yr BP, a potential uphill migration was identified by an increase in taxa like the trees *Symphonia globulifera* and *Craterispermum cerinanthum*. From 11,200 cal yr BP through the rest of the Holocene taxa from lower altitudes became dominant, except at c. 8500 cal yr BP when rapid cooling led to forest opening. Charcoal showed that fires were frequent during the Late

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Pleistocene, becoming rare during the Holocene until anthropogenic fires started at c. 220 cal yr BP. Other recent anthropogenic impacts included the appearance of pollen of introduced plant species (e.g., *Cestrum*), and the increase in pollen of economically important species (*Elaeis guineensis*, *Zea mays*) and in fungal spores related to introduced herbivores. Our results challenge the idea that, in Gulf of Guinea islands, these forests were buffered against the impacts of climate change due to the regulating capacity of the ocean. Therefore, it might be highly vulnerable to ongoing climate changes, worsening the threat already assumed from more direct human impacts, such as land use intensification and introduced species.

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Session 14-O11 - Tropical Forest management under climate change

Modeling the current and future distribution of *Dracaena ombet* Kotschy & Peyr. under climate change in Ethiopia

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Dracaena ombet is one of the trees that can survive a long period of drought and thus is an important part of desert ecosystems. The species is classified as 'Endangered' in the IUCN Red List. The historical climate data WorldClim version 2 for 1970-2000, CMIP6 for the future climate projections with the (UKESM1-0—LL)[1] spatial resolution 30 seconds (~1 km^2) were used. In this study, we predicted the potential current and future geographic distribution under two Shared Socioeconomic Pathways, SSP2-4.5 and SSP5-8.5.The test AUC average values of the simulated training data set based on the dominant environmental variables were 0.989 and the predicted results revealed that the geographical distribution of the predicted model is in high agreement with the actual distribution. Regarding the future distribution of this species, the present modeling suggests that there will be range contraction and gain or shift of its partial geographical distributions. Under scenario SSP2-4.5, comparing the sum of future high and very high suitable areas (p>=0.6) with their current, there will be loss of 2.91% and gain of 12.78% in 2050s and 2070s respectively. While under the worst climate changes SSP5_8.5 there will be gain of 5.19% and 3.63% in 2050s and 2070s respectively. The fate of this species remained highly restricted in a narrow portion, especially in pockets and hotspots in northern Ethiopia. Therefore, protecting, and maintaining of *its* population in the existing sites and introducing it to a newly suitable areas are crucial for safeguarding the species from extinction.

Merian Award Applicant

[1] United Kingdom Earth system Model-1-0-LL

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Session 14-O12 - Tropical Forest management under climate change

Strict protection reduces environmental and economic sustainability of dry Afromontane forests in low-income countries

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Protection of tropical forests continues to be seen as an effective way to combat climate change and biodiversity loss. However, prohibiting the local communities from utilizing forest resources and demanding indefinite protection proves theoretically unsound and impractical. In this study, we attempt to address this challenge using data from a 2009-2021 experimental site and explore the effects of strict protection through fencing and diverse silvicultural treatments on the above-ground biomass growth rates. The experimental design consists of three blocks, each characterized by varying tree canopy cover: low, medium, and dense. Within two subplots, one fenced and the other open (unfenced) in each block, are plots randomly assigned to silvicultural treatments: pruning, thinning, the interaction of pruning and thinning, and a control group. We employed a difference-in-difference technique to estimate the effects of the silvicultural treatments and determine the optimal growing stock for the selected species under varied management. The results reveal that silvicultural treatments increase aboveground biomass growth in forests with medium canopy covers compared to dense and open forests. Different growth rates of aboveground biomass and heterogeneous silvicultural effects revealed in this study are expected to give insights into sustainable environmental and economic practices by identifying optimal stocks and recommending interventions conducive to the coexistence of conservation efforts and local community needs.

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Session 14-O13 - Tropical Forest management under climate change

Fuelwood or carbon: Spatio-temporal trade-offs between major forest ecosystem services in a dry Afromontane Forest in Ethiopia

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Tropical dry forests, recognized as biodiversity hotspots and providers of vital ecosystem services (ES) at local and global scales, face increasing threats from climate change and anthropogenic activities. Adding to that pressure is the increasing demand for ES, particularly in developing countries where a large part of the population depends on natural resources for food, water, and energy. This increasing demand for the utilization of forest ES by local communities is in stark conflict with the efforts aiming to ensure sustainability of ES and climate change mitigation initiatives. Thus, the understanding of relationships and their intensities among vital ES is crucial to address these climate change challenges with effective and informed forest management. The production possibility frontier (PPF) provides an efficient analysis tool for analysing trade-offs between climate regulation and provisioning forest ES. In this study we used PPF as a tool to analyze spatio-temporal biophysical trade-offs between a provisioning (fuelwood) and a regulating (carbon sequestration) ES in Desa'a, the second largest dry Afromontane Forest in Ethiopia. We analysed temporal changes in ES from 1985 to 2020 at five-year intervals. The analysis was based on spatial data gathered from Landsat 5,7, and 8 together with forest inventory data to quantify the ES with an InVest® model and an aboveground biomass model. Preliminary findings showed a trend of an increasing trade-off in the ES pair fuelwood and carbon sequestration. This result indicates the necessity for targeted forest management and policy measures to address trade-offs and ensure sustainability of forest ES under a changing climate.

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Session 14-O14 - Tropical Forest management under climate change

Edge effect caused by linear canopy openings on tree biomass dynamics in an Atlantic Forest fragment

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The carbon (C) storage capacity of tropical forests is susceptible to anthropogenic impacts associated with edge effects caused by fragmentation. The Atlantic Forest, one of the world's hotspots for biodiversity, is strongly fragmented, being vulnerable to changes in biomass that may turn it into a C source rather than a sink. This study aimed to quantify the temporal variation in the above ground tree live biomass (AGB) of an Atlantic Rain Forest fragment in Rio de Janeiro State, Brazil and to relate AGB to edge effects caused by gas and power pipelines over a period of 18 yrs. We test these hypotheses: (1) AGB is larger on a ground area basis in the forest interior than at the edges of the fragment; (2) tree community dynamics are more accelerated in the graminoid matrix (Gas Pipeline, GA) than in the edge of the regenerating matrix (Power line, RE); (3) AGB is concentrated in large trees and certain ecological groups of secondary species. Data were obtained from five sample plots (20 m x 50 m) in each of the 3 treatments: (1) Forest interior (IN); (2) GA; (3) RE. AGB stock and forest dynamics were estimated based on measurements of all local trees (DBH ≥ 10cm) in 2001 to 2008, 2012 and 2018. AGB remained constant during the 18yr period. The hypotheses were supported since (1) AGB was significantly higher in the interior (526 Mg ha^{-1}) than at the edges (RE=360 Mg ha^{-1}), being lower at the GA (240 Mg ha^{-1}); (2) tree community dynamics were faster in GA than in RE, with higher mortality, recruitment, turnover, except AGB change rates; (3) AGB stock was higher in large trees (>40 cm stem diameter), except in GA where it was concentrated in small trees, and in the ecological group of 15 species of secondary trees (Edges=48; IN=62%). In conclusion, linear canopy openings caused edge effects on AGB in the Atlantic Forest, especially considering linear edges with a graminoid matrix (GA), highlighting the importance of edge characteristics on AGB stocks and dynamics.

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Session 15-O1 - Ecosystem services of tropical wetlands

Introductory overview on diversity and the conservation of globally important tropical freshwater wetlands

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The local and global importance of wetlands and their ecosystem services is increasingly acknowledged. Climatic changes and the effects of extreme droughts and floods are linked to their capacity to modulate atmospheric concentrations of greenhouse gases. And yet, freshwater wetlands and specifically floodplain forests are among the ecosystems which most rapidly disappear in the world. Forest degradation, human pressure by water abstraction, changes in the natural flood regime, land reclamation, pollution, over-utilization of natural resources, the construction of dams and draining are continuously converting wetlands. With a focus on Amazonian floodplain forests, we give insights on questions focused on the functioning of the ecosystem due to adaptations to flooding and the ecosystem services provided. We show how the real threats are represented by new factors such as prolonged drought and fire. Drought and fire completely change the ecosystem and the resources for sustainable use. The main challenge for scientists is to continue documenting and providing solid data that serves as a basis for decision making.

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Session 15-O2 - Ecosystem services of tropical wetlands

Amazonian large-river floodplain forests: Ecology, biogeography and conservation

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Amazonian floodplain forests along large rivers consist of two distinct floras that are traced to their differentiated sediment- and nutrient-rich (várzea) or sediment- and nutrient-poor (igapó) environments. While tree species in both ecosystems have adapted to seasonal floods that may last up to 270 - 300 days year^{-1}, ecosystem fertility, hydrogeomorphic disturbance regimes, water shortage and drought, fire, and even specific microclimates are distinct between both ecosystems and largely explain the differences in forest productivity and taxonomic composition and diversity. Here, we review existing knowledge about the influence of these environmental factors on the tree flora of both ecosystems, compare species composition and diversity between central Amazonian várzeas and igapós, and show that both ecosystems track distinct species life-history traits. The ecosystem-level and taxonomic differences also largely explain the biogeographic connections of várzeas and igapós to other Amazonian and extra-Amazonian ecosystems. We highlight the major evolutionary force of large-river wetlands for Amazonian tree diversity and explore the scenarios by which the large number of Amazonian floodplain specialist tree species might even contribute to the gamma diversity of the Amazon by generating new species. Finally, we call attention to the urgent need of an improved conservation of Amazonian várzea and igapó ecosystems and their tree species, and discuss how effective conservation measurements could be designed in order to preserve wetland functionality and biodiversity, but also to preserve their terrestrial and marine interactions.

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Session 15-O3 - Ecosystem services of tropical wetlands

How unique are the tree communities of the Amazon's floodplain forests?

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Session 16-O1 - Tropical molecular ecology

Past volcanic activity predisposes an endemic threatened seabird to negative anthropogenic impacts

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Humans are regularly cited as the main driver of current biodiversity extinction, but the impact of historic volcanic activity is often overlooked. Pre-human evidence of wildlife abundance and diversity are essential for disentangling anthropogenic impacts from natural events. Réunion Island, with its intense and well-documented volcanic activity, endemic biodiversity, long history of isolation and recent human colonization, provides an opportunity to disentangle these processes. We track past demographic changes of a critically endangered seabird, the Mascarene petrel *Pseudobulweria aterrima*, using genome-wide SNPs. Coalescent modelling suggested that a large ancestral population collapsed from more than 400,000 to less than 1,000 birds in two distinct phases, ca. 125,000 and 37,000 years ago, coinciding with periods of major eruptions of Piton des Neiges. Subsequently, the population was fragmented into genetically distinct colonies, ca. 1,500 years ago, following eruptions of Piton de la Fournaise. In the last century, both colonies declined significantly (< 100 birds) due to anthropogenic activities, and although the species was initially considered extinct, it was rediscovered in the 1970s. Our findings suggest that the current conservation status of wildlife on volcanic islands are shaped by historic volcanic activity, which may predispose them to current anthropogenic impacts driving species towards extinction.

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Session 16-O2 - Tropical molecular ecology

Dispersal dynamics of mouse lemurs in fragmented dry forests of northwestern Madagascar

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Animals living in fragmented landscapes generally have reduced opportunities for dispersal between isolated habitat patches. However, it is important to study the species-specific effects of habitat loss and fragmentation since connectivity across an open matrix is not uniform between species. In this study we examined patterns of relatedness and genetic structure in two congeneric mouse lemur species (*Microcebus murinus* and *M. ravelobensis*) to infer dispersal and connectivity in two fragmented dry forest landscapes in northwestern Madagascar. We generated genomic data for 113 *M. murinus* and 108 *M. ravelobensis* individuals using RADseq markers. We then calculated dyadic relatedness, examined population-level genetic structure, inferred potential barriers to migration, and modelled genetic diversity (inbreeding and heterozygosity) in relation to a set of ecological habitat variables. When comparing species, related *M. ravelobensis* were spatially clumped within 200m of each other. Conversely, related *M. murinus* were found farther apart with 10 dyads greater than 1000m apart, suggesting a greater capacity to cross the matrix. Structure and migration analyses as well as genetic diversity modelling revealed patterns that did not correspond to habitat-matrix dichotomies. Overall, our results suggest that these species are responding differently to habitat fragmentation, and that the relatively higher vagility of *M. murinus* may facilitate and explain their wide representation in fragmented landscapes.

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Session 16-O3 - Tropical molecular ecology

Inferring a demographic scenario accounting for population structure in two Indian Ocean bird species endemic to a single island

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Zosterops mauritianus and *Z. borbonicus* are passerines, respectively endemic to Mauritius and Reunion Island. A recent genetic study has suggested that while *Z. mauritianus* is panmictic at least five differentiated groups can be differentiated in *Z. borbonicus* for both morphological and genetic data (e.g. Gabrielli et al., 2020). Gabrielli et al. (2023) further compared these two species using the PSMC method of Li and Durbin (2011). When populations are panmictic the PSMC can be interpreted as reflecting changes in effective population sizes, but this interpretation is not necessarily valid when populations are structured, and the PSMC should then be interpreted as estimating the IICR (inverse instantaneous coalescence rate, Mazet et al., 2016) only. To assess the significance of PSMC-based inferences relative to population structure, we used SNIF (Structured Non stationary Inferential Framework), a freely available program developed by Arredondo et al. (2021), to infer the parameters of step-wise stationary n-island models, such as the deme population size (N), the number of demes (n) or the scaled migration rate (M) by taking PSMC curves as input data, and applied it to *Z. borbonicus* and *Z. mauritianus*. We inferred models producing IICR curves that are similar to the *Z. borbonicus* and *Z. mauritianus* PSMC curves even though there were differences. The range of the inferred number of islands for both species was very large even if it was smaller for *Z. borbonicus* than for *Z. mauritianus* (2-100 vs 50-400). These results suggest that the stepwise stationary models inferred here are unlikely to correspond to the actual demographic history of the two species. We hypothesize that the genomes of these species may contain information on the structure of the ancestral species that colonized the island and carried out simulations to test this hypothesis.

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Session 16-O4 - Tropical molecular ecology

Genomics-informed conservation to the rescue

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Mauritius is home to a rich biodiversity of animals and plants that includes some of the world's rarest species. Sadly, over 100 species have gone extinct since human colonisation of the island in 1507, and most famously among these is the dodo. Recently, however, several species of Mauritius have been saved from extinction. Coordinated conservation activities began in the 1980s with the establishment of the Mauritian Wildlife Foundation (MWF). Critically endangered species such as the Mauritius kestrel, echo parakeet, and the pink pigeon have been brought back from the brink of extinction. These endemic bird species of Mauritius experienced a slow population decline over several centuries, followed by a sharp population bottleneck during 1970–1990. Successful conservation management resulted in the demographic recovery of the species to several 100s of individuals, resulting in these species' being down-listed in the IUCN Red List. However, the evolutionary genomic effects have not yet caught up with the sharp population declines. In particular, the populations continue to lose genetic variation, whilst the loss of gene diversity (heterozygosity) makes the populations vulnerable to their genetic load of harmful mutations. The slowness of these evolutionary processes is called a "drift debt", and this poses new pressures on these populations. Managing demographically recovered species requires additional conservation efforts to restore their long-term population viability. In this talk, I will explain how genomics-informed conservation can help guide the management of demographically recovered species in the future.

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Session 16-O5 - Tropical molecular ecology

The critically endangered Coquerel's sifaka retains pre-deforestation genetic makeup

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Habitat loss and fragmentation significantly alter landscapes, affecting species dispersal within their environment. The isolation of populations increases their vulnerability to demographic and genetic declines, heightening the risk of extinction. Assessing the landscape components utilized by a species for dispersal can provide valuable targets for effective conservation measures. In this study, we employed landscape genetics to examine the effects of landscape features on the dispersal of the critically endangered Coquerel's sifaka (*Propithecus coquereli*). Firstly, we assessed the species' genetic diversity and structure by analysing 187 individuals across its entire distribution area using 29 microsatellite loci. Subsequently, we investigated which landscape components best accounted for the observed pattern of genetic variation. Our findings indicate that historical forest cover, narrow rivers, and cultivated areas facilitate gene flow, while the presence of large rivers hinders it. Based on these results, we recommend conservation efforts that focus on curbing deforestation in the region and restoring forest corridors between patches to enhance connectivity among populations.

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Session 16-O6 - Tropical molecular ecology

Ecological and molecular mechanisms of colour diversity in tropical aposematic frogs

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Diversity in coloration is a common phenomenon in animals, often resulting from local selection pressures. Particularly brightly coloured aposematic frogs usually show high variation in colour patterns. While the ecological factors influencing colour diversification are better studied, e.g. predator selection, the underlying molecular processes have been a recent research subject. To study ecological and molecular processes of colour diversification, we used two genera of tropical poison frogs, *Brachycephalus* from South America and *Oophaga* from Central America. We first show that colour differences between morphs can be distinguished by predators, with the orange or red morphs proving to be more conspicuous than green, grey, brown or blue morphs. The dermal chromatophores - xanthophores, iridophores and melanophores - produce pigments and platelets whose interplay with light results in the final skin coloration of these frogs. We found that differential expression of genes in the pathways of pigment and platelet production occurs among colour morphs in both taxa. However, these coloration genetic mechanisms are different between the most aposematic morphs of *Oophaga* and *Brachycephalus*. Our results indicate the possibility that different molecular solutions have evolved among aposematic taxa as a response to local selection pressures.

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Session 16-O7 - Tropical molecular ecology

Genetic consequences of abiotic and biotic forces shaping the distribution limits of a Neotropical orchid

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The center-periphery hypothesis (CPH) explains the decline of species abundance towards range limits and how this is driven by increasing ecological marginality. Here, we investigate both drivers' roles in restricting an orchid's range (*Epidendrum fulgens*) along a broad environmental gradient in south and southeastern Brazil, exploring its genetic consequences. We integrated empirical data on geographical distribution and pollinator richness with a large dataset based on transcriptomes from 80 specimens across the distribution range of *E. fulgens*, aiming to investigate whether range limits match niche limits and whether habitat suitability declines towards low- and high-latitude species ranges. We performed niche models to predict niche limits and used polynomial and linear regression models to investigate the associations between ecological niche and species range as well as to test the relationship between genetic-derived metrics and the geographical and ecological distances. Ecological conditions become more marginal towards the edges of the *E. fulgens* range, with an abrupt variation in precipitation. While pollinator richness increases habitat suitability of *E. fulgens* in the low-latitude edge range, climate has primarily shaped the species' high-latitude limit. Genetic diversity within populations decreases while genetic differentiation increases towards both margins, although with a more consistent pattern for the low-latitudinal component. This study corroborates the predictions of CPH regarding ecological and genetic patterns of variation in space and highlights distinct factors limiting geographical distribution at the opposite margins of a latitudinal and narrowly-distributed species. This improves our understanding on how biotic and abiotic variables limit species distribution ranges along latitudinal gradients in an extremely diverse and vulnerable tropical ecosystem, with potential for informing conservation practices.

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Session 16-O8 - Tropical molecular ecology

How fragmentation impacts the population genetics of specialist versus generalist oil-collecting bees in the Brazilian Cerrado

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Habitat loss and fragmentation is a major biodiversity threat, isolating populations and thereby potentially decreasing the amount of intraspecific gene flow and genetic diversity of those populations. Oil-collecting bees of the genus *Centris* (family Apidae) are pollinators of many plants in the Neotropics including economically important crops. Interestingly, while some *Centris* species are generalists in terms of their oil host plants, others are highly specialized and collect oil only from few plant genera. We aim to investigate if habitat loss and fragmentation has a different impact on the genetic diversity, population differentiation and effective population size (*Ne)* of *Centris* species with different diet specialization degrees. Thus, we used whole genome sequencing to compare thousands of SNPs in five populations of the generalist *C. aenea* and four populations of the specialist *C. spilopoda*, sampled in the Brazilian Cerrado biome. We found that nucleotide diversity (π), a measure of genetic diversity, seems to be similar in both species. Both species present a strong correlation with it and the percentage of natural cover, however at different scales (*C. aenea* |0.70| at the 250m and *C. spilopoda* |0.83| at 1000m). However, using F_{ST} as a measure of differentiation, we did not find signs of isolation by distance for any species and, after comparing the F_{ST} values between the two species we found no significant difference between them, even after correcting for sampling number. Effective population size reveals a common tendency of decreasing, with *C. aenea* having higher effective population size at any given time point. Our results show that this particular pair of species may be affected by habitat loss and fragmentation at different scales. Also, the decreasing *Ne* is in line with the current insect decline.

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Session 16-O9 - Tropical molecular ecology

Imperfect but improving – Evolving insight into the phylogeography of Sulawesi tarsiers

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Due to its location in the transition zone between Asia and Oceania, its complex geologic history and its long isolation from other major landmasses, the Indonesian island of Sulawesi hosts a high diversity of endemic vertebrates. Among these, the enigmatic, nocturnal tarsiers are the only living descendants of an ancient evolutionary lineage of primates. Known as "old endemics" or "early colonizers" of Sulawesi, tarsiers are an excellent indicator taxon for historical tectonics- and climate-driven landmass distributions that have shaped the island's unusual biodiversity. Compared to our knowledge 25 years ago, the discovery of new species and reconstruction of phylogenetic trees based on molecular data have led to a much-improved understanding of their evolution. This includes diversification of tarsiers on Sulawesi as early as 10 million years ago, followed by several waves of dispersal across the island, displacement among congeneric species and repeated bouts of interspecific hybridization. But our knowledge is still incomplete, the identification of new taxa and their phylogenetic interpretation keep challenging our view on tarsier phylogeography. I will present bioacoustic and multi-locus molecular data, integrate them with geologists' findings on the evolution of landmasses in the Malay Archipelago and will thus outline our current understanding of the origins of the astounding tarsier diversity on Sulawesi.

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Session 16-O10 - Tropical molecular ecology

Living with toxins: Convergent modifications of sodium channels against deadly batrachotoxin in New Guinean toxic birds

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Across the tree of life, toxicity has evolved multiple times, playing crucial roles for hunting, defense, and the deterrence of parasites. Toxins can be generated by the organism itself or by symbionts, or be acquired through the diet. The capacity to utilize toxins from external sources requires adaptations to prevent harmful effects on the consumer (autoresistance). Here we shed light on genomic adaptations that may facilitate autoresistance to the potent neurotoxic alkaloid batrachotoxin in toxic birds from New Guinea. First, chemical analyses allowed us to verify toxicity in three known and two new toxic species. We then went on to demonstrate that toxic birds have multiple mutations under positive selection in the SCN4A gene that encodes the most prevalent vertebrate muscle Nav channel (Nav1.4). Molecular docking indicates that some of the mutations associated with the pore-forming segment of this channel may decrease its binding affinity of batrachotoxin. This strongly supports that autoresistance comes from specific mutations that hinder the continuous opening of the sodium channels that would otherwise be triggered by batrachotoxin, thereby preventing muscle paralysis and, ultimately, death. The exact mutation positions in the gene varied across bird species, indicating independent origins of autoresistance to batrachotoxin in birds. Intriguingly, these mutations are in the coding regions of the same segments of the Nav1.4 channel as in Neotropical *Phyllobates* poison dart frogs, providing the first evidence for convergent evolution of a mechanism that enables members of two vertebrate classes to ingest and utilize the same neurotoxin.

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Session 16-O11 - Tropical molecular ecology

Effects of land-use change on above and below-ground plant phylogenetic diversity and carbon storage in soil, roots, and litter

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Land-use change is one of the main causes of deforestation and biodiversity decline in the tropics. The demand for biodiversity and environmental assessments, both above- and below-ground, is ubiquitous, particularly in tropical regions. These surveys help us gain a deeper comprehension of ecosystem processes and services, as well as enhance our ability to make accurate climate predictions. Understanding how plant biodiversity affects soil organic carbon stocks remains puzzling. Ecosystem processes such as decomposition can be enriched by plant abundance and composition, which, in turn, provides carbon inputs for plant assimilation via symbiotic fixation at the rhizosphere. In this research, we evaluated plant diversity in a vertical forest stratum and tested its effect on soil, roots, and litter organic carbon storage, while investigating the effect of landscape heterogeneity on plant-plant co-occurrences. This achievement was attained through a comprehensive analysis of plant composition, involving DNA metabarcoding of roots and litter, as well as DNA barcoding of leaf samples. The identified tree species were then cross-referenced with morphological taxonomy data collected from 128 strategically positioned plots. These plots were established across a heterogeneous mosaic of forest areas undergoing conversion into a monoculture oil palm system. We observed that richness above- and below-ground followed a similar pattern with a steep decline in managed plots. However, a higher number of species were detected in roots compared to the above-ground plant survey, indicating the possible emergence of natural regeneration. Community structure and modularity declined in response to land-use change. Moreover, litter and root richness had a positive effect on carbon storage in soil and roots, while the effect of plant richness based on our survey using samples from roots, litter, and leaf had little effect on carbon storage in litter.

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Session 16-O12 - Tropical molecular ecology

Combining genomics and spatial modelling to make multi-species population vulnerability predictions

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Environmental change, compounded by anthropogenic activities are introducing new selection pressures on biodiversity. Species abilities to cope with this depends on the magnitude of environmental change occurring and the adaptive capacity of their intraspecific populations. We combine genomics and spatial modelling to quantify predicted climate exposure, neutral and adaptive genetic diversity, landscape connectivity and population vulnerability under future global change scenarios for multiple amphibians across Europe and Africa. Using the newly developed 'Life on the edge' framework (https://cd-barratt.github.io/Life_on_the_edge.github.io/) as a proof of concept to evaluate multi-species intraspecific vulnerability, our work addresses an important knowledge gap in population-level climate change vulnerability assessments and shows how open access georeferenced genomic data can be repurposed to provide new insights for conservation, acting as a basis to conduct detailed population monitoring using genome-wide data.

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Session 16-O13 - Tropical molecular ecology

How to deal with the impact of the reference divergence in the demographic history of non-model species

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Reconstructing the demographic history of species represents a major challenge for evolutionary and conservation biologists. The pairwise sequentially Markovian coalescent (PSMC) of Li and Durbin uses the distribution of heterozygous sites along the genome of a single diploid individual to reconstruct the population demographic history. However, it also requires a reference genome, usually unavailable for non-model species. A common workaround uses a reference genome from a related species, which can bias the heterozygote calls and lead to spurious results. Here, we assess the impact of the reference genome divergence by inferring a human PSMC, using reference genomes from human and increasingly divergent primate species. Additionally, we compared the PSMCs inferred for each non-human primate using as reference both its conspecific and the other primates' reference assemblies. Results suggest that the divergence of the reference generates biases in the demographic inference. While we could recover a similar shape using the closer species as a reference, the PSMC curves tended to be shifted towards the recent past and lower effective sizes, with increasingly divergent references showing a larger shift or a drastic change of the curve shape. Finally, we investigate whether using a conspecific de novo assembly as a reference would be a better approach than using a high-quality reference from a closely related species. To assess the impact of the reference quality on the PSMC, we generated de novo assemblies for four primate species. We then compared the PSMC inferred using these as references versus using the conspecific high-quality reference genome. Results suggest that using a de novo assembly as a reference might lead to a more accurate inference than using a high-quality reference genome from a close species. This approach can be a valuable tool to infer the PSMC for species for which no high-quality reference genome is available.

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Session 16-O14 - Tropical molecular ecology

Reconstructing the evolutionary history of species with genomic data: What can the IICR (inverse instantaneous coalescence rate) tell us?

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The phrase "demographic history" is often used to represent changes in effective population size (Ne). Genetic data from endangered species are thus often used to quantify and date increases or decreases in Ne, or to compare Ne values between populations or species. While this simplified representation of the demographic history of species can be seen as a first approximation, there is no clear justification why we should not move beyond this first step today. Indeed, the demographic history of many species likely involved periods of spatial expansion and contraction together with periods of fragmentation of habitats. This is problematic because, when populations are structured, spurious changes in Ne will be detected, quantified and dated, even if the populations never changed in size. In other words, if we wish to understand the evolutionary history of present-day species we need to shift from a unidimensional view of their history to a view in which we try to integrate changes in Ne and changes in connectivity. To do that we need to improve our understanding of structured models. In this presentation I will try to clarify the IICR concept where IICR stands for inverse instantaneous coalescence rate. The IICR is equivalent to the coalescent Ne under panmixia but can significantly differ from Ne under structured models. Interestingly, the IICR can be estimated from real data using the PSMC method. This is particularly convenient for endangered species since the method only requires the genome of a single individual. However, this means that interpreting PSMC curves from endangered species as indicating changes in Ne may be misleading. If the evolutionary history of species is important to improve conservation, then we may need to go beyond the Ne concept, and identify the cases where it is required. Altogether I thus try to clarify what the IICR is, what it is not and how it can be used to improve our understanding of the recent history of endangered species.

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Session 16-O15 - Tropical molecular ecology

Life history traits predict contrasting dynamics of genetic diversity during a ca. 14,000-year glacial cycle: A spatial simulation study

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The worldwide decline of species due to habitat changes induced by climate change and human activities is alarming, especially in tropical regions. While some empirical studies report a loss of genetic diversity in species undergoing habitat loss, numerous articles observed no apparent reduction or even an increase in genetic diversity despite population decline. There is thus a gap in our understanding regarding variations in the genetic diversity patterns among species with distinct life-history traits experiencing the same habitat change scenarios. In this study, we first used spatial simulations to investigate the temporal dynamics of genetic diversity within refugium populations experiencing a range expansion followed by a stationary and a contraction period. This is important given that most species have gone through several of these cycles during the Pleistocene. We explored different scenarios, varying both the speed of contraction and the life-history traits of the simulated species. In addition, we used a simpler panmictic model from which we derived analytical results. Altogether, we identified three temporal dynamics of genetic diversity in the refugium population during the contraction: scenarios where genetic diversity i) decreased throughout the contractions, ii) increased for initial periods before plateauing and then decreasing, or iii) followed a persistent increasing trend, without any visible effect of the expansion or contraction. We show that these different temporal dynamics can be simply predicted by comparing the observed expected heterozygosity to the values expected if the species were at equilibrium within the refuge and within the whole landscape. We also observe scenarios where a rapid contraction maintains more diversity just at the end of the contraction, as widely believed and reported in a previous simulation study. However, we also observe the opposite pattern for a wide range of parameters.

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Session 16-O16 - Tropical molecular ecology

Coffee agroforestry, reforestation, and landscape genomics: The successful case of Mount Gorongosa, Mozambique

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Gorongosa National Park (GNP) is one of the greatest cases of wildlife restoration in Africa. Among others, the implementation of a coffee agroforestry system (CAFS) in the fragmented rain forest of Mount Gorongosa aims at reconciling biodiversity conservation and human development. In this work, we assessed the patterns of genetic diversity, structure, and functional attributes of *Coffea* and its associated rhizosphere microbiome. Field expeditions and landscape genomics revealed the occurrence of only one coffee wild-relative species, *C. racemosa*, in the study region. Plastid markers consistently found two main maternal lineages, splitting this species from *C. arabica* and supporting a single maternal origin scenario for each species. Simple Sequence Repeats and Single Nucleotide Polymorphisms (SNP) revealed low levels of genetic diversity in *C. arabica* implanted in the CAFS, likely related to its autogamous nature, while the allogamous *C. racemosa* presented higher levels of genetic diversity. The analysis of the functional pathways based SNP showed that *C. arabica* is enriched in flavour-related genes, while in *C. racemosa* stress signalling genes are more represented. Next generation sequencing (16sRNA and ITS) revealed that the rhizosphere microbiome of *C. arabica* was highly diverse, harboring a rich set of plant growth promoting functions, shaped by altitude and associated climate variations. Together with data from climate models, phenology and eco-physiology, biodiversity indicators, and carbon dynamics, these results highlight the importance of the introduction of more resilient species and increase of genomic diversity as part of the set of climate-smart practices.

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Session 17-O1 - Current trends in tropical African plant ecology

Rain forest fragmentation in northern Madagascar during the past millennium – a result of intensified human impact and climate dynamics?

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Rain forest fragmentation in northern Madagascar during the past millennium - a result of intensified human impact and climate dynamics?
With its unique flora and fauna, Madagascar is one of the earth's biologically richest ecoregions. It is known that Madagascar's ecosystems have greatly been affected by human influence during past decades, thus making it one of the most endangered ecoregions as well. Despite the clearly visible recent changes, the exact timing of arrival of the first settlers and their impact on the environment remains a scientific debate. By analysing the sedimentary archive of Lake Amparihibe (Nosy Be Island) and Lake Ravelobe (National Park Ankarafantsika) our research contributes to shed light on the timing of early human impact on Malagasy natural ecosystems. Several proxies i.e., pollen, fungal spore, other non-pollen palynomorphs, charcoal and diatoms combined with high-resolution sediment-physical and geochemical data were considered to reconstruct paleoenvironmental dynamics during the past three millennia. Both sites indicate an environmental change between 1300 and 1100 cal BP, characterized by an increase of Poaceae pollen and at Nosy Be an increase of charcoal particles, indicating an abrupt transformation from a highly diverse forest to a grassy landscape associated with fire disturbance. This quick shift is interpreted as a strong early human impact on the environment. After 1000 cal BP, the vegetation is dominated by a fire-disturbed forest/grassland mosaic, which is maintained until today. However, the scarcity of continuous records hinders a comprehensive regional synthesis. Further research is needed to disentangle signals originating from human impact and/or climatic background, and ultimately detect potential (dis)similarities in climate dynamics, ecosystem responses and anthropogenic influences at the island's scale during the Holocene. This is urgently needed to understand the relationship of human influence and natural factors to current climate

change and biodiversity loss, which is important to improve future conservation strategies for biodiversity hotspots such as Madagascar.

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Session 17-O2 - Current trends in tropical African plant ecology

Mapping tropical forest types and associated floristic, functional and faunistic composition in central Africa

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Central Africa is home to the second largest block of tropical rainforest in the world and is currently under important threats. This forest block hides a complex spatio-temporal mixture of forest types whose environmental drivers, composition, structure and dynamics are poorly known, despite constituting an essential prior knowledge for conservation and management decision. In this talk, we will first report original results on the distribution, structure and composition (floristic, functional and faunal) of the main forest types over a 18,500 km2 region in the North of Congo, combining satellite images, recent deep-learning architectures and extensive field data. We showed that water drainage depth is a major driver of forest type distribution and that the different forest types are characterized by different structure, composition and functions, bringing new insights about their origins and dynamics. Our results specifically show that Marantaceae forests, which are characterized by a dense layer of giant herbs and a low tree biomass compared to surrounding dense forests, are the most dominant forest type of the study area. This understudied forest type is present throughout central Africa and has been hypothesized to constitute an arrested succession following major past disturbances. Our results support the hypothesis that fires play a major role in the spatio-temporal dynamics of these forests through two alternative mechanisms: fire can either reinitiate the vegetation succession by triggering a bifurcation in forest trajectory or contribute to maintaining Marantaceae forests in the long term due to well-known positive feedback on the herbaceous compartment. We will finally introduce a current field experiment that aims at testing these hypotheses. Our study shows that combining remote sensing and extensive field measurement may help to better consider the diversity of forest types in monitoring strategies in a context of increasing pressures on tropical forests.

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Session 17-O3 - Current trends in tropical African plant ecology

Between land and sea – Analysis of historical land cover dynamics at the coastal interface in Guinea-Bissau

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Guinea-Bissau is a small country in West Africa with an extensive low-lying coastal area that accommodates a large percentage of the population and is primarily composed of mangrove forests, rice fields, and herbaceous savanna, which are essentially shaped by human activities and influenced by climatic factors. Coastal ecosystems are key for local livelihoods and income – either with, e.g., mangrove swamp rice production, fishing, seafood extraction, or firewood extraction. This study is part of the project MARGINS - *People, rice and mangroves at the margins: A hybrid and contested interface in a changing world*. It examines the historical dynamics of land cover changes between 1949 and 2022 in the coastal area of Ondame, a peninsula in central Guinea-Bissau. Five dates were selected for multitemporal land-cover mapping. Quantification of spatial and temporal dynamics was accomplished via visual interpretation and manual vectorization of each class in topographic maps for 1949, aerial photographs for 1976 and 1989 and satellite imagery for 2004 and 2022. Data collection in the field in January 2023 supported the validation of the classification carried out at randomly selected control points. The results show that there has been a 60.8% reduction in the area of rice paddies between 1949 and 2022. From all the area of rice paddies lost, around 89% was converted to mangrove forest. These changes fuelled both by environmental, political, and socioeconomic factors (e.g., price of rice, rain patterns, availability of manpower both for the rice plantation and the maintenance of the paddies' dikes), constitute yet another evidence of the trend of rice farming abandonment noticed by the locals and scholars since a few decades. Given the utility of land cover change analysis, these results can ultimately contribute as a foundation for a costal management plan for the study area.

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Session 17-O5 - Current trends in tropical African plant ecology

Leaf phenology across southern African woodlands varies with floristic composition and structure

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Woodlands, characterized by a sparse tree canopy over a grassy understory, span a vast region across the African continent, exhibiting distinct tree species compositions. Patterns in phenology, i.e. the flushing and senescence of leaves, can vary across climatic gradients, between trees and grasses and among different tree species, with important consequences for ecosystem functions like forage provision. Bicuar National Park in Angola represents a dry Miombo woodland (864 mm mean annual precipitation), with the vegetation displaying a pronounced seasonal leafing pattern. In this study we examined the differences in leaf flushing and fall between grasses and trees, and whether ecosystem-level leafing patterns are influenced by tree species composition. Four 1-hectare vegetation survey plots were selected, each with distinct floristic compositions dominated by: 1) Combretaceae (P2); 2) *Julbernardia paniculata and Brachystegia* (P5); 3) *Baikiaea plurijuga* and *Baphia massaiensis* (P9); and 4) *Burkea africana* and *Julbernardia paniculata* (P10). Cameras were used to monitor leaf phenology throughout 2022, capturing one leaf fall and one leaf flushing event. Time series of vegetation greenness (quantified by the green chromatic coordinate (Gcc) index) was used to calculate phenological metrics, the start and end of the growing season (SOS and EOS). The SOS for grasses and trees was similar and did not vary across plots. However, trees retained their leaves for a more extended period (i.e., later EOS), particularly in plots dominated by *B. plurijuga* (P9) and B. *africana* (P10), in comparison to those dominated by Combretaceae (P2) and *Brachystegia* (P5). These differences likely stem from the distinct characteristics of *B. africana* and *B. plurijuga*, both tall trees that likely have deep roots which can access groundwater.

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Session 17-O6 - Current trends in tropical African plant ecology

Contributions of subtropical and tropical plant species to belowground ecological strategies

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Root trait variation can improve our understanding of ecological and evolutionary processes shaping biodiversity, as well as allow a better forecast of functional changes resulting from global change drivers. Here, we aim to enhance our understanding of plant functional strategies by assessing the contributions of plant species in subtropical and tropical biomes to the global diversity in root trait strategies. We used species-level root trait data related to the belowground collaboration and conservation axes that define the "root economics space" from 1618 temperate, 341 subtropical, and 775 tropical species. Our results showed that global comparisons are currently only possible for woody species, with only 13% of the global data for non-woody species coming from tropical and subtropical species. Tropical woody species had greater root diameter than subtropical and temperate species, suggesting a latitudinal shift in the collaboration axis. Variation in the conservation axis differed when elucidated via root tissue density (RTD) or root nitrogen (N) concentration, with both increasing towards the tropics. Subtropical and tropical biomes account for 40% of the unique functional global space. Further, SRL and RTD variation within the subtropical biome was explained by species' climatic niches and differences in evolutionary history among continents but tropical variation was poorly explained by our predictors. Our results highlight the unique contribution of subtropical and tropical species by expanding the global root economic space, via subtropical species with higher SRL and RTD and tropical species with higher root diameter and RTD. To provide a global holistic plant functional biogeography perspective and better understand the present and the future of (sub)tropical ecosystems, we need to improve measurements and representations of their root

functional trait space as well as potential drivers, particularly in tropical regions and specifically in Africa.

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Session 17-O7 - Current trends in tropical African plant ecology

Rural communities' views on woodland contributions to people in Guinea-Bissau: The importance of wild edible plants

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The West African woodlands provide numerous contributions to local communities, but they have been severely degraded due to land use pressures and climatic changes. Many studies have evaluated woodland goods and services, but few include the interdependencies between perceptions, uses and values of natural resources and the wider sociocultural contexts. Using a sociocultural approach combining focus-group discussions and walk-in-the-woods in 20 villages located in the north of Guinea-Bissau, our research investigates how different ethnic groups use and value the nearby woodlands and how biophysical changes impact human-woodland relationships. We found that such values are influenced by the specific ways in which different socio-cultural groups interact with the woodlands, but that Wild Edible Plants (WEPs) were the most important contribution across the four ethnic groups (Manjack, Balanta, Mandinka, and Fulani). Moreover, we found that woodland degradation has multifaceted impacts on the instrumental and relational values of all ethnic groups studied, ranging from reduced material consumption to woodland detachment, with potential implications for the protection and sustainable management of the woodland ecosystem. Our study highlights the importance of the West African woodlands, and WEPs in particular, to local communities and the need to consider the diversity of human-Nature values when designing both development and conservation management plans.

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Session 17-O8 - Current trends in tropical African plant ecology

Conservation and sustainable use of tropical biodiversity: Ongoing projects with Guinea-Bissau and Angola flora

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The conservation of tropical biodiversity and the sustainable use and management of natural resources is a major global issue. Although there are various initiatives to promote the sustainable management of Africa's natural resources, the loss of agricultural biodiversity and the cultural practices and knowledge, is an issue of increasing concern, particularly in rural areas, which are centres of origin and diversity of unique useful plants. In recent decades there has been a progressive replacement of the indigenous food plants by high-yielding varieties with low genetic diversity, which has led to the loss of agricultural biodiversity. Guinea-Bissau, a small West African country, and above all Angola, the seventh largest country in Africa, have a great diversity of useful native plants, many of which are used for medicinal and food purposes. However, there is a lack of studies to identify and characterise the plant genetic resources of these countries to guarantee sustainable use and management of local plant genetic resources. This communication presents the main results obtained from ongoing research projects whose main objectives are the knowledge, conservation, and sustainable management of natural resources in Angola and Guinea-Bissau. Among the studies in their final stages are checklists of wild edible flora of Angola and Guinea-Bissau and the checklist of useful species of Leguminosae and Annonaceae in Angola. In this communication, it is also highlighted some of the species that are being used as a source of food and medicines that have also been the subject of recent phytochemical and functional analyses, which have revealed potential to contribute to improving food security and human well-being in these two African countries. Finally, considerations are made about how the knowledge that has been produced about the natural

resources of Angola and Guinea-Bissau can be used in future initiatives to ensure their valorisation and sustainable use, supporting the establishment of National Strategies for the conservation of plant genetic resources in these two African countries.

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Session 17-O9 - Current trends in tropical African plant ecology

Ecology and socio-economic importance of palms in West Africa

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The Arecaceae family includes around 2585 species and 188 genera. Palaeobotanical data indicate that palm trees have existed since the Cretaceous period, more than 65 million years ago, distributed mainly in tropical and subtropical regions. Archaeological data also shows that some species, such as *Elaeis guineensis*, had already been exploited by man for more than five thousand years. In Africa, with 17 genera and 65 species, the diversity of the palm flora is relatively low when compared to other tropical regions. However, there is a multiplicity of traditional uses of palms and their ecological, socio-economic, and sociocultural importance in the tropical and subtropical world, particularly in West Africa, has been analysed by various authors. Almost all, 25 palm species occurring in West Africa (including three introduced and naturalised) are used by rural populations. The roots, stems, leaves, and inflorescences, infructescences as well as the sap, are used for various purposes, such as food and medicine, artefacts, construction, phytochemistry, and ritual and magical-religious uses. Concerning the morphology of the native species, 11 have an arboreal size, with an erect and long stem, three have a short erect stem and a shrubby shape, and nine species have a slender and long stem, with a climbing habit. Most species occur mainly in coastal and riverine forest habitats, although a few, such as *Borassus aethiopum* and *Hyphaene thebaica* occur in dry or semi-arid habitats. Some species are also common in disturbed habitats, such as fallow land or clearings in forest areas. The data obtained on palm species and their uses in West Africa allows us to affirm that, although with a limited diversity of species, the Arecaceae family is of great socio-economic and sociocultural importance in the lives of resident communities. On the other hand, the vast majority of species occur spontaneously in the natural environments, and many are underutilised.

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Session 17-O10 - Current trends in tropical African plant ecology

Conservation lessons learnt from research on one of the fastest declining oceanic island endemic plant species worldwide

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Oceanic islands ease the study of human-induced impacts on biodiversity for implementation of corresponding conservation management. However, despite some resounding plant conservation successes, effective action is often impeded by a lack of information on the precise diversity, relative severity and spatio-temporal variations and interactions of threats besetting island plants. Here, we used *Roussea simplex* Sm. (Rousseaceae), hereafter *Roussea*, a threatened Mauritius endemic woody plant as a model to explore the ecology and threats besetting a tropical oceanic island plant species. Recorded as common up to the 1930's, *Roussea* then declined rapidly and today is confined mainly to mountain ridges and crater rims, mostly within protected areas. It is xenogamous and the newly discovered flower visitor, the threatened endemic Mauritius Bulbul (*Hypsipetes olivaceus*) is a much better pollinator than the endemic *Phelsuma cepediana* gecko previously recorded as sole pollinator. The main threats to *Roussea* include i) competition, mainly for light, with invasive alien plants, notably strawberry guava (*Psidium cattleyanum*) set in a context of a worsening invasion; ii) florivory by invasive alien black rats (*Rattus rattus*) and long-tailed macaques (*Macaca fascicularis*); and to a lesser extent iii) nectarivory by invasive ants and birds; iv) local or ecological extinction of endemic pollinators and frugivores; and v) rarefaction of its best germination micro-site due to the decline of the native tree fern, *Alsophila celsa*. Conservation lessons emanating from this research are: i) protection is insufficient, active management is a must; ii) severity of threats may vary substantially through space and time; iii) adopting a plant-centered approach reveals an improved holistic understanding of threats; iv) threats are better hierarchized to be addressed in decreasing priority; and v) some threats are best addressed simultaneously to get the optimal outcomes or avoid unwanted ones.

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Session 17-O11 - Current trends in tropical African plant ecology

Application of spatial conservation prioritization for terrestrial ecosystem management: A tropical island oriented global systematic review

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Tropical islands play a crucial role in the global conservation of biodiversity. They are disproportionately represented in biodiversity hotspots and have often been severely affected by human activities including habitat transformation, fragmentation, and alien species invasions. They thus serve as important and useful focal points for developing dedicated conservation efforts.
To address the threats faced by island biodiversity, the establishment and management of protected area networks have been crucial. However, managing such protected areas demands substantial resources. The judicious allocation of limited financial and physical resources is thus paramount for effective conservation management. Recognizing the need for a strategic and cost-effective approach, spatial conservation prioritization (SCP) tools have been developed. These tools aim to identify priority areas for achieving biodiversity conservation goals cost-effectively. To evaluate the adoption and impact of SCP on islands, we conducted a comprehensive review of the current literature, focusing on geographical distribution, implementation, and the most frequently utilized tools. Our results show that the adoption of SCP tools on islands is relatively low, and most relevant studies are concentrated in the Asian region. Notably, the most popular tools were employed for protected area management are Marxan and Zonation software. The limited application of SCP tools on islands can be attributed to several factors, including a lack of data, poor data quality, and lack of know-how. This is exemplified by the case of islands such as Mauritius. Addressing these challenges requires concerted efforts in research, securing funding, and the implementation of policies that actively promote the adoption of SCP tools. Advocacy for the integration of SCP into conservation practices is crucial for enhancing the effectiveness of island biodiversity conservation strategies.

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Session 17-O12 - Current trends in tropical African plant ecology

Review of tropical pioneer trees' roles for restoration and conservation management: *Harungana madagascariensis* (Hypericaceae) as a model

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Forests and other terrestrial ecosystems worldwide are increasingly being destroyed and degraded by human activities. This is exacerbated on tropical island ecosystems, leading to many species' extinctions and a growing number of species being threatened. To reverse this trend, native ecosystems restoration projects are widely implemented, using different methods depending on local contexts and objectives. However, the costs of restoration relative to available resources for *in-situ* conservation is an important factor limiting the effectiveness of projects globally, hence the need for cost-effective approaches to up-scale ecosystem restoration. A key to limit restoration costs is the adequate selection of species. As a pioneer tree, *Harungana madagascariensis* has often been proposed as a restoration tool, but the knowledge about its ecology and contribution to biodiversity conservation remains paradoxically little known. To assess the potential use of the species in restoration of degraded native ecosystems and biodiversity conservation, we reviewed the current state of knowledge about its distribution and habitat, and the ecological interactions and ecosystem services it provides. Our results show that *Harungana*'s native range spans across Tropical Africa, Madagascar and the Mascarene Islands, being characteristic of secondary forests and riverine areas. Ecological interactions involving *Harungana* comprise pollination, herbivory, and hosting of epiphytes, insects, and several parasitic species. The species is also recognized as an indicator of soil fertility and is important for carbon sequestration. However, knowledge gaps remain on its ecology, its role as nurse tree, and ability to compete with invasive alien plants, especially on islands like Mauritius. This work clarifies the further studies that remain to fully assess the potential of pioneer trees in promoting biodiversity conservation and ecosystem restoration, using *H. madagascariensis* as a model.

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Session 17-O13 - Current trends in tropical African plant ecology

Malagasy grass flora dynamics: An exploration of environmental influences on grassy functional traits

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Madagascar is home to at least 550 grass species, of which almost half are endemic - a surprisingly high percentage for an island of its size. Recent evidence indicates that Malagasy grasslands pre-date human arrival on the island and are instead part of the wide expansion of C4 grasslands in the late Miocene. This in combination with Madagascar's relatively recent megafaunal extinction in the last millennia, the subsequent transition to livestock grazing, and its complex history of fire and fire suppression, raises questions around its landscapes and ecosystem dynamics. In particular, greater understanding is needed with regards to how different biotic and abiotic aspects of Malagasy environments combine to shape the structure of extant grass flora across the island. Using measurements of plant functional traits related to growth (e.g. plant height, culm diameter, leaf dimensions) and resource acquisition (leaf C:N) for approximately half of the Malagasy grass species, we explore how grass traits vary in relation to the environment. We construct a series of phylogenetic generalised linear mixed models (PGLMMs) to assess correlations between plant functional traits and combinations of environmental predictor variables. Optimised models - developed through multi-model inference - are then used to produce island-wide trait maps, and test predictions about the influence of temperature, precipitation, human disturbance, and soil characteristics. Our explorations of the links between environment and the grassy flora provide valuable insight into community assembly of Malagasy grasslands and contribute fresh evidence for the argument about their ancientness.

Merian Award Applicant

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Session 17-O14 - Current trends in tropical African plant ecology

A review of the impact of alien species on the biodiversity of a tropical oceanic island

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Tropical oceanic islands often hold global significance by virtue of their biota of high endemicity. They are also often among the last places reached by humans and are frequently among the most severely impacted ecosystems worldwide, as exemplified by biological invasions, a major driver of biodiversity loss. Mauritius (Mascarenes) epitomizes this situation and may thus serve as an interesting laboratory of research to inform conservation management. Human colonization in 1638 led to major habitat destruction and introduction of alien species, triggering substantial conservation efforts rewarded with some world renown successes. After half a century of sustained conservation efforts, what lessons for conservation may be drawn from the Mauritius experience, in particular with regard to alien species, widely regarded as the top threat to biodiversity on tropical islands worldwide? We present a first systematic review of research on the influence of alien species (AS) on the terrestrial biodiversity of Mauritius, used here as a model oceanic island, to inform future research and improved conservation management. The specific objectives are to determine (1) the diversity of AS that influence the native terrestrial biodiversity; (2) the variety of interactions [direct/indirect] through which these AS influence native biodiversity [both negatively and positively] and (3) the conservation management that has been implemented or recommended in response to AS and their influence on native biodiversity. Results revealed that some 80% of research concerning AS were predominantly about their effects on native fauna and 20% on native flora. Many mechanisms of impact by AS emerge, the main ones being predation by alien vertebrates, competition and disruption of mutualistic interaction. Some AS are beneficial for example through native seed dispersal and herbivory of alien plant species. Some 60% of recommended management measures have been implemented to some extent.

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Session 17-O15 - Current trends in tropical African plant ecology

Invasive alien plants drive inexorable loss of native woody plant diversity in a tropical oceanic island: Insight from changes over 17 years in permanently set plots

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Invasive alien plants (IAP) pose arguably the greatest threat to the terrestrial biodiversity of most tropical oceanic islands worldwide, and Mauritius (Mascarene Islands) epitomizes this situation given the high and progressing levels of invasion by IAP in its remnant native habitats. Since human colonization in 1638, the island underwent a rapid habitat transformation that spared only 4.4% of its original habitats. These remain mostly in a fragmented state predominantly confined to the moist to wet uplands. Multi-decadal research showed alien plants to be inexorably invading these vegetation remnants. To try halt or reverse the impact of IAP, the National Parks and Conservation Service of Mauritius has weeded many hectares of the Black River Gorges National Park in the 1990's, offering an opportunity for comparative study of the influence of IAP removal on native biodiversity. We investigated the effect of IAP (overwhelmingly comprised of the small tree *Psidium cattleyanum* Sabine (Strawberry Guava, native of Brazil)) and its control on the diversity of native woody plants by comparing changes on a plant by plant (monitoring of permanently tagged plants) and area by area basis (in permanently set sample plots) between 2005 and 2022 between a one-hectare (100 x 100 m) plot weeded of IAP since 1996 and a close-by one-hectare plot that has remained invaded. The results clearly show that the diversity of native woody plants is declining alongside IAP, with understorey plants being particularly affected. The results suggest that the negative impact of IAP is likely to increase in future without conservation measures like weed control. The overall findings over the 17 years of change are in line with a study that used random plots to re-survey native wet forests of Mauritius that were first sampled in the 1930's, and which showed that over 68 years, the density of native trees with trunk diameter ≥10 cm, has halved despite the presence in protected areas.

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Session 17-O16 - Current trends in tropical African plant ecology

Control of invasive alien plants from native forests of a tropical oceanic island improves forest biomass against a backdrop of strong benefits to threatened biodiversity

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Ecological restoration is crucial to reinstate or strengthen ecosystem services and conserve biodiversity. However, its cost limits its use particularly for small developing states. Carbon credits provide new potential funding for ecosystem restoration, and to explore their potential use in upscaling ecological restoration, we set out to establish the first figures of carbon stock in Mauritius' native forests and estimate its changes with alien plants invasion and with recovery after weed control. We identified and measured all woody plants in three hectares of native forest: one weed invaded and two undergoing restorations after weeding in 1996, including one well-preserved (~1,600 trees of ≥10 cm diameter at breast height (DBH) per ha) and one more degraded (~1,100 trees of ≥10 cm DBH per ha). We monitored native woody plant regeneration, growth and mortality over up to 17 years (from 2005/2006 to 2022/2023). Wood density of 85 native species were also measured, most for the first time. We present preliminary results of changes in basal area (BA: cross-sectional area of wood per hectare) meanwhile a full analysis of carbon content is computed. Annual BA change averaged -0.07% in the invaded forest, +0.43% in the higher-quality forest and +1.8% in the low-quality weeded forest. Weeds in the invaded forests contribute 13.6% of the total BA. Their removal is compensated by native plant BA increase within <17 years. Annual BA loss in invaded forests is due to elevated mortality and reduced growth and regeneration. BA gain in weeded forests is driven by faster growth and strong regeneration against a backdrop of relatively low mortality. BA change in invaded and weeded forests follow opposing trajectories such that alien plant control led to a collective native BA gain of about +0.68 m^2 per ha per year. Although modest, this comes with major

benefits to forest biodiversity, which is shown to recover strongly following the control of invasive alien plants.

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Session 17-O17 - Current trends in tropical African plant ecology

Control of invasive alien plants promotes seed dispersal mutualisms and human-wildlife conflict mitigation: Case of the flying fox *Pteropus niger* on tropical oceanic island Mauritius

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Island fruit bats play important ecological roles of pollination and seed dissemination. Yet, most are threatened with extinction, as epitomized by *Pteropus niger* in Mauritius, the only Endangered species subjected to mass-culls by a government, in failed attempts to increase profits of farmers of commercial fruits like lychee, a fruit that the bat eats. Non-lethal solutions are needed to mitigate this human-wildlife conflict (HWC), one of which may be the restoration of the bat's native foraging habitats the bulk of which is being degraded by invasive alien plants [IAP], mainly *Psidium cattleyanum*. We quantified the influence of IAP on the tree community composition of native foraging habitats of *P. niger*, in particular, the community of native plants whose fruits are eaten by the bat, by comparing the community changes between 2005 and 2023 in two adjacent one-ha permanent plots: one weeded of IAP in 1996 and one not (the control). We found that in the presence of IAP, the native tree community of species whose fruits are eaten by the bats gradually decline in species richness, density and total biomass and that the reverse is true in forests where IAP were weeded in 1996. This means that IAP invasion, which is occurring in about 95% of the island's native vegetation, is reducing the foraging habitat quality of *P. niger* by causing a gradual decline in diversity, density and total biomass of species whose fruits are eaten by the bats. The reverse is happening in areas rid of IAP. Control of IAP in native vegetation remnants is therefore a valid non-lethal solution towards mitigating the HWC around *P. niger*'s diet because it would halt the decline of native fruits available to bats before improving their availability with time. This would reduce the need for the bats to leave native forests to forage on planted commercial fruit trees, thereby alleviating the HWC. Weeding of IAP would also reinforce the bat's mutualistic ecological role in native forest remnants.

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Session 18-O2 - Tropical ecological modelling

Modelling the influence of herbivory on plant functional trait diversity and nutrient availability in a tropical mountain forest gradient

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Biotic interactions are widespread in megadiverse environments such as tropical mountain forests. Herbivores consume a significant portion of plant biomass, potentially reducing leaf area and thus productivity, but they can also accelerate nutrient cycles and improve nutrient availability. However, it is still uncertain how herbivory affects larger-scale patterns such as carbon storage or plant community trait distributions. In this study, we used a trait-based dynamic vegetation model (LPJ-GUESS-NTD, parameterized and driven using data from the RESPECT tropical mountain forest sites in Podocarpus National Park to investigate how herbivory is shaping the vegetation structure and functional diversity of these environments. By using measured leaf herbivory data, we were able to develop an herbivory module in which leaf mass loss by insects is related to plant traits. Since the model includes a dynamic soil organic matter module, we were able to evaluate how changes in plant traits, litter quality, plant demand for nutrients, leaf area reduction and herbivore-mediated nutrient input affected the balance of competition of plant individuals with different traits and impacted the forest properties. Simulated loss of foliar C,N, and P caused by herbivory corresponded broadly to field estimates from similar sites, located at the eastern slopes of the Peruvian Andes (12-19%), resulting in 12.3%, 17.2% and 17.8% removed plant mass per hectare and year for the 1,000, 2,000 and 3,000 m sites respectively. The inclusion of herbivory in the LPJ-GUESS-NTD model had a significant impact of reducing forest biomass for the three sites. Regarding plant traits, modeled communities with herbivory had significantly lower specific leaf areas (SLA) than those without herbivory. Thus, in the model, herbivory favored plants with traits that reduces damage to herbivory. We conclude that, from the perspective of a trait-based dynamic vegetation model, herbivory promotes a community shift into more conservative trait strategies with more recalcitrant tissues through the tipping of mineralization rates towards higher immobilization of nutrients.

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Session 18-O5 - Tropical ecological modelling

Tracking successional stages of the Atlantic Forest through space technology

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The Atlantic Forest is one of the hottest biodiversity hotspots on Earth. After combined efforts, the Biome started to regrow in the last decades. Correctly classifying successional stages in the Brazilian Atlantic Forest is essential for conservation due to its legal protection framework, which was built to give more protection to advanced stages. In this research, we aim to operationalize successional stage classification using ground-based and remote sensing data. The first step involved a literature review to identify successful methods for classifying our consistently collected 375 forest plot data. Our second objective explores the feasibility of using optical and radar remote sensing data (NICFI Planet, Sentinel 1 and 2, and ALOS PALSAR yearly mosaics) and artificial intelligence algorithms (machine and deep learning) for upscaling the previously classified stages and identifying the most influential variables. Age has not been a reliable variable for field data classification since planted native forests grow quicker than those areas spared to regenerate naturally. So far, the Randon Forest algorithm has accurately classified about 73% of the testing data, and further algorithms are to be implemented. Employing AI and satellite imagery provides benefits such as reliable supporting maps with periodical updates and reduced reliance on landowner reports.

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Session 19-O1 - iEcology in the tropics

A culturomics approach to map African protected areas value and vulnerability

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The protected areas (PAs) of Sub-Saharan Africa host rich biodiversity, iconic landscapes and unique opportunities to observe a diverse range of large charismatic animals. Consequently, many of these areas significantly contribute to national economies by attracting international visitors primarily interested in wildlife tourism. Despite their cultural, economic, and conservation significance, some of these parks still face threats from development (e.g., agricultural expansion, infrastructure projects, and mining) leading to pressure to downgrade, downsize or degazette (known as PADDD). One promising approach to combat PADDD is to explicitly showcase the cultural value of PAs. Such a strategy can be used to mobilize support for imperilled parks and identify avenues for boosting public interest and external investment. Here, we use a novel culturomics approach to evaluate the political vulnerability of protected areas in Sub-Saharan Africa. Our findings reveal that fewer than 30% of these areas possess comprehensive or developing management plans, even among the five most frequently viewed parks on Wikipedia. Notably, nearly 90% of parks that experienced some form of PADDD event also lacked such strategic plans. Intriguingly, while tourism did not correlate directly with public interest in a protected area, it emerged as a potential buffer against PADDD. Agricultural pressure could be related both to a PA that has greater public interest, and to a PA that has had its area reduced. Overall, our results suggest that effective conservation strategies in Sub-Saharan Africa necessitate a holistic understanding of historical, socio-economic, and cultural factors. Furthermore, it is crucial to acknowledge the importance of public interest and awareness as pertinent factors contributing to the comprehension of a protected area's vulnerabilities.

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Session 19-O2 - iEcology in the tropics

Using social media and machine learning to understand negative sentiments towards Brazilian National Parks

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Protected areas (PAs) play a vital role in the conservation of natural and cultural heritage while supporting local livelihoods. However, in Brazil, where limited resources and poor effectiveness lead to negative sentiments and are leveraged as criticism towards PAs, it is necessary to better comprehend public perceptions of Brazilian Pas and identify the key factors contributing to negative sentiments. Here, we use data from online discussions about Brazilian National Parks (NPs) on Twitter and sentiment analysis to explore this question. We classified the sentiment of ~100,000 tweets collected over a twelve-year period (2011-2022) using the BERTimbau Base model. We also performed a topic modelling with the BERTopic model to identify prevalent subjects concerning Brazilian NPs. We identified 18,388 (17.30%) posts expressing negative sentiment towards NPs, mostly associated with wildfires occurring between 2011 to 2017 and concerning government decisions impacting conservation efforts after 2019. The results revealed six prominent topics: (1) Wildfires; (2) Security; (3) Regulations; (4) Wildlife roadkill; (5) Privatization; (6) Lack of financial resources, reflecting a diverse range of negative sentiments regarding the parks, surpassing isolated events. Furthermore, examining specific topics on a per-park basis proved beneficial in identifying distinct issues and conflicts in the five most tweeted NPs, facilitating targeted conservation actions. Using social media data to better understand public perceptions of NPs can strengthen their management and governance by reinforcing their conservation initiatives and enhancing visitor experiences. Our findings underscore the value of sentiment analysis in identifying gaps and driving improvements in the management of protected areas.

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Session 20-O1 - Understory shrubs: Adapting amidst change

Unveiling the genetic diversity and structure of wild *Coffea canephora* populations in Yangambi (DR Congo) and how they are impacted by forest disturbance

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Coffee is the most widely consumed hot beverage and one of the most traded commodities. About 44% of the total global coffee market share, is attributed to Robusta coffee (*Coffea canephora*). This share is likely to increase in the future because of the crop's high disease resistance and broad climatic range fit for cultivation. Naturally, this self-incompatible species occurs in the understorey of tropical rainforests of Central and West-Africa. These forests, however, are heavily threatened by anthropogenic processes like forest degradation. This within-forest disturbance can strongly affect gene flow in understorey species, resulting in genetic erosion and changes in genetic structure. As wild populations of *C. canephora* hold a genetic diversity that is vital for sustainable coffee production worldwide, it is crucial to assess how forest disturbance is associated with the genetic diversity, genetic structure, and pedigree relations in wild *C. canephora* populations. We sampled 256 *C. canephora* individuals within 24 plots across three forest categories in Yangambi (DR Congo) and used genotyping-by-sequencing to identify 18,894 SNPs. We found a high genetic diversity, both in terms of allelic diversity and heterozygosity, across all forest categories, and no signs of genetic erosion related to anthropogenic disturbance. The identified genetic structure was mainly a result of isolation-by-distance, with low to moderate relatedness at finer scales. Populations in regrowth forests seemed to originate from different neighbouring populations and were subject to founder effects. Our results suggest that the Yangambi area is key for the conservation of *C. canephora* genetic resources, but careful monitoring of their response to ongoing forest degradation remains required.

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Session 20-O3 - Understory shrubs: Adapting amidst change

Evolutionary dynamics of central African rain forest trees and understory plants reveal contrasting responses to past climatic fluctuations

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Central African rain forests are mega diverse and harbor the world's second largest expanse of this biome. Looming over this important habitat is the threat of climate change - we know little about how this process will affect the diversity and distribution of rain forest species. Here, we infer the evolutionary and demographic dynamics of six species of trees and understory plants, belonging to two major families: palms and Annonaceae. These species are co-distributed across the rain forests of Gabon, Cameroon and the Republic of Congo. We used comparative phylogeography via a high-throughput, targeted enrichment approach to generate a genomic dataset encompassing more than 600 individuals. Levels of genetic structure varied among trees and understory plant species. Divergence between populations emerged primarily during the Pleistocene but were rarely concordant. Demographic trends ranged from repeated contraction and expansion to continuous growth. Furthermore, patterns in genetic variation were linked to disparate environmental factors, including climate, soil, and habitat stability. Using a strict refugia model to explain past TRF dynamics is too simplistic. Instead, individualistic evolutionary responses to Pleistocene climatic fluctuations have shaped patterns in genetic diversity in understory and tree species in central African rain forests.

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Session 20-O4 - Understory shrubs: Adapting amidst change

Ecological and genomic vulnerability to climate change across native populations of Robusta coffee (*Coffea canephora*)

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The assessment of population vulnerability under climate change is crucial for planning conservation as well as for ensuring food security. *Coffea canephora* is, in its native habitat, an understorey tree that is mainly distributed in the lowland rainforests of tropical Africa. Also known as Robusta, its commercial value constitutes a significant revenue for many human populations in tropical countries. Comparing ecological and genomic vulnerabilities within the species' native range can provide valuable insights about habitat loss and the species' adaptive potential, allowing to identify genotypes that may act as a resource for varietal improvement. By applying species distribution models, we assessed ecological vulnerability as the decrease in climatic suitability under future climatic conditions from 492 occurrences. We then quantified genomic vulnerability (or risk of maladaptation) as the allelic composition change required to keep pace with predicted climate change. Genomic vulnerability was estimated from genomic environmental correlations throughout the native range. Suitable habitat was predicted to diminish to half its size by 2050, with populations near coastlines and around the Congo River being the most vulnerable. Whole-genome sequencing revealed 165 candidate SNPs associated with climatic adaptation in *C. canephora*, which were located in genes involved in plant response to biotic and abiotic stressors. Genomic vulnerability was higher for populations in West Africa and in the region at the border between DRC and Uganda. Despite an

overall low correlation between genomic and ecological vulnerability at broad scale, these two components of vulnerability overlap spatially in ways that may become damaging. Genomic vulnerability was estimated to be 23% higher in populations where habitat will be lost in 2050 compared to regions where habitat will remain suitable. These results highlight how ecological and genomic vulnerabilities are relevant when planning on how to cope with climate change regarding an economically important species.

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Session 21-O1 - Ecological and social dimensions of hydropower development

Interdisciplinary approaches to quantifying the social-environmental impacts of large hydropower development

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Within the framework of the United Nations Sustainable Development Goals (SDGs) there are dedicated global targets for climate and biodiversity conservation, alongside targets for renewable energy generation, livelihoods and reducing inequalities. Trade-offs between SDGs with differing objectives can lead to damaging outcomes for people and ecosystems. Using large hydropower as a model system, this talk highlights the importance and unique positioning of interdisciplinary scientific approaches in measuring SDG trade-offs through space and time. This talk will draw on a range of applied settings and interdisciplinary approaches, including social-environmental surveys and interviews, remote sensing, and a specially-developed game for mobile phones ("Power Up!").

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Session 21-O2 - Ecological and social dimensions of hydropower development

Renewable but not sustainable: The environmental and social costs of hydroelectric dams in the Brazilian Amazon

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The generation of electricity through large hydroelectric projects is often regarded as a renewable source; however, its sustainability is questionable. In the Amazon, these projects pose severe threats to the ways of life of indigenous and traditional communities, as well as causing significant damage to the region's fauna and flora. Paradoxically, while local populations lack access to electricity, the production in the Amazon is primarily directed to other regions of Brazil. This article proposes a critical analysis of the construction of hydroelectric projects in the Brazilian Amazon, starting from the fundamental question: Why not continue building large hydroelectric projects in the Brazilian Amazon? Based on this, we detail the ideal scenario – that being unattainable - in which such a possibility would exist. The elements of this scenario would include: (1) Ensuring zero deforestation, (2) Providing effective compensation to directly or indirectly impacted human populations, (3) Conducting ecological restoration, (4) Considering future climate scenarios, (5) Maintaining the natural flood pulse of the river (flow regime), (6) Ensuring the autonomy of the directly or indirectly affected population to decide on the construction of a hydroelectric project, and (7) Preserving the degree of endemism of the local fauna and flora. However, an analysis of ongoing, under-construction, or planned projects reveals that these criteria are fully respected and cannot be fulfilled. This renders the construction of hydroelectric projects in the Brazilian Amazon unviable. To ensure access to electricity in isolated areas of the Amazon, we recommend directing investments towards more sustainable energy sources characterized by lower social and environmental impacts through small-scale production.

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Session 21-O3 - Ecological and social dimensions of hydropower development

Extending species-area relationships to the realm of eco-acoustics: Island Soundscape-Area Relationships

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1. Species-area relationships (SARs) are one of the oldest, best documented, and most ubiquitous patterns in ecology, raising its status to ecological law. However, unlike species richness, little is known about the spatial scaling of alternate dimensions of diversity. Among these other diversity types, the quantification of soundscape diversity, or the spectro-temporal diversity of all sounds present in the landscape, has seen rapid growth in recent years. Soundscape diversity metrics have successfully been used as descriptors of landscape configuration, habitat identity, ecosystem health, diel and seasonal dynamics, proxies for taxonomic diversity, and more. Still, the effects of island size on the soundscape richness remain largely unknown.
2. In this study, we examined the relationship between the soundscape richness and island size for a set of Amazonian land-bridge islands in the Balbina Hydroelectric Reservoir. We collected long-duration acoustic recordings for 69 plots on 49 islands ranging from 0.45 – 668 ha. For each island, we calculated the island-wide soundscape richness (gamma) and assessed its relationship with island size. Furthermore, to disentangle the ecological mechanisms underlying the observed pattern, we decomposed the soundscape richness into its alpha and beta components and evaluated their relationship with island size.
3. We provide empirical evidence for a relationship between the richness of acoustic traits emanating from a landscape, or soundscape richness, and island area, which we term the Soundscape-Area Relationship (SSAR). We show a positive relationship between the gamma soundscape richness and island area. This relationship breaks down at the smallest spatial scales, indicating a small-island effect. Moreover, we demonstrate a positive spatial scaling of the plot-scale alpha soundscape richness, but not the beta soundscape turnover, suggesting disproportionate effects as an underlying mechanism.
4. We conclude that the general scaling of biodiversity can be extended into the realm of ecoacoustics, implying soundscape metrics are sensitive to fundamental ecological patterns and useful in disentangling their complex mechanistic drivers.

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Session 21-O4 - Ecological and social dimensions of hydropower development

Disentangling the effects of habitat fragmentation and top-down trophic cascades on small mammal assemblages on Amazonian forest islands

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Habitat fragmentation is widely acknowledged to affect species diversity. However, the pathways through which their effects are propagated through foodwebs, ultimately driving species diversity, is less well understood. We investigated to what extent the effects of habitat fragmentation on small mammals in Central Amazonia are mediated by higher trophic levels, specifically mammal mesopredators and apex predators. Across 25 fragments and three continuous forest sites, we examined both the direct effects of habitat area and isolation on small mammal abundance and biomass and the indirect effects as mediated by predators. Species abundance was best supported by models representing both the direct and indirect effects and direct effects only, while species biomass was best supported by direct effects. Direct effect models showed that mesopredators are positively affected by island size and isolation, while direct and indirect effects model additionally highlighted the negative effect of apex predators on mesopredators abundance. Contrary to expectations, small mammal populations did not increase in the absence or lower abundance of mesopredators, suggesting that the abundance of the latter is limited by the environment. This foodweb is governed by both top-down and bottom-up forces, with the latter likely most prevalent, rendering islands more susceptible to other major disturbances.

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Session 22-O1 - Fossil fuels in tropical forests

Compensation for rights holders of unextractable fossil fuels in tropical rainforests

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To limit the increase in global mean temperature to 1.5°C, CO2 emissions should be capped at 250 gigatons. To achieve this, most of existing coal, gas and oil reserves need to remain unburned. This implies an economic cost for fossil fuel rights owners, and any successful climate policy will rely on resolving the distributional challenge of how to allocate the right to use the remaining burnable reserves. To maximize the collateral benefits of climate policies (i.e. to leave untapped those fossil fuel reserves that overlap with highly biodiverse regions and/or coincide with outstanding socio-environmental values), previous analysis has suggested that most of the pantropical rainforests should be kept entirely off-limits to fossil fuel extraction. In here, we discuss the possibility of compensating rights holders of oil and gas reserves from tropical rainforests, producing the first estimates of the financial resources needed to secure full compensation of these reserves. While climate policies and action and the development of alternative energy sources might result in leaving in the ground those FF reserves with a higher production cost, compensating owners of those specific fossil fuel reserves that overlap with highly biodiverse regions and/or coincide with outstanding socioenvironmental values might be instrumental to protecting the world's tropical rainforests from imminent threat, guiding divestment strategies to maximize the collateral benefits of climate policies.

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Session 22-O2 - Fossil fuels in tropical forests

Environmental justice for the transition away from fossil fuels in tropical rainforests

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The latest remaining carbon budget assessment indicates that, at current CO2 emission rates, the window to limit global warming to a 1.5 ºC increase may close by 2030, calling for a rapid phase-out of fossil fuels. This involves leaving large portions of known global fossil fuels reserves untapped. To do so, the selection of the fossil fuel resources that need to stay under the ground is a crucial step. In here, we develop a strategic pathway to prioritize unburnable fossil fuel reserves in tropical areas based on environmental justice indicators. In tropical rainforests, fossil fuel projects disproportionately impact and threaten Indigenous Peoples and local communities by causing severe environmental and health impacts, loss of TEK and human rights abuses. Therefore, integrating indicators of environmental justice and on the equitable distribution of the industry's adverse effects is crucial for any inclusive and socially acceptable pathway for a managed fossil fuel phaseout. This paper examines data on socio-environmental conflicts (including human rights violations, contestation, and social resistance, among others) in order to prioritise the unburnable fossil fuels in the world tropical ecosystems.

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Session 22-O3 - Fossil fuels in tropical forests

Assessing unburnable fossil fuels in the world's tropical rainforests: Scaling down to oil and gas fields and coal deposits

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To limit the increase in global mean temperature to 1.5°C according to the Paris Agreement, CO_2 emissions from 2023 onwards should be capped at 250 Gigatonnes (Lambollet al. 2023). To achieve it, approximately 89%, 56% and 58% of existing coal, gas and oil reserves, respectively need to remain unburned (Welsby et al. 2021). The world's tropical rainforests zones contain minor quantities of oil. However, oil spills and the disposal of produced water are responsible of severe health and environmental impacts on tropical rainforest and local communities, causing pollution, deforestation and fragmentation.

In this work, we build from the analysis carried out by Pellegrini et al. (2023) which employs estimates and locations of the world's conventional oil resources and socio-environmental criteria to assess the unburnable fossil fuels reserves. Focussing the study on tropical rainforests, our enhancement of the analysis involves scaling down the integrated spatial assessment model to the oil field level while incorporating gas and coal reserves. We conclude that oil gas and coal reserves in tropical rainforests with a higher extraction cost, and those are overlapping with highly biodiverse regions, natural protected areas and/or coincide with outstanding socio-environmental values should be left untapped. Our model provides clear spatial guidelines to guide fossil fuel phase-out and divestment strategies for the green transition to limit carbon emissions while enhancing collateral socio-environmental benefits.

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Session 2-P1 - Cutting-edge biomonitoring in the tropics

The Osa conservation campus: Protecting central America's greatest pacific lowland rainforest

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The Osa Conservation (OC) Campus is situated at the southernmost coastal tip of the Osa Peninsula. Its 3000+ ha of privately protected land has an elevation gradient extending from sea level to ~340 m.a.s.l and a network of over 30 km of trails that allows researchers and visitors to study old-growth primary forest, naturally regenerating secondary-growth forest (>50 yrs. old), secondary plantation forest, recently abandoned cattle pastures, and remnant forest strips. Forty 0.5-ha permanent experimental plots established in abandoned pastures in 2016 (all cattle removed in 2014-2015) and divided into four restoration treatments allow researchers to investigate natural regeneration and restoration effectiveness. A 30-m canopy tower, the only one in the Osa Peninsula, offer researchers different opportunities for canopy-related research projects. The Campus Arboretum, a member of Botanic Gardens Conservation International (BGCI), protects over 300 native, endemic, rare, and threatened tree species and spreads along 11 km of the trail network highlighting the variety of habitats and programs of the organization. The trail network also provides access to critical sea turtle nesting habitats (Piro (2 km) and Pejeperro (4.5 km)) beaches. With seven main buildings, the OC Campus can host a total of 54 visitors. The facilities include a multi-purpose National Science Foundation funded laboratory with working spaces for visiting researchers. The Campus also hosts the Osa Verde Regenerative Farm, which uses sustainable and integrated farming practices and houses a native tree nursery. The nearby Greg Gund Conservation Center, a satellite educational campus, and the Osa Nature Retreat provide additional housing and lecture spaces for researchers and other visitors. The OC Campus has hosted since its establishment in 2003 a variety of educational institutions and student groups for long-term research and hands-on science on tropical forest succession, dynamics and nutrient cycling, agroecology, aquatic ecosystems, taxonomy, global change, and human-nature interactions to sustain the resources and people in a region where nature is pushed to the extremes by climate change.

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Session 2-P2 - Cutting-edge biomonitoring in the tropics

Shedding light on the dark side of the forest: Using camera traps to uncover nocturnal plant-animal interactions in the canopy of *Handroanthus chrysanthus*, a Neotropical tree species

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The study of plant-animal interactions is crucial to understand the role that each species has in maintaining the functionality of an ecosystem. In tropical forests trees, many of these interactions take place in the canopy. However, the difficult access to this stratum limits our knowledge on species interactions during the day, and particularly during the night. Here, we used camera traps to investigate the activity and behavior of nocturnal arboreal animals during flowering, flushing and fruiting of *Handroanthus chrysanthus*, a Neotropical tree characterized by a synchronous and abundant production of flowers, fruits and leaves. For this purpose, we used tree climbing techniques to install camera traps in the canopy of 6 trees during each phenological phase. The cameras were motion triggered to record videos at day and nighttime. Over the 110 nights of recording, we could document at least 9 arboreal species. Among them, at least 2 mammal species fed on nectar and flowers, 1 fed on leaves and 1 on fruits. The significance of these observations lies in the fact that they highlight the importance of *H. chrysanthus* as a resource for nocturnal mammal species, advocating for its conservation after many years of exploitation as a timber source, and habitat destruction in favor of foreign tree species such as *Pinus patula, Pinus radiata* or *Eucalyptus globulus*.

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Session 2-P3 - Cutting-edge biomonitoring in the tropics

Automated acoustic monitoring for tropical biodiversity assessment - prospects for Small Island Developing States

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The automated survey of acoustic signals is a powerful tool for biodiversity monitoring, that has profited from the new advances in data acquisition and analysis. This kind of "big data" has an enormous potential for oceanic volcanic islands, with high anagenesis and low diversity, especially when they belong to small island developing States (SIDS), most of them in the tropical region. Here, we showcase this potential with acoustic loggers deployed in Santiago, the most populated island of Cabo Verde (east Atlantic Ocean). Using machine learning approaches, we obtained positive identification of multiple events for all terrestrial bird species that were inserted into the classification pipeline, including all terrestrial endemic species in Santiago and a new unidentified species of bat. Acoustic indices clearly captured soundscape circadian variation and differences at the spatial and circadian scale. Overall, we show that integrated use of automated acoustic monitoring along with machine learning approaches can drastically enhance the immediacy and quality of data on terrestrial biodiversity, at the spatial, temporal, and taxonomic level. This design can be much more effective than regular census techniques based on point or transect counts, minimizing costs in specialized human resources and logistics, that usually have extra costs in developing countries. At the broader perspective, this can have important consequences for the sustainable management of biodiversity on tropical oceanic small island developing States.

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Session 3-P1 - Multi-trophic networks in tropical forests

Seed dispersal by brown-headed spider monkeys in the Chocó biodiversity hotspot, Ecuador

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The Chocó rainforest in Ecuador shows exceptionally high levels of biodiversity while being heavily threatened by anthropogenic activities. Most of the forest is subject to ongoing degradation processes, diminishing populations of many species or bringing them close to extinction. Seed dispersal as a key ecological process is essential for maintaining ecosystem functioning and to understand the mechanisms of this plant-animal interaction is crucial to mitigate the consequences of forest degradation. Spider monkeys are the main seed dispersers for many plant species throughout their distribution area. The brown-headed spider monkey (*Ateles fusciceps*), one of three primate species of the Chocó, is endangered (IUCN category EN). In this study, we aimed to assess the diversity of dispersed seeds, the impact of gut passage on germination rates, and dispersal distances. We followed groups of brown-headed spider monkeys within the Tesoro Escondido conservation area in Esmeraldas, Ecuador, from March to August 2023. During 148 contact hours on 63 days, we recorded 330 feeding events on 82 plant species from 33 families. 73% of the feeding events involved ripe fruits from which spider monkeys swallowed the seeds. We collected 283 faecal samples containing seeds of 60 plant species. We conducted germination experiments using 221 seeds from 9 plant species regularly consumed by spider monkeys. Seeds collected from faeces showed a higher germination rate (64%) than seeds collected from ripe fruits (29%). We directly observed 29 dispersal events, in which we were able to clearly assign a mother tree to seeds found in spider monkey faeces. Seeds were deposited at distances of 3 to 665m from the mother tree (mean=221m, median=230m). Our preliminary results are in line with the notion that spider monkeys play an important ecological role due to their seed dispersal activity. In heavily threatened ecosystems such as the Chocó, the extinction of these important seed dispersers would result in a dramatic reduction in regeneration potential.

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Session 3-P2 - Multi-trophic networks in tropical forests

Unveiling the role of bats and birds in rice pest control: A case study in Guinea-Bissau's rice paddies

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Rice is consumed by over 3.5 billion people worldwide and is considered a main stapple food in West Africa. Rice paddies also represent an important habitat for many species, some pests, others pest controllers. For Guinea-Bissau, a country reliant on subsistence-based rice production, integrated pest management is imperative. In this agroecosystem, insectivorous species can promote sustainable agriculture and food security. We employed a network approach to explore how a community of flying vertebrates may contribute to natural pest control. Faecal pellets were collected from bats and birds in 7 rice fields in the Oio region (GB), from 2021 to 2022. DNA metabarcoding was used to gather information on the predation of insect pests. Our findings revealed that 57 predator species, 24 bats and 33 birds, preyed on 17 insect orders and 1410 insect species. Hemiptera, Coleoptera, Orthoptera and Lepidoptera, recognized globally as insect rice pests, were the most consumed groups. Network analysis revealed low nestedness, specialization, niche overlap, and modularity (nine modules). Insects were predated by 7 species on average. These results point towards a low redundancy between specialist and generalist species and a high complementarity in predator diets. Among the most important insect predators (higher degree and species strength) were bats (e.g., *Scotophilus sp.*, *Hipposideros spp.*, and *Mops condylurus*), whereas *Ploceus cucullatus* was the only important bird. Nevertheless, abundance may play a role on the importance of these species. Despite some species showing disproportionate contributions to pest control, warranting targeted conservation, our results underscore the importance of a diverse predator community for effective pest control services in the region. This study sheds light on the structure of ecological interactions in rice paddies, offering insights for the development of sustainable and robust pest management strategies in West African rice landscapes.

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Session 3-P3 - Multi-trophic networks in tropical forests

Trophic simplification of predator-prey mammal systems in postwar Angola

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Global declines in terrestrial mammal populations are often exacerbated in post-war regions, disproportionately impacting larger ungulate species, particularly susceptible to overhunting. This trait-dependent defaunation may disrupt essential ecological processes, such as predation, significantly impacting ecosystem functioning. In the aftermath of Angola's prolonged armed conflict, large mammalian predator populations of Bicuar National Park persist on a depauperate prey base following the local extinction or depletion of ungulate populations. Using faecal DNA metarbacoding and high-throughput sequencing techniques, we assessed the dietary patterns of the extant large carnivore guild – spotted hyena (*Crocuta crocuta*), leopard (*Panthera pardus*), African wild dog (*Lycaon pictus*) – to understand how predation networks emerge in war-shaped mammal assemblages. We found the three carnivores to predominantly prey on ungulate species, albeit with a 71-79% contribution of the small sized common duiker (*Sylvicapra grimmia*) to their diets. Accounting for indicators of prey abundance, duikers were the only species to be actively selected by all three predators. Exceptions included spotted hyena's preference for bushpig (*Potamochoerus larvatus*) and kudu (*Tragelaphus strepsiceros*). Our results highlight a pattern of trophic simplification in the local predator-prey system, characterized by accentuated dietary overlap and a skewed preference for a primary, locally abundant prey species, despite the persistence of alternative ungulate prey. Further research is needed to ascertain whether the observed patterns result from low abundances of alternative prey, the loss of prey diversity across the body-size spectrum, or the challenges faced by gregarious predators occurring at low densities in capturing larger prey. This knowledge is crucial for informing conservation strategies aimed at the recovery of an adequate prey base and the functional restoration of postwar ecosystems.

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Session 4-P1 - Tropical chemical ecology

The role of floral scent for wasp attraction in *Pityrocarpa moniliformis* (Mimosoideae: Fabaceae)

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Wasps as an understudied group of pollinators, are known to be attracted to flowers by scent and flower morphology, often involving signals associated with food or prey when pollinated by predatory wasps. Studies revealed characteristic foraging patterns for wasps with high activities in the late morning and at the heat peak of the day. In this study, the importance of floral scent in attracting flower visitors of *Pityrocarpa moniliformis*, native to the Caatinga, a semi-arid region in the Northeast of Brazil, was investigated. For the first time, GC-MS analysis of the floral scent of young and old flowers of *P. moniliformis* and GC-EAD (Gas Chromatography coupled to Electroantennography) with the main visitor, *Polybia sericea*, a social wasp species, were conducted. We investigated the scent bouquet and the scent components perceivable by wasps. Y-maze tests were conducted to evaluate whether floral scent alone is responsible for wasp attraction. Wasp visitors of *P. moniliformis* were present on the inflorescences mainly at midday until the heat peak of the day. The chemical analysis revealed a difference between the two floral stages and substances attractive to wasps associative with food or prey, such as Green Leaf Volatiles (GLVs) and direct prey signals, both turning out to be EAD-active. The bioassays, testing the attractiveness of scent of different ages of flowers of *P. moniliformis* and different species of wasp visited flowers, revealed a trend towards the younger flower stage and indicate that also visual cues might be important for the attraction of *P. sericea* as a pollinator. However, the classification of *P. moniliformis* as a generalist pollinator system with characteristics of wasp pollination is strongly suggested by this study but needs to be verified by additional data.

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Session 5-P1 - Adaptations of Neotropical biodiversity to changes

Center for Research on Biodiversity Dynamics and Climate Change, a Brazilian center dedicated to research, innovation and science dissemination

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The unprecedented loss of biodiversity and the imminent threats of climate and environmental changes are among the most important challenges faced by humanity. Biodiversity continues to decline worldwide mainly in response to urban and agriculture expansion over natural areas. In addition, climate change is projected to commit over one-third of the Earth's animal and plant species to extinction by 2050. We present a Research, Innovation and Dissemination Center (RIDC) on Biodiversity Dynamics and Climate Change (CBioClima): a unique, innovative research centre congregating experts on science, diffusion, and innovation to produce global class and cutting-edge research and solutions targeting the current loss of biodiversity, its synergism with climate change and the consequences to human well-being. These threats include climate and other anthropogenic (e.g., the frequency and intensity of droughts and fires, habitat loss, habitat fragmentation, defaunation, invasive species, unplanned agricultural and urban occupation, leading to geographic expansion of degraded lands) and social changes (e.g., overpopulation, increasing poverty in urban areas, social and gender inequality), as well as ways to reverse these trends to ecosystem restoration. Framed by the United Nation Sustainable Development Goals (SDGs), the CBioClima mission is to establish an observatory of biodiversity and climate change research, and to promote innovation focused on science-based sustainable solutions and accelerating diffusion of knowledge, aligned with the United Nations Sustainable Development Goals. CBioClima includes four work packs: Synthesis and big-data, Next-generation natural history, Dimensions of biodiversity, Microbiomes for sustainable solutions.

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Session 5-P2 - Adaptations of Neotropical biodiversity to changes

Different but not isolated: Investigating reproductive barriers and morphological divergence between ecotypes of *Epidendrum fulgens*

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Plant species with wide geographic distribution can occur in contrasting environments and be subject to divergent natural selection pressures due to environmental characteristics. This can cause a decrease in gene flow between them, which can lead to the development of reproductive barriers, in addition to an intraspecific variation in morphological traits between populations. In this study, we investigate reproductive barriers and floral morphologic differentiation between genetically distinct ecotypes of *Epidendrum fulgens* (Orchidaceae) from two geographically separate habitats (coastal sand dunes and inland rock outcrops). We combined two methodologies, a classic approach in reproductive biology studies, which consisted of manual crossings and subsequent evaluation of fruit set and seed viability, to reach potential post-mating reproductive barriers, and geometric morphometrics to identify potential differences in floral shape. Elevated levels of fruit set were observed, indicating a negligible prezygotic barrier. Seed viability rates were highly variable: self-pollinations had significantly lower rates, indicating the presence of inbreeding depression on the species, and higher rates were found for cross-pollinations, but with a particularly high variance on the crosses between different ecotypes, suggesting that we may be facing non-fixed incompatibility genes in the species, as gene flow between ecotypes is probably constrained by reduced seed dispersal, but not by pollen dispersal. For morphometric analysis, we found a significant shape differentiation between ecotypes, indicating that they have a great floral morphological differentiation, probably due to divergent selective pressures. Our contrasting results offer an opportunity to explore different and unexpected outcomes of the mechanisms governing the first steps of species formation, and highlight the non-obligatory linearity of the speciation process and the importance of multidisciplinary approaches.

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Session 5-P3 - Adaptations of Neotropical biodiversity to changes

Impacts of salinity on Guatemalan marigold (*Tagetes patula* L.) flowers: Small and fewer flowers despite high antioxidant performance

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Salinization is an increasing problem worldwide. To counterbalance the effects of salinity, plants activate a complex detoxification system, which can help to mitigate the harsh effects of this stress but can also impose constrains to plant reproduction and growth. In this study, we investigated the impacts of salinity (0, 50, 100, 300 mM NaCl) on the marigold flowers of *Tagetes patula*. This flowering species within the daisy family is native to Mexico and Guatemala, with several naturalised populations in many other countries, where it is also commercialized. Here, we recorded how salinity affects total carotenoids, polyphenols, and flavonoids, as well as the activities of the antioxidant enzymes. Results showed an overall increase in all antioxidant compounds was reported as salinity increased, revealing the fast action of enzymatic and non-enzymatic defence components to cope with stress. However, high salinity levels (e.g., 100 and 300 mM) had a strong negative impact on plant and flower production, significantly compromising flower viability.

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Session 5-P4 - Adaptations of Neotropical biodiversity to changes

A 10-year case study: How do global changes influence hummingbird survival and phenology?

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The high reliance of hummingbirds (Family Trochilidae) on pollen, as an important food source, makes these birds particularly vulnerable to seasonal variations in the availability of nectar-producing plants. As such, changes in precipitation levels could be expected to have important impacts on hummingbird phenology. A better understanding of the impacts of global changes on these specialist bird species is therefore vital to developing reliable conservation strategies for them, as well as human modifications of landscapes may have already altered their behaviour. We measured variation in morphological traits among individuals and across 10 tropical and Neotropical hummingbird species with various geographical ranges and ecosystem associations. Species morphology was compared to population trends from road surveys across a 10-year dataset, and capture-mark-recapture was used to estimate survival-by-species. Through mark-recapture analysis, we tested the correlative relationship of species survival to precipitation, standardized to a 100-year mean, and projected climate changes were used to estimate future precipitation-by-species distribution. We showed that variation in bill, wing, and tail length did not strongly correlate with estimated population trends across most species, although of the species examined, those that exhibited the least variation among morphological traits also had declining populations. We observed differences in the timing of hyperphagia (mass gain preceding fall migration) among three species while also noting a negative correlation between precipitation levels across their breeding ranges and their estimated population trends. Overall, we conclude that global changes and landscaping within human-influenced landscapes are key considerations in supporting the conservation of tropical and Neotropical highly-specialist and migratory species, such as hummingbirds.

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Session 5-P5 - Adaptations of Neotropical biodiversity to changes

Withdrawal and expansion: A decade of dynamic ungulate distribution in Amazonian lowland sanctuaries (2010-2020)

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Neotropical ungulates favour undisturbed habitats. Forest conversion to agriculture is the main driver of the contraction of tropical large mammal distributions. In the Amazon, although Protected Areas (PAs) effectively reduce forest loss, deforested area has been growing inside within their boundaries in recent decades. Here, we aimed to study variations on ungulate distribution inside and outside PAs of the Amazonian lowlands over the last decade. We used data on ungulate presence, climate and landscape to predict species presence and absence in 2010 and 2020 through Maxent. Overall, rainfall and primary habitats positively influenced ungulates. Generally, distribution expansion and contraction were both predicted to be the highest in unprotected lands. Range contraction was higher in PAs established before 2010 (PA2010), whilst greater expansion was, in general, predicted in PAs created between 2010 and 2020 (PA2020). Results in PA2020 suggest that those PAs are more effective than PA2010 at preventing habitat loss and/or are yet to be exposed to heavy environmental deterioration. Further, our findings also suggest that PA2010 still retain elements important to ungulate conservation; however, there is a possibility that their adequacy for these species could be gradually diminishing. In turn, ungulate distribution may drift towards locations apparently more suitable in unprotected lands, where extinction risk may be greater.

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Session 5-P6 - Adaptations of Neotropical biodiversity to changes

Impacts of small-scale artisanal gold mining on understory bird communities in Guyana

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Gold is currently the second most mined metal globally, with much of it occurring in carbon and species rich tropical forests. The Guiana Shield region in northern South America accounts for 26% of Amazon forests. However, this region is increasingly under pressure from a rise in artisanal gold mining, which accounts for ~90% of forest loss in the region. This study investigated the impacts of gold mining on understory bird communities and the resulting community changes. Birds are known to be impacted by forest loss and fragmentation to varying degrees and are as such excellent indicators of forest degradation and resulting ecological edge effects. Using mist nets, we sampled bird communities within 16 abandoned gold mines in Guyana. We sampled within the mines, at the edge of the mines, and 100m into the forest, comparing these communities to control sites where no mining had occurred. We find that that bird communities 100m into the forest are more-or-less indistinguishable from control sites, indicating that edge effects extend less than 100m into the forest. However, the communities were significantly different at the edge and within the mine. Forest-dependent bird species, mostly understory insectivores, had lower abundance and species richness in mined areas compared to control sites. Insectivores showed the greatest recovery of species richness after mining, with older mines having higher species richness than newly abandoned mines. As such we find signs of recovery over time, with forest-dependent species richness increasing from the time since the abandonment of the mines.

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Session 7-P1 - Tropical forest/tree functioning

Horizontal composition of miombo species in two areas with different fire frequencies – Gilé National Park, Zambezia Province

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The miombo ecosystem is one of the most important in Mozambique due to the ecosystem services they provide, occupying an area of around 2/3 of the country's forest cover. And it has been one of the most studied in the country, to understand the dynamics of ecological processes. With the aim of understanding the composition of the miombo of Gilé National Park under the effects of fires, which is currently the only conservation area that does not have human populations residing within its limits. Using remote sensing techniques, a base map of fire frequencies was produced, a product of burned areas MODIS MCD64A1, where, based on this map, two strata were established, one where there are frequent fires and the other where fires do not occur. Around 59 plots were established, two of which in regions without fires, and 57 in places where fires occur. Where measurements were taken of the following parameters: Diameter and chest height (DBH), and total height. The species that occur most frequently in PNAG were: *Brachystegia spiciformis* Benth, *Brachystegia boehmii* Taub., *Julbernardia globiflora* (Benth.) Troupin, *Pterocarpus angolensis* DC., *Pseudolachnostylis maprouneifolia* Pax, *Diplorhynchus condylocarpon* (Muell.-Arg.) Pichon, *Burkea africana* Hook., *Deinbollia oblongifolia* (E. Mey. ex Arn.) Radlk., *Erythophleum africanum* (Welw. ex Benth.) and *Strychnos sp.*, respectively, and it was found that there are no significant differences ($p>0.704$) between the index values importance value of each species, which occurs in regions with fires and regions without fires.

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Session 7-P2 - Tropical forest/tree functioning

Functional composition in different canopy strata in unmanaged *Eucalyptus* plantations

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Different forest restoration methods can be applied to help mitigating forest loss effects on climate change, and one of the most controversial methods is planting monospecific tree stands to encourage native species regeneration. To evaluate if restoration efforts are contributing to ecosystem function and stability, the functional trait-based approach as a proxy to functioning can be useful; however, few restoration studies in the tropics take this approach, particularly when considering naturally regenerating forests under tree monocultures. In this context, our objective was to assess how forest type, stand age, canopy strata and macroclimate affect functional composition, focusing on stem, leaf and reproductive traits. We studied unmanaged *Eucalyptus* plantations and naturally regenerated forests sampled along a climatic gradient in São Paulo state, Brazil. In each plot, we measured and identified all trees and measured wood density, specific leaf area and leaf thickness. Dispersal syndrome data was gathered from existing databases. We divided the trees into different canopy strata, calculated the community-weighted trait means (CWM) for each trait for each strata and created models to test the effects of forest type, stand age, canopy strata and macroclimate on CWM values. We created models including and excluding *Eucalyptus*. Surprisingly, age was not significant for any of the considered traits. When including *Eucalyptus*, CWM of the forest types differs because the top strata of unmanaged plantations is dominated by Eucalyptus. However, when removing Eucalyptus, CWM did not differ between the forest types, with understory trees presenting conservative strategies for reproductive and leaf traits. In drier sites, the stem and leaf traits were more conservative and acquisitive than wetter sites, respectively. The results suggest that the functional composition of tree community growing under Eucalyptus is similar to the community regenerating in abandoned areas.

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Session 8-P1 - Free Session

Dietary segregation between two sympatric West-African swallows: Red-chested Swallow *Hirundo lucida* and Wire-tailed Swallow *Hirundo smithii*

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Swallows (Hirundinidae) are amongst the better-known groups of birds, due to their proximity to humans and their ubiquity, found on every continent except Antarctica. Nevertheless, there is still a big knowledge gap about some of these species, with most research effort being channelled to European and North American species. The ecology and diet of some of these species, especially African ones, are still poorly known, which is an important barrier to their conservation. Due to their adaptation to aerial insectivorous feeding, their morphology and feeding behaviour are somewhat similar across all species, and several species may share the same foraging sites. Competition for food resources can lead to food segregation, differentiating the diets of sympatric species. Here, we used DNA metabarcoding and next-generation sequencing to describe the diet of two sympatric, poorly studied, West African swallow species: Red-chested Swallow *Hirundo lucida* and Wire-tailed Swallow *Hirundo smithii* and assess the possible existence of dietary segregation between them. We collected excrements from swallows captured using mist nets deployed in smallholder rice fields in Guinea-Bissau, West Africa. Preliminary results show the Coleoptera Order to be the most frequent prey of both species, with Chrysomelidae being the most frequent family in the diet of *H. lucida*. Despite the overlap of habitat and foraging range, these two species showed differences in prey selection, sharing only three out of the 71 prey types identified in their diet. This study represents the first effort to apply DNA metabarcoding and next-generation sequencing to dietary analyses of *Hirundo* species in Africa and provides a useful methodological approach for future studies concerning the diet of closely related avian sympatric species and dietary segregation.

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Session 8-P3 - Free Session

Disturbance dynamics: Abiotic understory characteristics that are altered by selective logging and elephant trails impact seedling performance in a Gabonese tropical forest

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Selective logging can impact the diversity, composition, and ecosystem dynamics in forests, impacting forest conservation. Studying the ecological consequences of selective logging can inform forest management to ensure that selectively logged forests maintain ecological integrity and can support landscape-level conservation goals. Our study analyses vegetation data over a three-year interval across a logging chronosequence to assess logging impacts on understory characteristics and seedling dynamics. We found that selectively logged forest understories had i) greater prevalence of logging damage (i.e., branch/treefall and woody debris in the forest understory) up to fourteen years post-logging compared to unlogged forests, ii) higher light levels up to four years post-logging compared to unlogged forests, and iii) greater prevalence of elephant trails in the forest that was logged fourteen years prior compared to unlogged forests. Additionally, these abiotic variables – logging damage and light – negatively impacted seedling survival, while elephant trails had both negative impacts on seedling survival and positive impacts on seedling regeneration. Finally, we found that the strongest impacts of logging on seedling dynamics occurred up to four years post-logging and seemed to be explained by the changes in the abiotic understory characteristics (logging damage and light). Overall, the impacts of selective logging on seedling dynamics appear to be small and temporally limited, resulting in changes up to four years post-logging, but not permanently altered ecosystem dynamics. Additionally, our study highlights the role of elephants in natural disturbance processes that shapes vegetation dynamics. Understanding both the impacts of anthropogenic and natural disturbance processes is critically important for managing forest ecosystems and can improve the likelihood that high ecological integrity in timber production forests is maintained.

Session 8-P4- Free Session

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The problem of conserving an ecosystem that has not been completely delineated and mapped: The case of the Cocais Palm Forest

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Land cover changes threaten biodiversity and alter the geographic distribution of forests worldwide. Studies on this topic are important to establish conservation strategies and public policies. However, different studies may propose different spatial representations due to differences when identifying, classifying, and/or mapping the same vegetation formation, as observed for the Cocais Forest region. This palm-dominated ecosystem predominates the Brazilian mid-north region in an ecotone region with 3 of the 6 Brazilian biomes. We conducted a literature review of studies that delineated and mapped the Cocais Forest, aiming to compare different mapped regions and to establish a new distribution map integrating these spatial data. We found seven sources that revealed spatial divergences in identifying the spatial distribution of Cocais Forest, including its characteristics in terms of size and shape, which could affect the conservation, socioeconomic, and cultural policies and studies carried out on this emblematic vegetation formation and influence area. The delineation proposed by de Sousa Nascimento and Lima (Revista de Políticas Públicas 189–192, 2016) encompassed the largest area. In addition, there was a lack of consensus regarding the nomenclature for this ecosystem, and few works offered a detailed description of the mapping process. Despite the different spatial distributions found for the Cocais Forest, we succeeded in establishing a common area by overlapping individual maps, resulting in the identification of a core region exclusive located in the State of Maranhão.

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Session 8-P5 - Free Session

Vertebrate taxonomic and functional hotspots in the Brazilian Atlantic Forest

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The Atlantic Forest is one of the most important biodiversity hotspots in the world due to its high diversity and levels of endemism added to the high environmental impact due to anthropogenic actions. However, few studies have examined the effects of environmental conditions by analysing different taxonomic groups simultaneously or multiple dimensions of diversity. Here, we aim to find the main drivers of the taxonomic and functional richness and functional dispersion of vertebrates across the Brazilian Atlantic Forest. We also aim to identify hotspots of vertebrate diversity and quantify the extent to which they are legally protected. For this, we gathered data on the occurrence of vertebrates based on the most recent databases for Atlantic Forest vertebrates and measured taxonomic richness, functional richness and functional dispersion. We then related variation in diversity, within each group and overall, to environmental and landscape variables, and we modeled the diversity of each group for the entire extent of the Atlantic Forest. We found that taxonomic and functional richness and functional dispersion were driven by environmental and landscape variables for most taxonomic groups. The main hotspots of taxonomic richness are in the central region of the Atlantic Forest, whereas those for functional diversity are in the southern region of the biome. Only a little over 10% of the Atlantic Forest is covered by protected areas, and as such, the vast majority of the medium and high diversity areas fall outside of protected areas and are therefore not legally protected. Our findings support the evidence that different groups of vertebrates have different responses to the same environmental conditions, including the predicted positive effects of the amount of forest in the landscape and precipitation and the negative effects of agricultural areas on vertebrate diversity. Finally, our results show that most diversity hotspots are outside of legally protected areas.

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Session 8-P6 - Free Session

Production of babassu coconut almonds in the "core" region of the Cocais Forest

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Among the various palm trees that make up the Cocais Forest, the babassu palm stands out as one of the non-timber forest products with significant economic, social, and ecological importance in Brazil. It is among the most profitable in terms of production value, according to data from SIDRA/IBGE, base year 2019. However, the production of babassu almonds has decreased over the years in response to the pressure from the land use transformation process on the Cocais Forest. This study aimed to define, using remote sensing tools, the municipalities that constitute the "core" region of the Cocais Forest based on seven spatial distribution references, and assess the productivity of babassu almonds in these municipalities. The data were processed in shapefile format and, when necessary, georeferenced using QGis 3.18 Zurich® software. Vectorial information about municipality boundaries was obtained from the IBGE database. Production values and productivity of babassu almond were obtained from SIDRA, base year 2019, without distinguishing between babassu palm species. It was observed that the region demarcated as the "core" of the Cocais Forest is predominantly in the state of Maranhão, state which produced a total of 45,167.00 tons of babassu almonds in 2019. Comprising 14 municipalities, the production in the "core" region accounted for about 9% of the state's total. However, this percentage is still lower than the value of the state's largest almond producer, Vargem Grande municipality (9.61% of Maranhão's production). No relationship was observed between territorial extension and the ranking of babassu almond production among the municipalities in the core region. Studies focusing on the socio-economic aspects of these municipalities and their correlation with the information in this study, along with the inclusion of land use transformation data, can contribute to the discussion of the findings.

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Session 8-P7 - Free Session

Floristic clues to the origins of the Dahomey Gap from the Ewe-Adakplame forest (Benin, West Africa)

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The Dahomey Gap is a 200 km wide dry corridor in western Africa dominated by grasslands and containing patches of forest. Records of past vegetation change from within the Dahomey Gap suggest that the region could have been more extensively forested as recently as c. 3400 years ago. However, the degree to which the forest patches of the Dahomey Gap are related to the rainforest blocks to its west and east remains poorly parameterized. Here we compare floristic data from a forest patch within the Dahomey Gap (Benin) with floristic data from the forests to the west (Ghana) and east (Nigeria). The vegetation data used were checklists from: (1) Ewe-Adakplame Forest (Benin), (2) Kogyae Strict Nature reserve (Ghana), (3) Igbo-Olua Sacred Grove (Nigeria), and (4) Okomu Forest Reserve (Nigeria). Presence/absence data were used to compare checklists at three taxonomic levels (species n=376, genus n=267, family n=74). At each taxonomic level the non-native species and cultivars were excluded and the Jaccard similarity index was calculated. At all taxonomic levels the highest similarity was found between the two Nigerian datasets (0.093 at species level), and then between the data sets from Benin and Ghana (0.071 at species level). Despite the closer geographic proximity to the Nigerian forests to the east the forest patches of the Dahomey Gap (Benin) were therefore shown to have a closer floristic affinity with the forests in Ghana to the west. The floristic linkage to the forest to the west suggests that recent connectivity between the forest patches most likely came about due to the eastward expansion of the range of species in the western African rainforests.

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Session 8-P8 - Free Session

Assessing colonization trends of translocated ungulates using camera-trapping data

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Angola is one of the regions of the world that suffered greater biodiversity losses, due to the extensive sociopolitical instability and armed conflicts that severely affected the country and its wildlife. Reintroduction efforts of extirpated species have been enacted locally to reverse war-induced defaunation, however, the success of these interventions often lacks empirical support. In November 2020, five ungulate species, Giraffes (*Giraffa giraffa angolensis*, N = 4), plains zebras (*Equus quagga*, N = 19), common elands (*Taurotragus oryx*, N = 20), and black-faced impalas (*Aepyceros melampus petersi*, N = 40), were released into the Cuatir Conservation Area in Angola, an open system private reserve, which encompasses a 800ha core conservation area partly delimited by a ungulate-proof fence. Spatial colonization patterns of each species from the release zone were then monitored using camera-traps over the following year and characterized using dynamic occupancy models. Our findings show that all species were able to increase their ranges in the new environment, however each species showed different post-release colonization trends according to their ecological, biological, and behavioral features. Notably, temporal trends positively affected black-faced impala colonization, while habitat types had varying effects among species. Our results also highlight the role of the fence as a barrier to animal movement, since colonization probabilities for most species were low outside the fence, except for greater kudu. This work provides guidance for future reintroduction efforts, by showcasing species-specific post-release colonization patterns, as well as the impact of barriers into the colonization process. This study also shows the importance of long-term monitoring effort pre- and post-reintroduction to better understand success factors of reintroductions and thus support the global restoration effort.

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Session 8-P9 - Free Session

Inter-annual changes in plant phenology in a tropical ever-wet forest community of Western Amazonia

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Climate models predict that everwet western Amazonian forests will face warmer and wetter atmospheric conditions, and increased cloud cover. It remains unclear how these changes will impact plant reproductive performance, which plays a central role in sustaining food webs and forest regeneration. Warmer and wetter nights may cause reduced fruit production, via increased dark respiration rates or alteration in the reliability of cue-based processes. Additionally, more persistent cloud cover should reduce the amounts of solar irradiance, which could limit fruit production. We tested whether interannual variation in fruit production has changed in response to fluctuations in irradiance, rainfall, temperature, and relative humidity over 18 yrs. in an everwet forest in Ecuador. Analyses of 203 plant species showed that fruit production declined as nighttime temperature and relative humidity increased, suggesting that warmer nights and greater atmospheric water saturation negatively impacted reproduction. Species varied in their reproductive responses to climatic variables, but this variation was not explained by life form or phylogeny. Our results shed light on how plant communities will respond to climatic changes in this everwet region, in which the impacts of these changes have been poorly studied compared with more seasonal Neotropical areas.

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Session 9-P1 - Tropical biomonitoring in a molecular era

Faecal DNA metabarcoding and stable isotopes shed light on the short-term and long-term diet of frugivorous bat species in Papua New Guinean rainforests

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Papua New Guinea (PNG) stands out as a biodiversity hotspot, hosting a total of 95 bat species that span various trophic levels and niches. Despite this richness, studies are sparse, and species are largely understudied. Consequently, detailed dietary information for most of the species is lacking, resulting in a very limited understanding of the interaction networks linking bats to their diet items. In this study, we collected faecal samples and fur from five frugivorous bat species within two rainforests of the Madang province, Papua New Guinea. Employing DNA metabarcoding for plants enabled us to investigate their short-term diet, while stable isotope analysis provided insights into their long-term dietary patterns. Our results reveal within-species variation in diet detection between the two rainforests, and report some of the first detection of diet items for the focal bat taxa. This study represents a comprehensive first effort to apply DNA metabarcoding to bat diets in Papua New Guinea, providing rich and novel information into the ecology and conservation of PNG bats.

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Session 10-P1 - Biodiversity and sustainable tropical agriculture

Consequences of replacing natural savannas with eucalyptus plantations and soybean fields for the taxonomic and functional diversity of bats in the Amazonian savannas

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The conversion of natural habitats into plantations is among the greatest threats to Neotropical biodiversity. This conversion has occurred over time, including in areas with a dominance of non-forest vegetation, such as savannas, with direct impacts on different taxonomic groups, including bats. Focused on this, our main aim in this study was to understand the consequences of replacing natural savannas with eucalyptus plantations and soybean fields on taxonomic (richness, diversity and evenness) and functional (richness, diversity, dispersion, evenness and redundancy) dimensions of bat diversity, considering the families Phyllostomidae and Mormoopidae, from the Amazonian savannas that occur in the state of Amapá, northeastern Brazilian Amazon. To achieve this objective, we captured 2311 bats belonging to 41 bat species in natural savannas and forest patches, eucalyptus plantations and soybean fields that replaced natural savannas, and forest patches adjacent to these plantations. Our results showed that bats continue to use the landscape after replacing the natural savanna matrix with eucalyptus plantations. However, converting savannas to eucalyptus plantations leads to lower taxonomic diversity and taxonomic and functional equitabilities. In soybean plantations, there is a drastic decrease in the occurrence and abundance of species. In the forest patches of these planted landscapes, the taxonomic and functional richness and diversity increased. Thus, establishing these plantations may seem favourable for the forest patches in these landscapes. However, the presence of eucalyptus plantations and soybean fields also decreased taxonomic and functional equitabilities. These changes could negatively impact different ecosystem services provided by bats.

It is urgently necessary to implement and increase the effectiveness of policies for managing the Savannas of Amapá to guarantee the conservation of the different habitats that comprise this Amazonian ecosystem.

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Session 10-P2 - Biodiversity and sustainable tropical agriculture

Gleaning insectivorous bats eat seasonably on a West African rice farming landscape: Implications for ecosystem services

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Throughout the history of agriculture, pests have been a constant threat to agriculture, affecting production through crop damage and yield loss. In developing countries such as Guinea-Bissau, where rice farming is a major source of income, the population often lacks the financial means to acquire modernized farming techniques and pesticides. An effective and low-cost method for controlling arthropod pests is the use of biological control, such as insectivorous bats. Studies indicate that insectivorous bats significantly contribute to suppress some crop pests. However, the feeding ecology of most African species is still poorly understood, hindering their potential ecosystem service. Using metabarcoding and next-generation sequencing techniques we aim to analyse the seasonal changes in the diet of a small colony of slit-faced bats (*Nycteris* sp.) in an agricultural landscape across the year in Guinea-Bissau, West Africa. Fifteen samples were collected bimonthly from two colonies in abandoned houses in the region of Oio, from June 2022 to December 2023. Preliminary results from 246 samples collected in the second half of the first year confirm that slit-faced bats prey on arthropods considered agricultural pests from at least 69 families. Araneidea spiders are common throughout the sampling period, peaking during the rainy season (June to September), while bush-crickets (Tettigonidae) become the predominant prey as it gets dry, reaching over 40% of the identified items in November. Our findings can guide landscape and crop management strategies to enhance ecosystem services provided by a species that frequently uses human structures, improving living standards for rice and other producers in Guinea-Bissau by reducing crop damage caused by pests and optimizing agricultural practices. Furthermore, a deeper understanding of these ecosystem services may raise awareness and improve the public perception of bats in Guinea-Bissau and other African regions.

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Session 10-P3 - Biodiversity and sustainable tropical agriculture

Guild-dependent patterns of bird abundance along the rice growth cycle in lowland rice fields of Guinea-Bissau (West Africa)

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In the West African rice belt, this cereal is the primary staple food produced by 16 countries. This includes Guinea-Bissau, where 75,2% of households participate in its production. While fundamental for people, rice fields are also considered of critical importance to birds, often replacing the once existing natural wetlands. Our study delves into the relationship between the rice growth cycle and temporal bird abundance patterns in lowland rice-fields. Specifically, our objectives were twofold: (1) to comprehend how bird abundance varies throughout the rice cycle, both generally and for each of the five pre-defined feeding guilds, and (2) to identify species richness variation patterns associated with the rice growth cycle. To assess bird communities in rice fields, we conducted nine transects, across seven lowland rice fields, during two annual rice cycles. Birds were pooled into five feeding guilds: frugivores and nectarivores, invertebrate eaters, plant and seed eaters, vertebrate eaters (including fish and carrion) and omnivores. Preliminary results using Generalized Additive Models reveal distinct variations in the five feeding guilds during the rice cycle. Some patterns are particularly evident such as the one displayed by the invertebrate eaters that seem more abundant during the rice vegetative and reproductive stages, declining when the rice is mature and during harvest. Additionally, overall species richness also appears to decline throughout the rice cycle. This study is part of a broader project aiming to understand the ecological and economic value of birds as rice insect pest suppressors in lowland rice fields of West Africa. Our goal is to contribute to the knowledge on how to increase rice production through ecological intensification, thereby benefiting local communities while concurrently preserving the bird biodiversity.

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Session 10-P4 - Biodiversity and sustainable tropical agriculture

Sowing seeds, soaring feathers: Exploring the role of temporal and spatial heterogeneity in shaping bird assemblages of Guinea-Bissau's freshwater rice fields

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In the 20th century, a revolution in agriculture practices escalated its impacts on biodiversity. One substantial sector of agriculture is rice cultivation. Rice fields hold a complex food chain and support rich biodiversity that provides significant ecosystem services. In Guinea-Bissau rice is the main staple food. This study assesses the influence of temporal and spatial heterogeneity in shaping the bird assemblages throughout the crop cycle of lowland freshwater rice in Guinea-Bissau. In particular, we want to understand a) how do some landscape factors influence the bird assemblage composition and species richness – spatial variation; and b) how do the bird assemblages and rice habitat usage vary throughout the rice growth cycle – temporal variation. The study was conducted in five villages in Oio region. Birds were sampled through space using automatic acoustic recorders, and in time using transects. A total of 127 species were identified across 16 different orders. The considerable overlap in species composition and ecological guilds observed within various landscape units underscores the significance of the landscape gradient and confirms the predicted need for heterogeneity. Species richness was positively influenced by the density of vegetation cover and negatively by the distance to villages. Grassland and wetland species' abundance varied inversely in time. Gradual turnover of species followed the habitat progressive conditions. As expected, shrubland species were the turnover's strongest drivers. Habitat complementarity was demonstrated, further highlighting the importance of environment structural complexity. This study provides updated information on the bird community occurring in this farming landscape while tackling its multiple dimensions. Despite the production value of rice fields, this crop can also contribute to biodiversity conservation.

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Session 10-P5 - Biodiversity and sustainable tropical agriculture

Variation of pest consumption by insectivorous bats and birds in smallholder rice fields in West Africa

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Two of the greatest challenges facing humanity are to provide enough food for all in a sustainable manner and to conserve biodiversity. In this work, we propose to investigate the possibility of the use of insectivorous birds and bats as pest suppressors in West African rice fields. To this aim, we used metabarcoding and next-generation sequencing (NGS) techniques to analyse the diet of these animals and to assess their potential as pest suppressors. More specifically, we aimed to answer the following questions: (1) Can birds and bats be considered as potential pest suppressors? (2) What is the dietary composition of these insectivores and how does it vary between taxa? (3) How does pest consumption vary along the rice life cycle? The fieldwork took place in 2021, 2022 and 2023, from June to December, spanning the life cycle of the rice crop. We captured birds and bats with mist nets in smallholder lowland rainfed rice fields in northern Guinea Bissau and collected their scats. Preliminary results from 705 samples from animals captured during 2021 and 2022, confirmed the presence of several arthropods considered agricultural and other pests on the diet of both birds and bats. Both groups show seasonal changes of prey frequency, with birds consistently showing a higher richness of items preyed. Termitidae dominates the samples of both bats and birds in June and July. During the last stages of rice growth, the families Cicadelidae, Rhyparachromidae and Carabidae increase importance in the diet of bats while birds distribute their preferences more evenly over several prey families. This study enhances understanding of rice pests in West Africa, their predation by bats and birds, crucial for both human well-being and conservation. Given rice's significance as a primary energy source in the region and globally, connecting birds and bats to this ecosystem service highlights its monetary value, promoting their conservation and reducing reliance on pesticides.

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Session 10-P6 - Biodiversity and sustainable tropical agriculture

Global variation in the flowering phenology of cacao trees (*Theobroma cacao*)

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Understanding the phenology of crops and the factors that influence it is essential to secure their production in a changing climate. Native to the Amazon Forest, cacao (*Theobroma cacao*) is now cultivated globally in tropical climates. Despite the economic importance of this tree, little is known about its flowering phenology and the influence of abiotic factors such as precipitation and temperature on flowering intensity. Our main objective is to study how flowering moment and intensity differs between the three biogeographic regions in which cacao is cultivated (Americas, Africa, and Australia & India). To do this, we did a meta-analysis of flowering data extracted from scientific articles found while doing systematic searches in the Google Scholar and Web of Science databases. We ran multiple models and tests to examine the effect of precipitation and temperature on flowering intensity. We found that precipitation did not affect the number of flowering months and that cacao trees in the three biogeographic regions flower at different moments of the year.

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Session 10-P7 - Biodiversity and sustainable tropical agriculture

Simulating the potential effects of cocoa-related deforestation on species connectivity in a West African biodiversity hotspot

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In recent decades, the expansion of cocoa cultivation has been responsible for a substantial fraction of deforestation in the tropics. In the West African Guinean biodiversity hotspot the country of Ghana has been considerably affected. As the second largest cocoa producer in the world, the country has recently experienced a rapid increase in cocoa-related deforestation associated with a biodiversity decline, especially in terms of mammals. However, little is known about the landscape-scale consequences of deforestation for a range of biological parameters. Using the graph-based Probability of Connectivity (PC) metric, we explored how cocoa-related deforestation over the last two decades affected the network connectivity for mammals in the cocoa-dominated Juabeso-Bia landscape in Ghana. By classifying mammals based on their dispersal abilities and habitat preference, we were able to assess which species might have suffered the most from cocoa expansion. We found that cocoa-related deforestation, and more specifically conversion to monoculture plantations, did not simply result in habitat loss but also in a substantial decline in connectivity. The agricultural matrix's habitat loss between protected areas confines poor dispersers within fragmented forests and diminishes the suitable forest patches essential for the connectivity of proficient dispersers. Overall, our results suggest that connectivity mediated by cocoa agroforestry might help maintain landscape connectivity for mammals in a tropical landscape mosaic with scattered forest fragments, but this is subject to further validation. Jointly evaluating habitat quality and connectivity at landscape scale, as done in this paper, is important because it can help to judge the benefits of land sparing or sharing strategies for conservation.

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Session 10-P8 - Biodiversity and sustainable tropical agriculture

Effects of land use change on soils from Guinea-Bissau

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Current studies show a decline in soil biodiversity, which puts at risk future food production since soil organisms play a key role in essential ecosystem functions such as, nutrient cycling and soil fertility, soil carbon sequestration, climate regulation, litter decomposition, erosion, water retention, interaction with plants, among others. This study aims to evaluate how the conversion of a tropical native forest into a field for agricultural production impacts the soil chemistry and its microbial communities. The soils analysed were collected in Guinea-Bissau, at 3 locations with different land uses: a primary forest, an annual crop field (peanut) and a perennial crop field (cashew), during the wet and dry season. We analysed several soil parameters including pH, water content, N, P and C contents, soil respiration, and soil protein index. Mycorrhizal spore density, analysis of soil PLFA (Phospholipid fatty acids analysis) soil enzyme activity (protease, glucosidase and phosphatase) and qPCR targeting genes involved in N, C and P cycling, were selected for investigating alterations in soil microbial diversity. Our study on a tropical ecosystem from Guinea-Bissau shows that forest soils have overall higher values for most chemical parameters, while peanut and cashew soils have lower values, with some exceptions, such as $N\text{-}NO_3^-$. Regarding soil biodiversity, our results point to a greater soil biodiversity in forest soils. Land use change resulted in alterations in functional microbial communities, with cashew soils showing the highest abundance of microbial communities involved in N cycling, while peanut soils showed the highest abundance of microbes related to the mineralization of organic P compounds. Our results confirm that land use change alters soil chemistry and its microbial communities and there is a decrease in soil quality and biodiversity following the conversion of forests to crop fields.

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Session 10-P10 - Biodiversity and sustainable tropical agriculture

African wild beans as a source of nutritional and bioactive compounds

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Legume species are a staple food and a source of nutrients for people experiencing food insecurity in Africa. The genus *Vigna* is unique among native African legumes since it contains the cowpea (*Vigna unguiculata*), one of the most widely consumed and farmed species. The biochemical composition of wild *Vigna* species is still little understood, despite their potential as a food supply and genetic resource. Through field surveys, laboratory procedures, and an extensive review of the literature, the primary objective of this project is to collect and provide new data on the nutritional and bioactive composition of wild *Vigna* species native to Africa. It also aims to examine their potential role as a source of nutrition for food security and its sustainable use. Our data revealed that wild *Vigna* has a high protein content and a low-fat content. The biological activity of these taxa as well as their composition in terms of minerals, fatty acids, starches, amino acids, and bioactive compounds are detailed. Furthermore, wild *Vigna* taxa are a good source of macro- and micronutrients as well as bioactive compounds. In conclusion, and in the framework of the Sustainable Development Goals (SDG), wild *Vigna* could be a new source of food or a genetic resource that can be used against hunger and food insecurity in a changing climate, particularly in developing African countries.

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Session 10-P11 - Biodiversity and sustainable tropical agriculture

Characterization of the invasive pest fall armyworm, *Spodoptera frugiperda* Smith (Lepidotera, Noctuidae), populations in Cape Verde

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The fall armyworm (FAW), *Spodoptera frugiperda* Smith, an invasive pest native to America region, was first detected in Africa in 2016 and having spread to multiple continents, become a global problem. This polyphagous insect is considered as pest due to the high destructive capacity in many crops, especially maize, posing a significant threat to global food security. Its rapid spread and ability to adapt to diverse environments have exacerbated the challenges posed by this pest, making its effective management an urgent priority. The utilization of sex pheromones for integrated pest management has proven effective in controlling certain Lepidoptera species, namely the mating disruption (MD) method. Mating disruption has been tested as an alternative sustainable control tactic in different countries for several pests. However, the efficacy of this approach for fall armyworm control depends on various factors, including strain diversity, populations densities, migratory behavior, and geographic variations in pheromone responses. To implement mating disruption, it's crucial to know the population structure and the level of infestation of *S. frugiperda* in the territory, and the biological cycle associated with maize. For this purpose, from July to October of 2023, the following determinations were carried out: 1) flight activity of adult males was monitored by counting the capturing males in funnel-type traps baited with sexual pheromone; 2) intensity of infestation of the immature stages of the species through visual observation of the maize plants, in accordance with the protocol adopted by FAO. The dominant phenological state of the maize was also determined. The frequency of observations was every 10 days, and three locations were chosen in the two main agroecological zones with corn plantations in the Cape Verde archipelago. The main results are presented and the main implications of these results for planning future bioassays are discussed.

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Session 10-P12 - Biodiversity and sustainable tropical agriculture

Communities of pollinating arthropods in the agroecosystems of São Tomé

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One major threat to biodiversity is the homogenization of ecosystems through agricultural practices, especially monocultures. Arthropods pollinators can be particularly sensitive to agricultural practices as they are often specialised in a reduced number of plant taxa, often unavailable in agricultural fields. São Tomé Island is inhabited by a high number of endemic species. Although 25% of its area is protected, agriculture has historically been the country's economic foundation. Plantations of sugar cane, cocoa and palm oil, have degraded São Tomé's lush rainforest. Also, little is known about its communities of pollinating arthropods and the potential impacts of agroecosystems on their diversity and composition. Our objective was to understand how the biodiversity of pollinating arthropods is distributed among habitats and how much of natural communities is still harboured in monocultures. Specifically, we aimed to assess differences in taxa richness and composition across an environmental gradient of human intervention. For this, we conducted a survey in four different habitats (villages, oil palm plantations, cocoa plantations, and forests) during the dry season of 2022 and the wet season of 2023, using four sets of pan-traps across twelve sites. Pan-traps target pollinating arthropods as they act as coloured baits. Each pan-trap had four coloured containers (yellow, white, blue and orange) and was hung in trees for 24 hours. Specimens of each collected sample were morphologically identified.
We observed 20 arthropod orders, with the most represented orders being Diptera and Hymenoptera. Dipterans were predominant in the forest, while hymenopteran specimens were predominant in cocoa plantations. Overall, the colours of the pan-traps that seemed to attract more specimens were yellow and orange. This study is the first to document communities of pollinating arthropods on São Tomé Island and will serve as a baseline for future biodiversity assessments.

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Session 11-P1 - Biodiversity, biotic interactions and functioning

Water and carbon fluxes induced by seasonal variations of microclimatological conditions using eddy-covariance measurements over a tropical mountain dry forest ecosystem in South Ecuador

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Forest ecosystems play an important role in controlling the exchange of energy, water and carbon in the land-atmosphere continuum, which contributes to the regulation of the climate through biogeochemical process. However, carbon dynamics are strongly driven by climatic conditions induced by the temperature, precipitation and soil moisture, which impacts carbon uptake and release by the ecosystem. In the Tumbesian mountain dry forest (MDF) in the Laipuna reserve on the western escarpment of the Andes mountains in South Ecuador an eddy-flux tower has been installed to investigate atmospheric CO_2/H_2O fluxes. The tower is equipped with an open-path Irgason system to obtain net-ecosystem exchange (NEE) and evapotranspiration (ET) as well as additional meteorological sensors to measure microclimatological conditions. The MDF is characterized by a distinct seasonality, with a dry (May - December) and wet (November - May) period. Mean monthly precipitation totals ranges between 50 and 400mm, while temperatures vary between 21 – 26°C. The forest is dominated by deciduous trees and feature clear seasonal phenological cycle. Under global climate change such water limited ecosystems are strongly vulnerable to climatic stresses associated with a higher evaporative demand and feedback to the exchange of CO_2/H_2O. The study shows seasonal flux variations over MDF canopy as a response to changes in microclimatological conditions. For this, NEE is partitioned into gross primary production (GPP) and ecosystem respiration (Reco). During the dry season lower rainfall and higher temperatures dramatically reduce the carbon uptake down to almost zero, but the ecosystem still shows a carbon neutrality rather than carbon source. With the onset of precipitation energy and carbon dynamics are modified with an increase in the sequestration and a clear sink function of the MDF ecosystem

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Session 11-P2 - Biodiversity, biotic interactions and functioning

From large mammals to small dung beetles: Diversity & abundance along a forest elevational gradient in Peru

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Understanding the distribution of biodiversity on earth is one of the greatest questions in ecology, challenging early naturalists such as Alexander von Humboldt in the 19th century, and keep challenging us to date. We still lack a mechanistic understanding of the processes producing biodiversity gradients, but most current hypotheses support energy (i.e., food resources) and temperature. As global biodiversity hotspots, tropical mountains offer a natural laboratory to study on an assessable scale how various factors may determine patterns of biodiversity. In this project we combine genetic and bioinformatic tools with ecological field work along a forest gradient in the Peruvian Andes, ranging from ~200-3600 meters above sea level. Besides collecting environmental data, we sample dung beetles using baited pitfall traps and record large mammals using camera traps at 26 study sites along this gradient, including sites within and close to Manu National Park. The data on local mammal assemblages allows us to quantify biomass and, hence, estimate dung production per study site. Since dung is a primary resource for dung beetles, this serves as an explanatory variable to predict dung beetle abundance and diversity along the gradient. Camera trap data is also interesting per se, as the patterns and drivers of the local diversity of large mammals have scarcely been studied along elevational gradients. Ultimately, this project aims to disentangle the effect of climate, physiological constraints and resources on biodiversity, and contributes to a better understanding of the response of organisms to climate change.

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Session 11-P3 - Biodiversity, biotic interactions and functioning

Detecting functional rarity in a hyperdiverse Amazonian dung beetle assemblage

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Functionally rare species are characterized by having combinations of functional traits that differ from the rest of the community. These species are expected to play ecological roles that cannot be replaced by other species in the community and support vulnerable ecosystem functions. Sampling methods used to characterize arthropod assemblages usually filter species based on their functional traits, reducing the probability of detecting functionally rare species. Although dung beetles are mainly known for their contributions to the nutrient cycles, they also participate in other ecosystem processes like seed dispersal or parasite regulation. Most of the studies sampling dung beetle communities in tropical rainforests use baited pitfall traps only and therefore may be overlooking functionally rare species not attracted to the baits. We characterized the functional structure of an Amazonian dung beetle assemblage using five different sampling methods (dung- and carrion-baited pitfalls, dung-baited aerial traps, flight interception traps, and visual transects) and 18 functional traits to assess the suitability of different methods for the detection of functionally rare species. We found that, although the widely used dung-baited pitfalls detected the highest species richness and proportion of the functional volume, the additional sampling methods captured more functionally rare species than expected by chance. Some of these species were trophic specialists not attracted to baited pitfalls. The use of complementary sampling methods revealed functional volume, redundancy and functionally rare species overlooked by dung-baited pitfalls. Given the threats that tropical rainforests face worldwide, consideration of functionally rare species is of great importance to characterize the functional structure of arthropod communities inhabiting these ecosystems and to adequately assess potential environmental impacts on ecosystem functioning.

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Session 11-P4 - Biodiversity, biotic interactions and functioning

From Andes to Amazonia: Abundance of bees along a tropical forest elevational gradient

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Mountains are great ecological study systems since they display deep changes in environmental conditions in relatively short distances. The Eastern slope of the tropical Andes reaching high elevations and getting high precipitations, hosts the most diverse tropical humid montane forests in the world, making it a very suitable region for studying drivers of biodiversity changes along gradients. We studied an elevational gradient in Kosñipata Valley, South of Manu N. P., SE Peru, ranging across the rainforests of Cusco and Madre de Dios. A remarkable feature of the study area is its exceptionally good state of conservation, displaying continuous forest from the Amazonian lowlands up to the tree line. During a 11-month fieldwork campaign we completed 3 rounds of sampling in 26 locations from 230 to almost 4000 masl. Bees (Hymenoptera: Anthophila), are very important pollinators in most terrestrial ecosystems, however, the knowledge about them in the Neotropics is scarce, and few studies have worked on them along tropical elevational gradients. We collected bees for 2 hour random transect walks in all the 26 sites and on the 3 field seasons, adding up to 78 samples and 156 hours of active bee catching. In addition to bees found feeding in flowers and flying in the forest, we used different attractants: rotten fish and sweaty clothes (Meliponini and Halictidae mostly) and 4 different essential oils for Euglossini. We found abundance of bees to decrease markedly with elevation, from over 500 individuals in some lowland Amazonian transects to less than 10 or even none in the highlands. Additionally, different groups respond differently to the elevation, e.g., stingless bees (Meliponini) dominate the communities in the lowlands and occur up to approx. 2500 m, bumblebees (*Bombus* spp.) occur along the whole gradient but are more diverse and abundant in the highlands, whereas orchid bees (Euglossini) reach 2200 m but keep decreasing in abundance from the lowlands.

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Session 14-P1 - Tropical Forest management under climate change

Forest regeneration in a chronosequence of restored areas in the Atlantic Forest of Rio de Janeiro, Brazil

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Studies on the restoration of degraded ecosystems have shown that biodiversity and ecosystem services can be affected by the initial species composition, planting age, restoration technique, and land use change. The aim of this study was to assess forest regeneration in a chronosequence of eight restored sites in the Atlantic Rain Forest, Brazil. The plantings were established from 2005 to 2015. In each planting, five plots of 25 x 8 m were allocated and all tree individuals ≥ 5 cm DBH were tagged and measured. A total of 1277 individuals were sampled (686 planted and 591 natural regeneration), distributed amongst 33 botanical families, with Leguminosae, Meliaceae, Solanaceae, Piperaceae, and Polygolaceae being the families with the highest number of individuals. The most representative species in the community were *Inga laurina*; *Inga edulis*; *Guarea guidonia*; *Triplaris americana*; *Inga vera*; *Piper arboreum*. For the planted individuals, no relationship was observed between planting age and density and basal area, however, a negative and significant relationship was found for species richness. For natural regeneration, there was a positive and significant relationship between planting age and the density, basal area and species richness. In the regenerating stratum, out of the 133 species found, 89 were unplanted species (67%), indicating a high number of colonizing species from the surrounding area. This fact suggests that the regeneration is active and highlights the importance of forest remnants adjacent to plantings and local disperser fauna. Thus, natural regeneration is not only related to the age and initial species composition of the plantation but mainly to the quality of the surroundings (i.e. presence of forest remnants and disperser fauna), indicating the importance of these parameters for the establishment of the tree community in restored areas, both in terms of structure and species composition.

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Session 14-P2 - Tropical Forest management under climate change

People, Rice and Mangroves in coastal Guinea-Bissau: Modelling sea level rise and its potential effects

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Guinea-Bissau is a small country in West Africa with an extensive coastal area and a very low-lying topography. The coastline is home to a large percentage of the population who depend on costal ecosystems for their livelihoods. Mangrove forests provide several ecosystem services (e.g., fishing, wood gathering or seafood extraction) and the conditions for the production of mangrove swamp rice is one of the most important. Because of the low-lying topography, the Guinean coast is highly vulnerable to climate change effects, particularly to sea level rise (SLR) and extreme weather events. This study is part of the project MARGINS - *People, rice and mangroves at the margins: A hybrid and contested interface in a changing world*. It aims to model the effect of SLR in the Ondame peninsula, located in central Guinea-Bissau, analyse the potential environmental and social consequences, and to discuss adaptation measures. To model the potential effects of SLR for different scenarios and time horizons, a high-resolution Digital Surface Model (DSM) was produced from drone imagery collected in a field campaign carried out in Ondame, in January 2023, and georeferenced through GPS with a RTK (Real Time Kinematic) system. Tide observations contributed to the DSM reference frame, and to the calibration of a tide model for this coastal area. These data and outcomes will allow the production of a probabilistic flood mapping for different tidal height range and recurrency, for the different climate scenarios up to 2100. The expected results can be useful to assess the need and effectiveness of possible impact mitigation or adaptation measures, such as relocating infrastructures or housing or reinforcing the agricultural protection provided by main tidal containment dykes, or even agricultural areas' accommodation.

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Session 14-P4 - Tropical Forest management under climate change

Protected areas are more exposed to extreme weather than unprotected areas across Central America

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Central America and the Caribbean are regularly battered by megadroughts, heavy rainfall, heat waves, and hurricanes. While 21st century climate change is expected to increase the frequency, intensity, and duration of these extreme weather events (EWEs), their incidence on regional protected areas remains poorly explored. We examine historical and future projected EWEs across the region and compare trends both within protected areas and across unprotected lands. Results indicate that while EWEs will increase generally across the region, protected areas will be more exposed to climate extremes than unprotected areas. This is particularly true for heat waves, which are projected to disproportionately affect protected areas across all scenarios, and hurricanes, affecting protected areas more severely in carbon-intensive scenarios. Our findings also indicate that protected savannas and dry forests will be heavily impacted by EWEs, particularly heat waves and droughts. However, protected areas in the Chocó, the Central American corridor of Panama and Costa Rica, and the Guiana lowland moist forests will likely experience relatively lower impacts. Our results highlight that new conservation strategies - adapted to threats associated with EWEs - need to be tailored and implemented promptly. Unless urgent action is taken, significant damage might be inflicted on the unique biodiversity of the region.

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Session 15-P1 - Ecosystem services of tropical wetlands

Drought affects tree growth in two species (*Nectandra amazonum* and *Hydrochorea corymbosa*) in Central Amazonian Floodplain Forests

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The floodplain forest in the Central Amazon is subject to a monomodal flood pulse with the non-flooded period occurring between September to February, which matches with the beginning of the rainy season, usually offering sufficient water supply for tree growth during that period. Throughout the last two decades, the Central Amazon region has been impacted by increasingly frequent and more climatic extremes, including severe floods, droughts, and extreme temperatures. However, little is known about the effects of these climatic effects on tree growth in floodplain forests. In this study, we analyzed two flood-adapted tree species with different phenological strategies, *Nectandra amazonum* (Lauraceae) as an evergreen and *Hydrochorea corymbosa* (Fabaceae) as a deciduous tree species in várzea floodplain forest. Using the tree ring chronologies of different ages for each species (*N. amazonum* 17 years and *H. corymbosa* 30 years), we analyzed the intra- and inter-annual climate-growth relationships from local climate and hydrological data. The two species did not show a correlation between tree growth and hydrological regime. However, the climate-growth relationship indicates that droughts play an important role in tree growth in the two species, especially during the non-flooded period. The growth of *N. amazonum* had a high negative correlation with evapotranspiration (r=0.8), especially in November, and *H. corymbosa* correlated negatively to vapor pressure deficit (rho=0.69) in December. November and December are in the middle of the non-flooded period when tree growth in floodplain forests usually is enhanced. Based on our findings, we emphasize that the effect of climate change with increasing strong drought events can decrease tree growth in flooded forests. To understand if this is a general pattern that affects the entire floodplain tree community, more dendroclimatic studies in floodplain forests are necessary, focusing particularly on the effect of the drought conditions during the non-flooded period, as, for instance in the strong El Niño years 2010 and 2023.

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Session 15-P2 - Ecosystem services of tropical wetlands

Late Holocene riparian vegetation dynamics, environmental changes, and anthropogenic impact in the Harapan forest of Sumatra, Indonesia

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Riparian wetlands are important ecosystems for carbon storage but are vulnerable due to climate change and human activities. For the past few decades, riparian wetlands in Sumatra are under transformed and converted into arable lands. Aiming to understand the effects of natural factors (e.g. climate change, flooding, drought) and human activities (e.g. agriculture, socioeconomically local communities) on riparian wetlands is vital for development of management strategies. For that, we conducted a multi-proxy palaeoecological analysis, including pollen and spore, macro-charcoal and radiocarbon dating, on a sediment core taken at a riparian area in the Harapan forest, Sumatra. The results show an ecosystem evolution from riparian forest to freshwater swamp during the last 1000 years. Three periods are highlighted: i) AD 1100 - 1400: the sandy layers associated with the frequent pollen of riparian and swamp vegetation indicate that the study site is a part of a riparian buffer zone (e.g. riverbank) and there is a presence of freshwater swamps of *Pandanus, Elaeocarpus*, grasses and herbaceous mashes nearby the study site under a strong dry season regime; ii) AD 1400 – 1870: a high frequency of swamp vegetation suggests that the freshwater swamps started expanding to the study site under a higher precipitation; iii) later, from AD 1870 to present, this ecosystem became a dominance of upland forests with a strong dry season. The presence of cereal pollen grains indicates agricultural practicing has been conducted in the study area from AD 1300 to 1450, later the presence of oil palm (*Elaeis guineensis*) has been recorded since the mid-19th century AD, signifying the establishment of small-scale oil palm plantation in the study site. Examining the dynamics of riparian vegetation and environmental shifts in the Harapan forest of Sumatra reveals a transformation from a riparian forest to a freshwater swamp and upland forest, influenced by both climate change and human activities. The insight of this study allows us to predict and explore the response of riparian wetland vegetation in Sumatra to climate change and human impacts in the future.

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Session 16-P1 - Tropical molecular ecology

A demographic model of structured populations for common chimpanzees (*Pan troglodytes*) to infer past changes in connectivity

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Common chimpanzees (*Pan troglodytes*) inhabit tropical forests of Africa and are classified in four sub-species: Western, Nigeria-Cameroon, Central and Eastern chimpanzees. Several genetic studies have shown the existence of population structure, both across the species and within subspecies (Lester *et al*. 2021, Fontsere *et al*. 2022). It is increasingly recognised that inferring the past demographic history of species while ignoring population structure can be problematic and lead to spurious signals of change in effective population size (Mazet *et al*. 2016). In this study, we used PSMC curves (Pairwise sequentially Markovian coalescent, Li and Durbin 2011) as summary statistics to infer non-stationery n-island models for each subspecies independently using the SNIF method of Arredondo *et al*. (2021). We found that it was possible to construct a model integrating the four subspecies and that succeeds at explaining the empirical PSMC curves. We also found that this scenario predicts well estimates of genetic diversity within each subspecies even though it overestimates genetic differentiation. Future work should be moving towards more complex spatial models that could in particular explain observed patterns of isolation by distance.

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Session 16-P2 - Tropical molecular ecology

Filling gaps in tropical Africa: The fascinating diversity of Angolan frogs

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Africa hosts the largest terrestrial tropical area among all continents, but it is the most poorly surveyed. Its huge area, history of political instability, intense natural resources exploitation, and little research in many countries, pose challenges to understanding its diversity. Angola is a perfect representative of tropical Africa, being wide and diverse, in a transition between the central moist forests and the southern deserts. Many studies addressing ecological hypotheses in Africa lack data from this crucial region, thus filling these gaps is valuable. Angolan biodiversity is poorly studied and amphibians are the least known tetrapod class therein. We used Angolan amphibians as proxys for afrotropical biodiversity to create a genetic reference database, identify cryptic diversity, and map the distribution of species richness. Amphibian samples were collected across all provinces during 14 years (2009–2023). Barcoding was used to delimit mitochondrial lineages based on the 16S rRNA gene. Their distribution was mapped to identify richness and endemism patterns by 1-degree grid cells, biomes and ecoregions. The first comprehensive genetic reference database of Angolan amphibians was produced, with over 1600 sequences, including 133 anuran taxa from 28 genera and 13 families, and 47 endemic and 47 candidate species. Patterns of richness distribution follow a north-south latitudinal gradient decrease, reflecting rainfall and temperature regimes. Northern ecoregions displayed the highest richness. Endemic taxa were found mostly along the escarpment. These results greatly increase the previously reported amphibian richness in Angola. New taxa will likely continue to be found as field surveys progress, especially in northern areas. Similar richness patterns are expected for other taxonomic groups and countries in the region. This dataset improves considerably the knowledge about the Angolan transition zone and now enable ecological studies at a continental scale.

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Session 17-P1 - Current trends in tropical African plant ecology

Recent fire history and plant diversity in Madagascar Central Highlands

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More than 70% of the area burned across the globe concentrates in sub-Saharan Africa, fire being a major ecological disturbance in most African biodiversity hotspots. This is the case in Madagascar, where approximately 30% of the Central Highlands burn every year, and the role of fire regimes on current biodiversity patterns remains unclear. In this study, we provide new insights into how vascular plant richness and diversity vary among recent fire histories in three different systems in the Central Highlands: the endemic *Uapaca bojeri* woodlands; high altitude (1500 m) grasslands dominated by *Loudetia simplex;* and medium altitude (950 m) grasslands dominated by *L. simplex, Aristida similis* and *Heteropogon contortus*. We specifically investigated (I) the effects of recent fire history on alpha species richness and diversity, both overall and by growth forms; (II) the influence of soil major nutrients (N, P, K) and pH on filtering the effects of fire history on plant richness and diversity; and (III) the role of heterogeneity in fire histories on species turnover (beta diversity). To do this, we distributed 20 plots of 20 m × 20 m per site, where we characterized the fire history (2016-2022) using Sentinel-2 imagery, and we sampled the density of plant individuals or bunches. Results showed different responses to fire in woodland than in the grasslands, although in general, intermediate times since the last fire supported the highest richness. In the woodland, tree richness increased with frequent fires, while shrub and sedge richness and diversity decreased. In the grasslands, tree and shrub richness decreased with recent or recurrent fires while sedge richness increased. Apart from this, we did not find significant interaction effects between soil nutrients and fire history on plant richness and diversity. Finally, we found limited differences in species turnover when comparing plots with heterogeneous fire histories to plots with similar fire histories.

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Session 17-P2 - Current trends in tropical African plant ecology

Forest cover dynamics in Angolan protected areas between 2001-2022

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Angola, located in Southern Africa, has a great diversity of biomes and vegetation types, ranging from the desert in the southwestern part of the country to the Guineo-Congolian forest in the enclave of Cabinda, and with large areas of miombo woodlands in the central part of the territory. Angola forest vegetation has been subject to several factors of disturbance, such as wildfires, the selective cutting of forest trees for timber use and charcoal production, the extraction of firewood, and the felling of forests for agriculture and pastures, which have led to high levels of deforestation and forest degradation. The country currently has a network of 14 protected areas to preserve ecosystems of special ecological interest but few study exists about the forest trends along the years. The main objective of this work is to analyse the dynamics of forest cover in Angolan protected areas since the beginning of the 21st century. For such it is used the Hansen Global Forest Change Dataset of annual forest cover loss data derived from satellite imagery at medium-to-high spatial and temporal resolution across 2001–2022. Forest cover loss quantifies any tree cover loss or deforestation dynamics against a baseline of year 2000 forest cover. Results showed that some of the protected areas with the largest forest surface are those where exists higher losses of forest (e.g. Maiombe, Luando), while in parks with less dense forest, losses are near zero or residual (e.g. Namibe, Iona). Most of the protected areas present values of forest loss up to around 0.2% per year but in some cases with values above 0.4% per year. In the last decade, the forest loss was more drastic in three protected areas: Quiçama, with great interannual variation and no noticeable trend, Maiombe, with a decreasing trend since 2013, and Luando, with an increasing trend in forest area loss. The results obtained need to be contextualized namely with climatic and socio-economic data.

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Session 17-P3 - Current trends in tropical African plant ecology

Tree species diversity as a function of environmental conditions in potential seed collection areas in Amhara Region, Ethiopia

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This study aimed to identify the tree and shrub species that occur in the forests of Amhara region in Ethiopia. This survey was carried out to determine possible areas for seed harvest. The sampled species can be used as seeds for both the recovery of degraded areas and the formation of base populations for tree breeding programs. The study was conducted at Fudi Natural Forest in Fagta Lekoma district, Amhara region, northwestern Ethiopia. The points of presence of species were plotted on the USGS SRTM map (GTOPO30) at 1: 250,000 scale (USGS, 2018) using Arc GIS 10.1 software (ESRI, 2011). The maps were elaborated using multiple linear regressions, relating the bioclimatic variables with the numerical models of latitude, longitude, and altitude. The frequencies of occurrence of species and families were compared with local geographic aspects. Fudi Natural Forest in Fagta Lekoma district, Amhara region, northwestern Ethiopia, comprises 32 families and 46 species. The most common families in the northeast, north, northwest, southwest, southeast, and, west regions were Fabaceae (Mimosoideae subfamily), Euphorbiaceae, Celastraceae, and Rubiaceae; Albizia gummifera occurs in greater density in the various sampled regions and is the most dominant. The region presents a high-altitude gradient, which influences the edaphoclimatic attributes and, consequently, the diversity of species. In the northern region, the diversity of species and the size of the trees are lower due to the low water supply, higher solar radiation, and higher temperature.

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Session 17-P4 - Current trends in tropical African plant ecology

Wild edible plants in Angola: Diversity, uses and properties, and socio-economic potential

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With almost 7,000 native species, Angola is one of the African countries with the greatest plant diversity worldwide. A large quantity of wild plants is used daily by rural communities to supply different needs, namely as food and as a source of valuable secondary compounds in terms of bioactive assets and as food additives and supplements. These properties are mostly inferred from traditional uses and must be confirmed and validated. Thus, this work aimed to explore the diversity of plant species in Angola and their traditional uses found in the literature and herbarium collections, to identify the species with potential to be used for different purposes, and to provide information that promotes their consumption and sustainable use in the daily diet of several populations. Through this research it was possible to identify a total of 156 species of wild edible plants, of which more than two thirds are native to Angola, including some endemics, and around a quarter are introduced and naturalized. In addition to the main plant parts used as food and their way of consumption, the main types of plants and vegetation in which they occur were identified. Around 56% of these plant parts are consumed in natura, 36% are consumed after processing, 11% as condiments, and 3% are used as infusions. The main types of plants with edible parts were trees, annual and perennial herbs, shrubs and subshrubs, and in a lesser extent lianas and herbaceous climbers, which are found in forests, woodlands, riverbanks and gallery forests, as well as in fallow land and disturbed places. The identification and characterization of species allowed us to deepen our knowledge of the country's genetic resources and their potential not only as food but also as a source of bioactive compounds, which we hope can contribute to improving food security and the sustainable use of natural resources in Angola.

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Session 17-P5 - Current trends in tropical African plant ecology

Thriving in dry tropical ecosystems: Species functional adaptation

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Understanding the current distributions of species is crucial to predicting how climate change will affect them and thus supporting effective management and conservation actions. Island ecosystems are especially vulnerable to environmental and natural disasters and due to their altitudinal gradients and small size, can be good models to understand the effects and responses to climate issues. The archipelago of Cabo Verde, the southernmost islands of Macaronesia, is characterized by a dry tropical climate. Here, the desertification processes driven by the scarcity and irregularity of rainfall, and aggravated by human activities, strongly affect the vegetation cover. The Poaceae family (Gramineae) is one of the largest in Cabo Verde, occurring from the wettest to the driest habitats. They dominate the landscape, standing out in the xeric grasslands that cover large areas of these islands. Using data from 80 years, corresponding to two climatic periods - wet (from 1929 to 1968) and dry (from 1969 to 2007) - we assessed the impacts of temporal (climatic periods) and spatial (altitude and aspect) variability on the distribution pattern of grass species. We identified changes in distribution patterns, as well as in their respective traits. In general, the analysis revealed an increase in annual species, C4 photosynthetic pathways species and xerophytic taxa in response to the drier climatic period. In addition, the alternation of wet and dry periods led to altitude changes in the distribution of grass communities, and factors affecting the mesoclimate (such as altitude and aspect) are relevant to mitigating the effects of the macroclimate. These conclusions can be useful for predicting (and mitigating) the impacts of climate change on Cabo Verde's herbaceous communities, where grasses and grasslands are an important natural resource for local populations, both as fodder and for food, particularly as small cereal crops.

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Session 17-P6 - Current trends in tropical African plant ecology

Mangrove restoration in Africa: Case of success stories of the Western Indian Ocean

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Mangrove forests are one of the most important ecosystems in the world and cover most of Africa's coastal regions. Current extent of mangroves in Africa is 3.2 million ha, with the Western Indian Ocean region countries of Kenya, Madagascar, Mozambique and Tanzania covering 745,518 ha compared to 775,675 ha in 1996 (19 % of Africa mangrove area), 302,735 ha are found in Mozambique, 277,567 ha in Madagascar, 110,787 ha in Tanzania and 54,430 ha in Kenya. The direct causes of mangrove degradation in WIO include exploitation of timber products, conversion of areas for aquaculture, salt marshes and urban development, and natural causes such as floods and cyclones shear winds. Large-scale restoration initiatives have been initiated in response to mangrove degradation, efforts driven by growing understanding of the critical role that mangrove forests play in mitigating and adapting to climate change. The main objective of restoration is carbon sequestration and the recovery of ecological and socioeconomic functions. However, restoration initiatives in this region face several challenges, including a lack of scientific data, financial and technical resources, and the socioeconomic context of African countries. Despite these challenges, there have been some successful mangrove restoration projects, in Madagascar, with the Rebiom project implemented in Ambanja Bay. In Mozambique, the restoration at Foz do Limpopo, shortly after the 2000 floods. In Tanzania, the Rufiji Delta Mangrove Restoration Project and in Kenya, where KEMFRI has implemented several mangrove restoration projects, notably Mikoko Pamoja in Gaza Bay. In general, these initiatives aim to restore areas, involving local communities, promoting livelihoods and effective management practices. Therefore, the objective of this article is to understand the current state of the art and lessons learned about mangroves in the WIO region, evaluate different restoration techniques, their success, failure, and metrics, and propose recommendations to improve mangrove restoration.

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Session 20-P1 - Understory shrubs: Adapting amidst change

Monitoring plant-animal interactions with camera trap: *Heliconia* model in Martinique

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Although the harmful effects of human disturbance on forest species is well-known, understanding the consequences on biotic interactions remains a major challenge for conservation science. The Caribbean's tropical islands have a unique species community with a high rate of endemism that is equally threatened by human activity. Despite their endemism, island ecosystems can suffer from lack of functional resilience due to their lower number of species. Understanding these impacts and how ecosystems react may be crucial, especially regarding animals' involvement in pollination and seed dispersal in the tropics. The aim of the study was to describe the plant-animals network, identify their interactions with plants, and describe their activity pattern related to the plant's phenology. The biotic interactions of *Heliconia caribaea*, an indigenous common herb species of rainforest, was surveyed in Martinique Island using a novel method of camera trap setting during blooming and fruiting seasons. In total, 18 cameras were set in front of 113 individual plants in 7 sites across the Martinique's rainforest from March 2022 to September 2023. The same protocol was done in a long-term survey in 1 site and in a 7-day survey completed 42 times in 6 sites. A total of 147,658 photos were captured with the long-term protocol and 173,675 photos with the short one. A total of 17 species were identified while 1 was identified to the genus level and 6 to the family level. Aside from a few interactions still classified as "unknown", 6 were detected and identified: flower foraging, flower removing, fruit eating, fruit removing, plant damaging and insect foraging. Overall, this novel camera set-up method confirmed the primary role of *Eulampis jugularis* in the pollination process and showed the potential impact of *Rattus* sp. in seed dispersal or destruction. Although data collection is still in progress, the potential of this survey method to study plant-animal interactions is very promising.

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Session 21-P1 - Ecological and social dimensions of hydropower

"Power Up!" A mobile phone videogame collecting big data on sustainable development decision-making: Insights from COP26

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Unequivocal evidence of the dual climate and biodiversity crises was presented in 2021. At COP26 (Glasgow, 2021), climate leaders negotiated global targets for climate action, biodiversity conservation, climate justice and associated UN Sustainable Development Goals (SDGs). However, trade-offs between SDGs - and conflicts between people with different priorities - prevent the realisation of SDG targets. Hydropower development can be especially illustrative of this issue: renewable energy is generated, while simultaneously, important ecosystems and biodiversity may be destroyed and communities, food security and livelihoods negatively impacted. To manage such trade-offs effectively, it is vital, but challenging, to equitably engage and incorporate diverse voices into decision-making. Videogames have real potential to critically engage society in reflecting on SDG trade-off decisions, generating detailed data on people's decision-making at the scale needed to assist global sustainable development policy. "Power Up!" is a mobile videogame where players are sustainable development decision-makers, making choices about hydropower, biodiversity and communities, that have consequences in terms of equity. Gameplay from the month of COP26 generated a dataset comprising 57,780 decisions from 723 unique player sessions. These data revealed biodiversity conservation to be players' priority, alongside minimising social and environmental damage from hydropower development. Finer-grained patterns associated with 'tunnel vision' decision-making were also revealed. We believe early findings such as these demonstrate the potential of videogames for generating the big data needed to support real-world sustainable development decision-making. Our future work focuses on integrating gameplay data with detailed player information and qualitative data, to further explore this value.

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Session 21-P2 - Ecological and social dimensions of hydropower

Benthic macroinvertebrates as bioindicators of water quality in view of the construction of a hydropower dam on the Dibombe River in Cameroon

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Intensive and incessant disruptions in watercourses such as dams have become frequent in Cameroon due to the growing demand for hydroelectric power. This usually results in severe deterioration of ecosystem services on which local communities highly depend. The purpose of this study was to highlight the expected changes in macroinvertebrate community structures of the Dibombé river due to flow stressors induced by a Hydropower Plant (HPP) during its construction and operation phases. Sampling was carried out during the month of April 2021 in seven sampling stations along a five-kilometre stretch of the river. Data collected involved habitat characteristics, physicochemical properties of water, and macroinvertebrate diversity. In total, 346 individuals of macroinvertebrates belonging to 2 phyla, 3 classes, 8 orders, 18 families and 29 genera/species were collected. Insects were the most abundant taxon with many orders, while Crustaceans and Molluscs were less represented with only one order each. The presence of the pollutant-sensitive families was undoubtedly favoured by the absence of anthropogenic activities. The Dibombé river is of great importance for the conservation of many benthic taxa that are intolerant to anthropogenic stress. However, these organisms could disappear with the construction of HPP. Analysis of environmental variables show that Dibombé river has good ecological status, with important canopy coverage, well oxygenated and very low mineralized waters. However, the construction of HPP could affect macroinvertebrates through modification of natural flow regimes and changes in stream physicochemical characteristics.