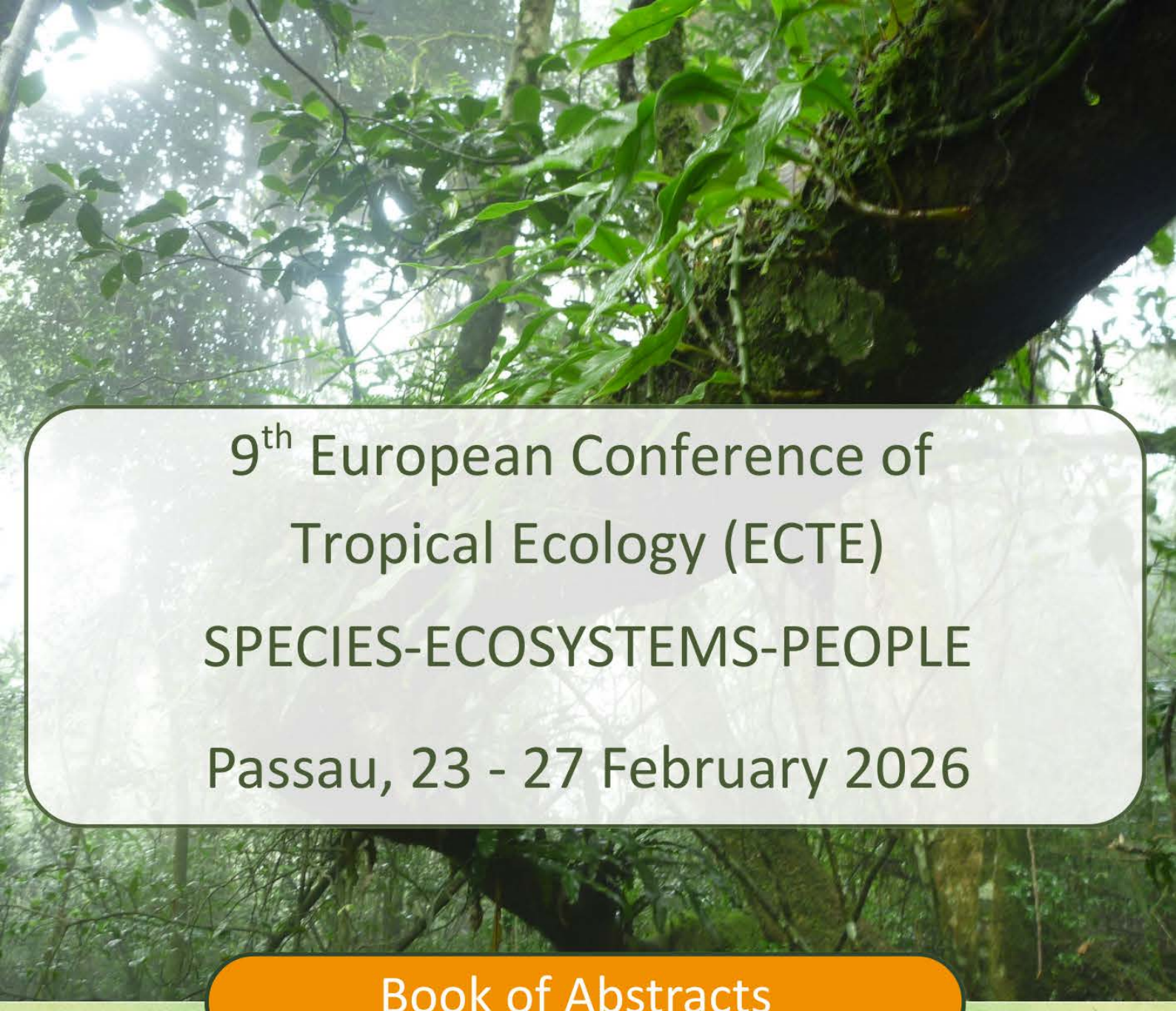

9th European Conference of Tropical Ecology (ECTE)

SPECIES-ECOSYSTEMS-PEOPLE

Passau, 23 - 27 February 2026

Book of Abstracts

Society for
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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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DOI: 10.30427/ecotrop202601
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Catering

- Studierendenwerk STWNO

Layout and social media

- Conference posters: Noah-Emanuel Galler
- Cover page: Liesa Cosman, Noah-Emanuel Galler
- Pictures: Christine B. Schmitt
- Social media design: Luca Perl, Kilian Seiberl, Lena König
- Website: Ogarit Uhlmann, F&U confirm

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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Welcome to Passau!

9TH EUROPEAN CONFERENCE OF TROPICAL ECOLOGY (ECTE)

37TH ANNUAL MEETING OF THE SOCIETY FOR TROPICAL ECOLOGY (gtoe)

"SPECIES – ECOSYSTEMS – PEOPLE"

23 – 27 February 2026

On behalf of the entire organising team, we are delighted to welcome you to the 9th European Conference of Tropical Ecology at the University of Passau!

This year's conference has its focus on the diverse interactions between species, ecosystems and people that take place at different spatial and temporal scales. In line with this theme, the conference offers an interdisciplinary perspective on tropical ecology spanning from purely ecological topics to issues such as the sustainable use, conservation and restoration of tropical ecosystems. We are very pleased to count more than 240 participants from 32 countries, as well as roughly 180 oral presentations and 40 posters across 17 thematic sessions. This variety of participants and contributions promises an inspiring week full of new insights and valuable exchange.

We want to extend our sincere thanks to the session chairs and the Scientific Committee for their support in creating such an exciting programme. Moreover, we thank our six main speakers for their invaluable contribution to this conference: Dr. Bea Maas holds the public Elisabeth Kalko Memorial Lecture, while Prof. Alexandre Antonelli, Dr. Maria Fungomeli, Dr. Viola Heinrich, Prof. Rob Marchant and Dr. Alfredo Romero-Muñoz contribute keynote lectures throughout the conference. We also gratefully acknowledge the German Research Foundation (DFG) for providing funding, as well as sponsoring by the University of Passau, the Faculty of Social and Educational Sciences and further partners.

Lastly, we thank you for joining us in Passau this week. We hope you enjoy your time here and take the opportunity to explore the city's rich cultural heritage, its beautiful riverside atmosphere, and the surrounding landscapes. Have a productive and memorable conference, and many rewarding conversations with colleagues old and new.

Welcome to the ECTE 2026 – and welcome to Passau!

The Conference Organisers

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DOI: 10.30427/ecotrop202601
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Keynotes

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Thematic Sessions

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Keynotes

Keynote 1

Why tropical ecology matters to everyone – biodiversity, ecosystem services, and sustainability

Bea Maas

University of Vienna, Austria

Biodiversity is the foundation of resilient ecosystem services that sustain human well-being. However, advancing impacts of intensive land use, climate change, and resource overexploitation critically threaten biodiversity – particularly in the tropics. This talk will highlight the far-reaching challenges arising from these developments as well as the opportunities tropical ecology provides for a sustainable future. We will take you on a journey from long-term research sites in Southeast Asia to South America, exploring how birds and bats shape the balance between biodiversity, ecosystem services, and agriculture. Field experiments from tropical cacao agroforestry systems show that these species can enhance yields by up to 118% through natural pest control, corresponding to nearly 960 US dollars per hectare each year. Similar results across multiple crops and regions reveal that land-use systems can be managed both profitably and biodiversity-friendly, depending on landscape context and functional diversity – often near critical ecological tipping points. Translating this knowledge into practice requires diversity at multiple levels – through the inclusion of varied communities, methods, and perspectives that bridge knowledge and implementation gaps. Such diversity can advance global Sustainable Development Goals by linking environment, society, and economy. Tropical ecology thus points the way toward our shared sustainable future.

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Keynote 2

Illuminating a global biodiversity darkspot

Alexandre Antonelli

Kew Gardens, United Kingdom

Centuries of scientific exploration have not yet given us a robust understanding of how many species there are on Earth, let alone what roles they play in ecosystems and how they interact with one another. While a global characterisation remains elusive, in this talk I will present our efforts to take a deep dive into one of the world's most biodiverse yet threatened biomes: the Atlantic Forest of eastern Brazil. Through a collaboration between academia, industry and policymakers, and integrating new technologies with classical surveys, we are beginning to map and understand the full biological and environmental complexity of the Alto da Figueira private reserve, just 2.5 hours away from Rio de Janeiro. These studies are not only breaking new ground in our understanding of tropical ecology but also informing conservation and restoration practice for the benefit of nature, climate and people.

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Keynote 3

Biodiversity patterns in the Kenyan coastal forests and conservation implications

Maria Fungomeli

National Museums of Kenya, Kenya

Tropical ecosystems are among the most biologically rich and diverse ecosystems on Earth. The Kenyan coastal forests, being part of the Eastern Arc and Coastal Forests of Tanzania and Kenya biodiversity hotspot, host a rich biodiversity, including numerous endemic and threatened plant and animal species. They include the culturally significant Kaya sacred forests which hold immense cultural and biological significance. These forest ecosystems are vital not only for supporting rich biological communities but also providing ecosystem services that sustain local livelihoods. However, they are facing unprecedented biodiversity loss, fragmentation, human population pressure, unsustainable land use practices, urbanization, logging and climate change. Protecting biodiversity and species, therefore, requires action beyond formal reserves: it must be guided by science-based conservation strategies across landscapes, where sustainable management can maintain ecological functions, enhance ecosystem resilience, and support both people and nature. Understanding the spatial patterns of species and communities across Kenya's coastal forests is critical for effective conservation strategies. My research in Kenya's coastal and Kaya sacred forests exemplifies this approach, combining vegetation and butterfly surveys, socio-ecological, land-use and land-cover change analyses, evolutionary approach, and biodiversity monitoring for conservation. This presentation shares key findings and their implications for biodiversity conservation and policy engagement.

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Keynote 4

Putting B before C? Rebalancing earth observation for biodiversity and carbon

Viola Heinrich

GFZ Potsdam, Germany

Tropical forests are one of the most biodiverse and productive ecosystems on Earth, playing a crucial role in the global carbon cycle. However, they are increasingly threatened by deforestation, degradation, and climate change. Remote sensing technologies provide unique opportunities to monitor and analyse the dynamics of tropical forest across spatial scales, with applications for operational and policy frameworks. While carbon dynamics have long dominated Earth Observation (EO) driven forest assessments, the growing focus on biodiversity signals a needed diversification of observation priorities. In this talk, I will explore how integrating different observing systems – from satellite to field data – can be used to inform understanding of the extent of degradation and regeneration and the associated carbon fluxes in tropical forests, which are often studied independently. In a world that is dominated by quantifying (aboveground) carbon fluxes from space, other transformations within and between degradation and regrowth forests are often overlooked. Examples from recent workshops will highlight how collaborative EO efforts are beginning to bridge this gap. Ultimately, by integrating numerous platforms for monitoring forests, we can move towards a more comprehensive understanding of tropical forest dynamics—putting not one before the other, but bringing B(iodiversity) and C(arbon) together.

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Keynote 5

Embedding the past for balanced future tropical mountain social ecological systems

Rob Marchant

University of York, United Kingdom

Tropical mountain systems are biodiversity hotspots that sustain billions of people through the production and flow of vital ecosystem services, yet mountains globally are under pressure from a perfect storm of changing climates, growing populations, biodiversity threats and agricultural transformations; challenges that increasingly impact not just mountain communities, but also the surrounding lowlands that rely on highlands for the provision of resources, most obviously water. With the recognition that human systems and ecosystems are now so interlinked that they must be understood as social-ecological systems; in our case mountain socioecological systems. Focussing East African mountain settings, we will explore the past, present and future of mountain social ecological dynamics and how this has evolved over 50,000 years. A new project, AFRI-CAN will showcase how we can apply our new understanding of the drivers of change to co-producing scenarios and pathways of change to inform how tropical worldwide could navigate future opportunities and challenges. Participatory scenario planning can integrate time and space, scientific and local knowledge to foster collective learning and actionable transformation toward resilient, balanced, and biodiversity-positive tropical mountain systems.

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Keynote 6

Impacts of multiple threats on mammal diversity across a global deforestation hotspot

Alfredo Romero-Muñoz

Humboldt-Universität zu Berlin, Germany

Understanding how multiple threats impact biodiversity across space and time is essential for effective conservation, yet global-scale studies typically use coarse resolutions and lack species-specific assessments. We used spatially explicit habitat and individual-based models to assess habitat destruction and overexploitation impacts across the 1.1 million km² Gran Chaco, a deforestation hotspot driven by beef and soy expansion. Over three decades, threat impacts expanded beyond deforested areas, causing widespread loss of high-quality habitat for jaguars, large mammals, and across all mammalian diversity facets (taxonomic, phylogenetic, functional). Jaguar and puma populations declined 88% and 80% respectively, with top carnivore guild function lost across 67% of the Chaco and concurrent strong declines across 61% of their historical co-occurrence – far exceeding extirpation zones. Both threats contributed substantially, with relative importance varying among species and diversity facets. Synergistic threat areas increased over time, exacerbating losses. Large protected areas served as critical strongholds, though threat impacts intensified at boundaries. Assessing multiple threats simultaneously at conservation-relevant scales can directly inform complementary proactive and reactive strategies to prevent further biodiversity decline.

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Thematic Sessions

Session 1: Biodiversity monitoring for sustainable wildlife management

Conveners: Lauren Coad, Stephan Funk, Neal Millar

As biodiversity loss accelerates across tropical ecosystems, the need for inclusive, scalable and cost-effective monitoring systems requires urgent attention. This session brings together interdisciplinary perspectives to explore cutting-edge approaches that integrate ethical frameworks, local knowledge, advanced technologies and emerging financial mechanisms. Emphasis is placed on ensuring equity and participation of Indigenous Peoples and Local Communities, whose stewardship and Traditional Ecological Knowledge are essential for effective biodiversity outcomes. Discussions will examine how artificial intelligence, co-designed monitoring platforms and biodiversity credit systems can transform conservation practices by making data more accessible, actionable and aligned with global biodiversity goals. By bridging scientific innovation with local realities and global finance, this session aims to chart a path toward more just and resilient biodiversity monitoring systems in tropical ecosystems.

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Session 01 – Oral 1: Biodiversity monitoring for sustainable wildlife management

Towards robust and scalable biodiversity monitoring in the tropics

Neal Millar[1], Lauren Coad[1,2], Stephan Funk[1,3]

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[2]*University of Oxford, United Kingdom*
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Tropical ecosystems support unparalleled biological richness yet face accelerating pressures from issues including deforestation, climate change and land-use change. Monitoring biodiversity in these regions is both critically important and methodologically complex. Traditional field-based biodiversity assessments, while valuable, are often limited in spatial and temporal scope because of logistics, cost and the typically required long time frame hindering timely conservation responses and reliable evaluation. Advances in alternative methods such as camera trapping, bioacoustics and environmental DNA (eDNA) provides promising avenues for improving biodiversity monitoring by enabling broader, more continuous, less invasive and less costly data collection. The suitability of Local Ecological Knowledge (LEK) is also increasingly recognized. In this session, findings are presented from an integrated biodiversity monitoring initiative in Guyana and Cameroon. Leveraging a combination of eDNA, acoustic monitoring, camera traps and LEK, our approach aims to generate rigorous, scalable and cost-effective biodiversity data. We discuss how these methods complement one another and can be tailored to these countries' diverse habitats. Importantly, we demonstrate how this integrated approach can empower Indigenous Peoples and Local Communities to monitor their lands effectively and cost-efficiently, supporting informed governance and decision-making.

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Session 01 – Oral 2: Biodiversity monitoring for sustainable wildlife management

Unveiling tree-level biodiversity: the Life on Trees integrative protocol

Maurice Leponce[1,2], **Olivier Pascal**[3]

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Traditional forest biodiversity studies often focus on a few emblematic groups, such as vertebrates and flowering plants, usually observed from the ground. In contrast, the Life on Trees (LOT, www.lifeontrees.org) program explored biodiversity across a wide range of organisms—from ground to canopy—on individual large, old trees rich in microhabitats.

The main goal was to document the diversity and distribution of eukaryotes (plants, animals, fungi, protists) using an integrative protocol combining 36 sampling methods. Both morphological and molecular taxonomy were used to identify the specimens. This protocol was applied to 3 giant trees (32–50 m tall) in the Andes–Amazon biodiversity hotspot. Professional climbers, guided by experts, collected samples, while the trees' complex architecture was mapped for the first time with a canopy-mounted laser scanner. Each tree was monitored over a full annual cycle, concentrated in 2 intensive four-week expeditions, each involving about 20 field participants. Complementary activities (e.g., insect traps, orchidarium) continued locally with Colombian partners and Peruvian forest rangers, supported by knowledge-sharing workshops. In total, over 200 participants from 21 countries are currently involved.

Preliminary results reveal record levels of per-tree diversity across many eukaryotic groups, showing that individual-tree approaches can uncover a significant share of forest biodiversity and open new avenues for assessment and monitoring.

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Session 01 – Oral 3: Biodiversity monitoring for sustainable wildlife management

Tracking the untracked: spatially explicit modelling of free-ranging dog density Using SECR

Kavya Pinalkumar Shah[1,4], Rohit Chaudhary[2], Aadil Kazi[1], Keshab Gogoi[3]

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Introduction: Spatially Explicit Capture Recapture (SECR) is a key framework for estimating population density across species. Free-ranging Dog (FRD)–wildlife conflicts increasingly threaten native wildlife ecology. This study uses SECR to estimate FRD density, providing baseline data for future studies.

Objective: To quantify the density and spatial distribution of free-ranging dogs using an SECR-based analytical framework.

Method: Density was estimated using the SECR polygon search method. A systematic sampling design divided the Navsari Agricultural University (NAU) campus into 32 grids of 12 hectares each. Foot-based surveys were conducted across three occasions (Jan–Apr 2024). Adult dogs (>1 yr) were photographed on both flanks using a DSLR for ID. GPS location, age, sex, and group size were recorded. Individuals were identified by coat patterns and natural marks. Detection probability(λ_o) and movement parameter(σ) were modeled by sex using four models. Model selection used ΔAIC in R package "secr."

Results: 160 unique FRDs were identified from 280 detections over 94.29 km. The best model included sex as covariate. Density: 43.38 ± 0.04/km² (95% CI: 35.44–53.09). Detection (λ_o) was higher for females (0.47) than males (0.28); movement (σ) was greater for males (111.29 m) than females (63.73 m). 55 groups (2–6 dogs), mean size 2.97, mostly male-female (47.27%).

Conclusion: SECR is a practical tool for monitoring FRDs in peri-urban areas and informs future management.

Merian Awards Candidate

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Session 01 – Oral 4: Biodiversity monitoring for sustainable wildlife management

Shade tree diversity enhances bat activity in Indonesian cacao agroforestry systems

Rym Nouioua, Bea Maas

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Biodiversity loss from expanding and intensified land use threatens the stability and productivity of tropical agroecosystems. Bats are key providers of ecosystem services in these landscapes, yet their ecology in Indonesia remains poorly understood, limiting efforts to integrate biodiversity conservation with sustainable land management.

We conducted a standardized acoustic survey across 12 cacao farms in Central Sulawesi from 2023 to 2024, examining how local habitat structure and landscape context influence bat assemblages. With two sampling points per farm, we recorded full-spectrum audio. The calls were segmented and classified in Kaleidoscope Pro, and then validated to sonotype, species or guild.

Preliminary analyses show higher bat activity and sonotype diversity on farms with richer shade-tree cover. Forest-associated guilds (e.g., rhinolophids, hipposiderids) and several rarely documented taxa occurred predominantly in structurally diverse, forest-adjacent farms, indicating positive effects of habitat connectivity and canopy heterogeneity.

These results provide one of the first systematic acoustic datasets from Indonesian cacao agroforestry. They highlight actionable strategies for sustaining bat populations and their pest-control services, such as maintaining shade diversity and conserving forest edges. Our approach offers a replicable template for tropical agroecosystems and supports biodiversity-friendly cacao management across Southeast Asia and beyond.

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Session 01 – Oral 5: Biodiversity monitoring for sustainable wildlife management

Community indicators of well-being and wetland rights in a protected area of the Bolivian Amazon

Dennis Lucy Aviles Irahola, Jean Paul Benavides Lopez

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This study explored participatory approaches for identifying and monitoring community-based indicators of Wetland Rights and Vivir Bien (well-being) in a community within a protected area of the Bolivian Amazon. The community identified key actors, power relations—including gender dynamics—their own conceptualizations of well-being and wetland rights, and relevant, measurable indicators. Quarterly measurements by community volunteers, combined with meetings with researchers, interviews, and mapping, allowed iterative validation and adaptation of indicators. Findings show that community-led monitoring is feasible, empowers local governance, raises awareness of wetlands' ecological and social value, and strengthens conservation and well-being. Challenges such as funding, limited infrastructure, and time for negotiation exist, but the process enhances community capacity for territorial governance. Researchers influenced indicator selection by presenting multiple dimensions of Vivir Bien, including gender relations and resource use, which the community adopted according to local priorities. Participatory indicators thus provide culturally relevant, actionable data while enhancing local autonomy and benefit from researcher support in early stages.

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Session 01 – Oral 6: Biodiversity monitoring for sustainable wildlife management

Ethics and social safeguards for biodiversity monitoring for Indigenous People and local communities

Michelle Lisa Kenyon, Lauren Coad

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Across the globe, the role of Indigenous Peoples and Local Communities (IP&LCs) as vital custodians of biodiversity is increasingly recognized. For generations, IP&LCs have safeguarded ecosystems through Traditional Ecological Knowledge (TEK) and deeply rooted management practices. However, escalating threats from climate change, habitat loss, and overharvesting are significantly challenging these efforts, necessitating support that provides communities with the tools, autonomy, and authority to drive local solutions. This abstract presents the results and lessons learned from the Sustainable Wildlife Management Programme (SWM) in Guyana, demonstrating how locally led solutions can be developed through a rights-based approach. At its core, SWM employs a Community-Based Rights Approach (CBRA), placing IP&LCs as the primary decision-makers for their lands and resources. This framework is supported by essential social safeguard tools and, significantly, co-developed protocols for Free, Prior, and Informed Consent (FPIC). We demonstrate how these mechanisms enhance transparency and ensure community authority in biodiversity monitoring. Ultimately, this work provides compelling evidence that when supported by strong policies and legal frameworks, community-led management rooted in rights and local governance is not only a moral imperative but also one of the most effective, long-term strategies for conserving nature and sustaining ecosystems.

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Session 01 – Poster 1: Biodiversity monitoring for sustainable wildlife management

Bat diversity in a fragmented savanna landscape of central Brazil

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Bats are an exceptionally diverse group of mammals, comprising over 1,400 species with most diversity concentrated in tropical areas. Brazil, a megadiverse country, hosts nearly 200 species. The Brazilian savanna (Cerrado) is a global biodiversity hotspot that has been extensively converted for agricultural use. We employed two sampling methods — mist-netting and bioacoustic monitoring — to characterize bat assemblages in Cerrado fragments embedded within an anthropogenic matrix in Goiás state. We recorded 26 species from six families, with Molossidae being the most abundant and species-rich family. Diversity estimators suggested higher richness (30 spp.). Phyllostomidae comprised seven species, all detected via mist-netting. The fragments exhibited high similarity (>50%), and beta diversity analysis indicated moderate variation in species composition between sites (0.618). No significant correlation was found between fragment size and species richness (r2=0.166; p=0.422), possibly due to the relatively small spatial scale of the study. Our results indicate that small Cerrado fragments within agricultural landscapes can sustain moderately diverse bat assemblages. Given ongoing habitat loss in the Cerrado, these remnants likely play a crucial role in maintaining regional bat diversity and, along with the protection of roosting sites, should be prioritized in conservation planning.

This work was funded by CONSAM – Environment and Archaeology and PELD-CEMA (#2021/10267000329)

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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Thematic Sessions

Session 2: Tropical molecular ecology

Conveners: 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 resulting in a need to modify life history strategies and/or change distribution ranges in response to environmental changes. 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.

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Session 02 – Oral 1: Tropical molecular ecology

Introgression and potential cytonuclear extinction of an endemic Ethiopian primate, the Bale monkey

Dietmar Zinner[1], Lakshmi Seshadri[1], Anagaw Atickem[2], Christian Roos[1], Liye Zhang[1]

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Bale monkeys (*Chlorocebus djamdjamensis*) are an endemic primate species found in a small area in the southern highlands of Ethiopia. The species exhibits several local adaptations to living at high altitudes and feeding on a bamboo-rich diet. In our genome analysis, we found non-synonymous mutations in genes involved in cellular responses to low oxygen (hypoxia), in genes related to bitter taste receptors and cyanide detoxification. Phylogenetically, Bale monkeys form the sister taxon to grivet monkeys (*Chl. aethiops*). In addition, we found some evidence that the western part of the Bale monkey population has been affected by genetic introgression from the grivet monkeys. Humans clearing the high-altitude bamboo forests to create grasslands and farmland most likely facilitated the influx of grivet monkeys into the southern highlands. Climate change and the growing human population of Ethiopia might force humans to convert also the last bamboo forests in high altitudes into agriculture and thus increasing the risk of extinction for Bale monkeys.

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DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 02 – Oral 2: Tropical molecular ecology

Conservation genomics of the Bornean reticulated python (*Malayopython reticulatus*)

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The Lower Kinabatangan Wildlife Sanctuary (LKWS) is a protected area of secondary forest in Sabah, Malaysian Borneo. Borneo has experienced rapid habitat loss and fragmentation since the production of palm oil was industrialised in the 1970s in order to meet global demand. The reticulated python (*Malayopython reticulatus*) is endemic to Southeast Asia and is thought to tolerate fragmentation due to their generalist nature and high dispersal ability, both of which allow it to survive within and travel across palm oil plantations. However, studies on other generalist species in tropical forests have found a decrease in genetic diversity as a result of fragmentation. This study used a 913bp Cytb alignment and 2,056 SNPs generated from ddRAD sequencing to investigate genetic variation, population structure and demography of 88 individuals within the LKWS. Limited evidence of population structure was identified with a limited difference in genetic variation across the study sites. A shrinkage in effective population size was detected corresponding to the last glacial period in Borneo with a recent population expansion approximately 10,000 years ago. Overall, this study has not identified any negative effects of fragmentation on these LKWS M. reticulatus individuals and suggests that no management is required.

2026 VOL. 28:202601
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Session 02 – Oral 3: Tropical molecular ecology

Conservation genomics of the critically endangered Mountain Chicken Frog

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Amphibians are the most threatened vertebrate group globally, with emerging infectious diseases such as chytridiomycosis driving severe declines. The mountain chicken frog (*Leptodactylus fallax*), once widespread across the Lesser Antilles, suffered a catastrophic population collapse following the introduction of the chytrid fungus (*Batrachochytrium dendrobatidis*) in 2002. The species is now functionally extinct in Montserrat and survives as a small, isolated population in Dominica, with fewer than 100 wild individuals remaining. A bio-secure captive population established in the UK before chytrid arrival now supports reintroduction efforts. Despite previous research on its ecology and demographic history, the genetic basis of resistance and adaptive potential in this species remains poorly understood. This project will apply ddRAD sequencing, a well-established technique in conservation used for studying non-model organisms, to characterise genome-wide diversity and identify candidate markers associated with chytrid resistance. Here, I will present preliminary ddRAD results and outline next steps for integrating genomic data to assess population structure, diversity, and adaptive potential. These insights will inform evidence-based management strategies and contribute to our understanding of how these, and other, threatened amphibians can adapt to emerging infectious diseases.

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Session 02 – Oral 4: Tropical molecular ecology

Contrasting genomic patterns in an African megafruit palm related to megafaunal seed dispersal loss

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Fruit-eating megafauna (megafrugivores) can disperse large seeds across long distances, thus playing a vital role in maintaining biotic connectivity. However, it remains unclear how the global extinction of most megafauna since the late Quaternary has affected megafruit plant populations. Here, we hypothesize that the loss of megafaunal seed dispersers has led to dispersal limitation of megafruit plants, resulting in genomic signatures that coincided spatially and temporally with the extinction of co-occurring megafauna. We focus on the megafruit palm *Hyphaene coriacea*, which naturally occurs in savannas in Madagascar (where all megafrugivores have gone extinct) and mainland Africa (where elephant populations are still dispersing their seeds). Using ddRAD-seq from 150 individuals across 20 populations, we find that *H. coriacea* populations in mainland Africa have higher genetic diversity, lower population differentiation, and more contemporary long-distance migration than Malagasy populations. However, demographic reconstructions indicate a shared long-term history of pervasive population declines across the two regions, coinciding with the Last Glacial Period (120-10 kya). Additionally, several populations in both regions experienced bottlenecks of varying magnitudes between 10 and 20 kya. Our findings suggest that while regional megafaunal extinction shaped recent dispersal dynamics, paleoenvironmental legacies and individualistic population responses leave lasting imprints.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 02 – Oral 5: Tropical molecular ecology

The build-up of fern diversity in the American tropics

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The American tropics are home to some of the richest biodiversity on Earth, but we still don't fully understand how this diversity developed. We explored how speciation and dispersal have shaped the distribution of ferns (Polypodiopsida) across this area with a complex geological history. We combined timed phylogenetic trees with geographic occurrence data and applied biogeographic models to reconstruct species movements and diversification through time, comparing results from a broad dataset of 56 fern clades encompassing 67 genera obtained from GBIF with those of a single genus with taxonomically curated observations.

Our results show that the American tropics act as a network of connected corridors, unlike the more isolated tropical regions of Southeast Asia. Ferns were found to disperse about twice as often as angiosperms in the same area. Fern diversity patterns also differ from those of flowering plants; the diversity of flowering plants peaks in Amazonia, whereas fern diversity was centred in the Andes, which both promoted speciation and acted as a hub for dispersal. In the taxonomically curated genus, however, diversity peaked in Amazonia, possibly due to better resolved species boundaries in this poorly known area. Our findings also show how both speciation and dispersal have varied through time in response to geological change, shaping today's biodiversity patterns.

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Session 02 – Oral 6: Tropical molecular ecology

Seed and pollen dispersal in the tropical canopy timber species *Triplochiton scleroxylon* K. Schum

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In tropical species exploited for their timber, understanding patterns of pollen and seed dispersal and their determinants has major implications for management guidelines. We assessed pollen and seed dispersal in *T. scleroxylon*, a species with regeneration deficit, and the third most exploited timber in Central Africa. We (i) characterized the mating system and seed and pollen dispersal, (ii) tested the relative importance of trunk dbh and crown dominance on female/male reproductive success – RS, (iii) characterized the fine scale spatial genetic structure (SGS), and (iv) tested if assortative mating occurs. We performed parentage analyses, estimated parameters of the neighbourhood model, and computed the kinship-distance relationship using spatial and genetic data of 741 adults, 407 juveniles, and 124 seeds from a 400-ha plot in Cameroon. Outcrossing predominates (0.9% selfing). Seed dispersed at short distances (105 m, CI: 92–121 m), leading to a strong SGS. Pollen dispersed at larger distances (413 m, CI: 287–733 m) with about five-time more immigration than seeds. Tree dbh had 1.4 times higher positive effect on the female RS than on male one. Crown dominance affects only the male RS. There was no evidence of assortative mating. If all trees above the Legal Minimum Cutting Diameter – LCMD were harvested, < 10% of the regeneration potential would be maintained, suggesting that logging strictly based on the current LMCD would be detrimental. Implications were discussed.

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DOI: 10.30427/ecotrop202601
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Session 02 – Oral 7: Tropical molecular ecology

Evolution of inbreeding depression in a predominantly selfing African tree species, *Pericopsis elata*

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Most tree species are predominantly outcrossing, showing low inbreeding at the adult stage. A notable exception was recently found in an African tree threatened by overexploitation for its high-quality timber, *Pericopsis elata* (Fabaceae). This moist tropical forest species exhibits a fragmented distribution from West to Central Africa, and very high selfing rates for a tree species (55% to 85%). However, the species also suffers from inbreeding depression, as attested by a reduced growth rate of self-fertilized seedlings compared to outcrossed ones, and a significant reduction of inbreeding from seedling to adult stages, suggesting that the survival rate till adulthood is an order of magnitude lower for selfed seedlings than outcrossed ones. The newly assembled genome of *P. elata* (1C = 0.85 Gb) is peculiar because each of its nine chromosomes is made of a large non-recombining central region, depauperate in genes but rich in some types of repetitive elements, surrounded by recombining regions. Each non-recombining region contains a few classes of closely related haplotypes. This pattern is suggestive of a system where pseudo-overdominance (POD) would maintain high inbreeding depression, but further work is needed to demonstrate the role of POD. Understanding the origin and dynamics of selfing and inbreeding depression in the different populations of *P. elata* could help manage this species sustainably, through assisted regeneration or plantations.

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Session 02 – Oral 8: Tropical molecular ecology

Exploring the gut microbiota and diet of small Bornean carnivores with DNA metabarcoding

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Gut microbiota play a key role in vertebrate hosts, performing symbiotic functions including digestion and immune defence. DNA metabarcoding of environmentally collected faecal samples has become an important tool for genetically characterising gut microbial communities. Faecal metabarcoding provides a non-invasive insight into the gut microbiota and diet of the host, yet many studies focus on humans and domestic animals, with limited research on wildlife. We used 16S metabarcoding to characterise the gut microbiota from opportunistically collected faecal samples of several small carnivore species inhabiting forest and oil palm plantation sites in the Lower Kinabatangan, Malaysian Borneo. Preliminary results have indicated interspecific differences, with Asian palm civets (*Paradoxurus hermaphroditus*) and Malay civets (*Viverra tangalunga*) showing greater intraspecific variability than Sunda leopard cats (*Prionailurus javanensis*), which exhibited a more conserved gut microbiota. Gut microbiota are often closely associated with diet and to investigate this additional metabarcoding libraries targeting vertebrate (12S), invertebrate (COI) and plant (trnL) dietary material were generated in parallel to be analysed. This data represents the first metabarcoding dataset for small Bornean carnivores, providing a baseline for future assessments of wildlife gut microbiota and helping to understand how anthropogenic change may influence host health in tropical ecosystems.

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2026 VOL. 28:202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 02 – Oral 9: Tropical molecular ecology

Moss as a novel and accessible eDNA source for surveying biodiversity across tropical ecosystems

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Biodiversity monitoring is critical to assess ecosystem health and guide effective conservation strategies. Advancements in the field of environmental DNA (eDNA) have delivered cost-effective biomonitoring tools to detect biodiversity across a range of ecosystems. Building on these efforts, we show how mosses (Bryophytes) can act as natural eDNA samplers for surveying terrestrial vertebrates in the tropics. A first pilot study in Ivory Coast revealed that swabbing 29 moss patches allowed for the detection of 37 locally occurring wild vertebrate taxa, including 19 birds and 16 mammals. Based on this proof-of-concept, we explored if the method could detect spatial trends in vertebrate diversity across habitats. To do so, we sampled moss patches across habitats ranging from grasslands to rainforests along a tropical elevational gradient in Peru. By characterizing vertebrates in 288 moss swabs, we detected 107 taxa identified at the genus level, including 47 birds and 50 mammals. We found a clear negative association between elevation and vertebrate richness. Next, by comparing our taxa detections with known species lists for the rainforest site, we showed that moss-derived eDNA is better for detecting mammals than birds. In conclusion, our results demonstrate that moss is a promising available source for surveying tropical biodiversity, particularly mammals, complementing other terrestrial eDNA sources such as airborne eDNA.

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Session 02 – Oral 10: Tropical molecular ecology

Molecular biology meets ethnobotany: material analysis of palm-leaf manuscripts

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Palm-leaf manuscript (PLM) production is a traditional practice in South and Southeast Asia, important both culturally and historically, yet never properly documented and now nearly disappeared. Material analysis and palaeoecological reconstructions are nowadays the only possible ways to assess the history and peculiarities of this unique craft. To understand which plants were used for PLM production, we analysed for plant DNA historically accumulated material from 30 folios of 10 PLMs originating from South India. Each manuscript sample revealed about 100 to 250 distinct plants. Notably, 30-35% of detected taxa were neither known as native to South India nor mentioned in the PLM production and preservation literature (ca. 300 sources in 20 languages over 270 years were analysed). Among the exotic plants are not only those introduced into the study area in the 17th-19th centuries and adopted by local communities, but also diverse surrogate species used as admixtures or as commercial substitutes for material benefits. For example, 11 surrogate taxa were revealed for East Indian sandalwood (*Santalum album* L.), 8 taxa for *Curcuma longa* L., and 6 for *Crocus sativus* L. As literature on PLM preparation is mainly non-academic, subjective, and difficult to verify, these cases of incoherence may serve as important sources of data on which plants were actually used historically (and revealed analytically) and which were mentioned for various reasons but not actually used.

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Session 02 – Poster 1: Tropical molecular ecology

Mating system, seed and pollen dispersal distances in two African tree species of the genus Prioria

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In the context of selective logging practiced in Central Africa, limited seed or pollen dispersal, inbreeding can have negative consequences on the regeneration of harvested species and the sustainability of logging. We develpped new microsatellite markers to analyze the mating system, seed and pollen dispersal, and determinants of reproductive success in *Prioria balsamifera* and *P. oxyphylla* in a 400-hectare plot located in Yangambi (DRC). The results show that these species have low rates of selfing (s~1%) and inbreeding. Seed and pollen dispersal is more extensive in *P. balsamifera* (ds = 564 m mean seed dispersal distance; ms = 78.5% seed immigration rate; dp = 582 m mean pollen dispersal distance; mp = 78.4% seed immigration rate) than in *P. oxyphylla* (ds = 368 m; ms = 46.2%; dp = 171 m; mp = 80.8%). The spatial genetic structure is low in both species (Sp = 0.022 for *P. balsamifera*; Sp = 0.011 for *P. oxyphylla*). Half of the regeneration is provided by trees with dbh > 60 cm in *P. balsamifera* and dbh > 80 cm in *P. oxyphylla*. Our results indicate that seed and pollen dispersal is not a limiting factor for the natural regeneration of these species. However, if all trees above the minimal legal cutting diameter (MLCD = 80 cm in DRC) were harvested, the reproductive potential would be reduced by 33.3% for *P. balsamifera* and 51.7% for *P. oxyphylla*. Therefore, we recommend increasing the MLCD or introducing measures to ensure that effective seed trees are maintained during logging.

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Session 02 – Poster 2: Tropical molecular ecology

Phylogenomic insights into the evolution of fruit types and dispersal strategies in angiosperms

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Fruits are key innovations in angiosperms, with dry and fleshy types reflecting distinct ecological strategies. In tropical ecosystems, most trees produce fleshy fruits that vary in size, color, and dispersal strategy, playing critical roles in sustaining frugivore communities and plant reproduction. However, the molecular mechanisms underlying the functional differences between dispersal strategies and how they contribute to the repeated evolution of dry and fleshy fruits remain unclear. Here, we performed phylogenomic analyses across 187 angiosperm species and analyzed transcriptomic data from 20 species to explore their developmental and evolutionary basis. Cross-species RNA-seq revealed that genes upregulated in fleshy fruits are enriched in pathways for fruit enlargement, sugar and secondary metabolite accumulation, and ripening, while those in dry fruits are linked to dehiscence and dehydration-related stress responses. Most fruit-associated genes act during ripening, marking the transition from photosynthetic and defended tissues to fleshy reproductive organs. Conserved amino acid substitutions in ABA biosynthesis and signaling genes in dry fruit species suggest convergent adaptation to abiotic stress. These findings highlight the convergent recruitment of similar molecular mechanisms in species that evolved to rely on animals for seed dispersal, and provide insights into the molecular basis of fleshy fruit diversity and reproductive strategies in tropical plants.

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DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

Thematic Sessions

Session 3: Linking environmental change, biodiversity, and ecosystem function through functional traits

Conveners: Eike Lena Neuschulz, Nina Farwig, Jörg Bendix

Climate and land-use changes are reshaping biodiversity and triggering feedback effects on the atmosphere. Predicting the consequences of biodiversity shifts for ecosystem functioning, particularly in biodiversity hotspots, remains a significant challenge. Tropical ecosystems, characterized by pronounced environmental gradients—such as elevational, successional, or land-use gradients—offer natural experiments to explore the complex relationships between environmental change, biodiversity, and ecosystem processes. Trait-based approaches provide powerful tools to capture how gradual environmental changes influence the composition of functional traits, revealing their impacts on species interactions and ecosystem functioning. This session seeks to bring together the latest research on biodiversity patterns and ecosystem functions across environmental gradients. A special emphasis will be placed on leveraging functional traits to predict biotic interactions and ecosystem functionality in the face of environmental change.

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Session 03 – Oral 1: Linking environmental change, biodiversity, and ecosystem function through functional traits

The effects of temperature gradient on flower and fruit traits: a meta analysis

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Angiosperm reproduction is driven by two largely animal-dependent consecutive processes: pollination and seed dispersal. Factors governing these interactions are critical for plant regeneration, habitat structure, animal communities, population genetics, and hence ecosystem stability. A major driver of plant-animal interactions is trait matching: morphological, chemical, and mechanical traits of flowers, fruits, and animals such as size or chemical composition that promote pairwise interactions and prohibit others. Critically, floral and fruit traits are influenced by a variety of factors susceptible to global change such as temperature or precipitation patterns. Yet most studies on the potential effects of global change on flower and fruit traits are localized and species-specific. Thus, any systematic effects of climate change on flower and fruit traits remain unknown. We report a meta-analysis on the effects of temperature on flower and fruit traits using the elevation-for-temperature approach. Using data from 151 species in 81 studies covering ranges between 0 and 5500 m above sea level, we show that in flowers, floral shape and longevity was highly susceptible to elevational changes, whereas in fruits crop size and micronutrient content are affected. These results indicate that climate change may drive changes in flower and fruit traits with downstream consequences for animal communities, plant regeneration patterns, and ecosystem functioning.

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Session 03 – Oral 2: Linking environmental change, biodiversity, and ecosystem function through functional traits

From seed dispersal and seedling recruitment to tree communities in a tropical dry forest

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Seed dispersal and seedling recruitment are essential processes of plant regeneration that together shape the assembly of plant communities. These processes are determined by a variety of biotic and abiotic environmental filters. Knowing which are the limiting filters of these processes is crucial to understand community assembly and the natural regeneration of forests. We conducted a one-year survey of seed dispersal and seedling recruitment of woody plants and recorded tree communities in forests and silvopastures in a tropical dry forest in Southern Ecuador. Specifically, we assessed 1) the effect of environmental filters on seed dispersal and seedling recruitment as well as 2) the resulting changes in plant community composition across two elevations and habitat types. Our study contributes to a mechanistic understanding of plant regeneration in tropical dry forests which are highly threatened and strongly modified by human activities.

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2026 VOL. 28:202601
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Session 03 – Oral 3: Linking environmental change, biodiversity, and ecosystem function through functional traits

Tree-seedling recovery is mainly modulated by the forest structural heterogeneity and biotic interac

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Key factors for the fast recovery of tropical forests include landscape connectivity, local conditions as well as experimental perturbations. We therefore carried out a full factorial perturbation experiment that included the clearance of aboveground vegetation and exclusion of terrestrial mammals across a chronosequence of 32 plots spanning agriculture, recovering and old-growth forests. We used mixed models to analyze the effect of the experimental disturbance, along with local and landscape conditions on abundance, diversity, and composition of the seedling community. Landscape connectivity played an important role in the recovery of tree-seedling diversity, but its effect was negatively influenced by terrestrial mammal exclusion. Moreover, structural complexity and prior land use strongly modulated the recovery of seedling communities. Following the vegetation clearance, older forests and former cacao plantations recovered faster in their diversity and species composition similarity, especially when terrestrial mammals were excluded. Local perturbations by terrestrial mammals hindered seedling establishment and thus strongly modulated the seedling composition, especially in older secondary forests. The complex interplay of landscape composition, prior land use, structural complexity, and local perturbation by mammals emphasizes how forest recovery can be promoted through scale-integrated restoration strategies.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 03 – Oral 4: Linking environmental change, biodiversity, and ecosystem function through functional traits

Global responses of tropical tree seedling species to nutrient addition

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Tropical forest soils are increasingly subjected to nutrient enrichment by nutrients from human activities and climate change. Rising nutrient deposition on pristine forests can alter regeneration dynamics and ecosystem functioning. To anticipate forest trajectories, it is crucial to understand how nutrient availability influences seedling performance. This study quantified the effects of nitrogen (N), phosphorus (P), NP, and NPK additions on tropical tree and shrub seedlings. We performed a systematic review and hierarchical meta-analysis of 59 experimental studies, encompassing 160 species from 54 tropical sites. We also considered climate, experimental methods, and species strategies. Nutrient addition increased shoot biomass by 26% and growth by 14%. The strongest effects occurred with combined nutrients: NPK raised growth by 27% and NP by 18%. Nitrogen addition enhanced shoot biomass by 38% (N alone) and 48% (NP), revealing N and P co-limitation. Seasonality was key, with shoot biomass increasing by 38% and 70% in seasonally dry sites. Species-specific patterns reflected stoichiometric strategies and adaptive responses. Overall, we expect that nutrient deposition significantly modifies regeneration processes. Yet, seedling responses, shaped by biotic and abiotic interactions, remain only partially understood. Future research should integrate successional dynamics and site-specific factors to improve predictions of tropical forest responses to global change.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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Session 03 – Oral 5: Linking environmental change, biodiversity, and ecosystem function through functional traits

Effects of long-term nutrient manipulation on the functional structure of Andean tree communities

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The Ecuadorian nutrient manipulation experiment (NUMEX) was started in 2008 to study the effects of increasing nutrient availability on tropical Andean forests. By adding N or/and P to old-growth forest stands NUMEX simulates higher nutrient deposition.

Leaf properties were monitored since the beginning of the experiment. We expected to find distinct species-specific foliar chemical compositions and shifts in the biogeochemical niche of the common tree species as a result of experimental nutrient addition.

We found increasing concentrations of foliar N and especially of foliar P after addition of the respective nutrients. After more than 15 years of nutrient addition the tree communities in the fertilized plots showed wider ranges of N and P concentrations and an overall higher functional richness (based on their foliar element concentrations) suggesting an expansion of the biogeochemical niches of these communities.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 03 – Oral 6: Linking environmental change, biodiversity, and ecosystem function through functional traits

Functional traits predict leaf optical properties across tropical dry and rain forests in Ecuador

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Understanding how plant traits mediate light interactions is crucial for linking biodiversity with ecosystem energy balance under environmental change. Leaf optical traits—VIS and NIR albedo and transmittance—govern radiation exchange and are key parameters in land surface models (LSMs). However, these traits are typically represented by fixed values within plant functional types (PFTs), overlooking the vast variability found in tropical ecosystems.

Here, we investigate how functional traits can predict leaf optical properties in mountain rain and dry forest – along an elevational and climatic gradient in southern Ecuador. We measured hyperspectral reflectance (475–1695 nm) and a suite of morphological and chemical traits (e.g., SLA, leaf thickness, punch force, and foliar nutrients) for over 500 trees representing diverse PFTs. Using random forest models, we identified the most relevant predictors of VIS and NIR albedo and transmittance.

Our models achieved high predictive performance for VIS and NIR transmittance (R^2 = 0.67 in rain forest; 0.59 in dry forest), with moderate accuracy for albedo. Structural traits—leaf thickness, SLA, leaf area, and mechanical strength—were the most influential predictors. Dry forest species exhibited higher VIS and NIR transmittance and albedo. These findings highlight that readily measurable functional traits can serve as effective predictors of leaf optical behavior, bridging biodiversity and biophysical processes.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 03 – Oral 7: Linking environmental change, biodiversity, and ecosystem function through functional traits

How does herbivory shape plant functional diversity in a tropical mountain forest gradient?

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Herbivory is a major biotic process shaping plant diversity, productivity, and ecosystem functioning. In tropical forests, insect herbivores can remove up to 30% of total leaf biomass, yet their broader impacts on vegetation structure and biodiversity remain poorly understood. Insect herbivory can either promote or suppress plant growth depending on how it alters resource-use strategies and community composition.

Here, we applied a trait-based Dynamic Global Vegetation Model (LPJ-GUESS-NTD) to assess how observed, leaf-trait-dependent insect herbivory influences vegetation functional diversity and productivity. Model simulations show that herbivory reduces net primary production by 6% and vegetation carbon storage by 26%. It also drives community-level shifts toward more conservative resource-use strategies, decreasing specific leaf area (SLA) by 34% and increasing wood specific gravity (WSG) by 10%. These trait shifts lower litter quality and nutrient availability, reinforcing nutrient gradients across elevation and enhancing community trait dissimilarity (β-diversity).

Our results demonstrate that insect herbivory substantially decreases tropical forest productivity and carbon storage, primarily through feedbacks between altered plant traits and soil nutrient cycling. Moreover, by selecting for conservative trait combinations, herbivory may play a key role in structuring functional diversity and maintaining ecosystem heterogeneity across environmental gradients.

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DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 03 – Oral 8: Linking environmental change, biodiversity, and ecosystem function through functional traits

Community-level trait variation along environmental gradients in tropical mountain rainforests

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Environmental conditions act as filters, that can lead to selecting species with similar traits and ecological strategies, resulting in covariation in community-level trait composition. For example, 'small and fast' organisms with acquisitive resource-use strategies may be associated with resource-limited environments, whereas 'large and slow' organisms with conservative strategies may dominate in resource-rich systems. To test for such coordinated organismal responses to environmental conditions, we investigate functional traits related to resource acquisition, mobility, and body size in trees, ants, beetles, and birds across three elevational levels in a tropical mountain rainforest in southern Ecuador. Using species-level trait data, we assess systematic changes in trait composition across taxa and elevation. By disentangling how environmental conditions shape functional composition across trophic levels, we aim to improve our understanding of trait-environment relationships and biodiversity responses to climate change.

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DOI: 10.30427/ecotrop202601
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Session 03 – Oral 9: Linking environmental change, biodiversity, and ecosystem function through functional traits

Trees, Traits and Traces: Tracking herbivory under tree species extinction pathways

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The functional identity of species is a major mediator of extinctions, with the loss of functionally distinct and functionally redundant species possibly defining extinction sequences. However, little is known how such sequences alter forest food webs, specifically for interactions such as herbivory. Using the subtropical BEF-China experiment, we constructed trait-based extinction scenarios from structural and nutritional leaf traits. We compared a first scenario, where functionally distinct tree species disappear first, and a second scenario, where functionally similar species disappear first, therefore species combinations with a maximized functional diversity remain. For both scenarios we examined how herbivory rates changed along a tree species richness gradient. With functionally distinct tree species being removed first, herbivory decreased more slowly with the loss of tree species. Under the second scenario where the decrease in functional diversity is dampened, herbivory declined much stronger. These results show that extinction pathways defined by functional identities restructure multitrophic dynamics. Hence, herbivory depends on both species richness and functional diversity. In a world where tree species extinction is driven by competition for resources, with similar tree species tending to disappear first, the decline in herbivory will be steeper. Such effects are likely context dependent and may be most pronounced in systems dominated by generalist herbivores.

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DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 03 – Oral 10: Linking environmental change, biodiversity, and ecosystem function through functional traits

Plant functional traits as mediators of tree-shrub interaction

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Forests are complex, multilayered ecosystems where the understory plays a vital role in processes like nutrient cycling. Shrubs, a key woody component in the understory, inhabit a niche shaped by trees. Tree diversity can modify the abiotic (soil properties, light availability) and biotic (competition, facilitation) factors in the forest that affect shrub growth. Shrub functional traits mediate these influences on shrub physiology and serve as indicators of their physiological status. We investigated the direct and indirect effects of neighborhood tree diversity on shrub growth in the BEF-China tree diversity experiment. We studied 88 shrub individuals of two different species, each surrounded by up to four trees representing 1, 2, or 3 species. We measured leaf functional traits of the shrub and of the neighbouring trees at the individual level. Using structural equation modeling, we quantified the pathway through which tree diversity affects shrub growth, including changes in canopy structural complexity, light availability, soil nutrients and competition and how these effects are mediated by shrub functional traits. First results show that tree diversity indirectly affected the shrub growth by increasing canopy structural complexity, which reduced light availability to the understory. This light limitation changes the shrub leaf traits related to resource acquisition and photosynthesis, ultimately affecting shrub growth.

Supported by the International Research Training Group TreeDì (GRK2324)

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DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 03 – Oral 11: Linking environmental change, biodiversity, and ecosystem function through functional traits

Landscape-level rainforest loss modifies avian functional characteristics on a national scale

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Avian functional ecology in the tropics exists on a continuum from local studies to distribution-based biogeographic syntheses. However, such research can be confounded by local conditions, or lack of distributional data. There remains a lack of large-scale, coordinated field surveys that could inform nationwide conservation management in developing tropical countries.

We report results from the first national forest inventory of Papua New Guinea, performed in the world´s third largest continuous rainforest landscape. Teams of ornithologists have travelled a range of lowland and highland forests to estimate how landscape-scale loss of primary forest affects bird conservation. A range of methods was used, including point-counts, recordings, and Mackinnon lists. Remote-sensing data were used to inform on the intactness of rainforest ecosystems.

We found that primary forest loss interacts with elevation in shaping functional structure of avian communities. Specifically, we show that larger birds with high dispersal ability, particularly frugivores, are negatively affected by decreases in landscape-level primary forest extent. However, this pattern is restricted to lowland forests.

This is contrary to findings from methodologically analogous but spatially restricted previous studies. As such, we help ellucidate the complex relationships between avian traits and landscape-level forest loss within a uniquely biodiverse tropical country.

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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 03 – Oral 12: Linking environmental change, biodiversity, and ecosystem function through functional traits

Forest cover and heterogeneity mitigate avian functional loss in the Brazilian Atlantic forest

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The conversion of tropical forests into agricultural lands has led to severe losses of ecological functions, largely due to the decline or disappearance of specialized insectivorous and frugivorous birds. Functional diversity (FD) reflects both the variety and balance of ecological roles within bird communities and is highly sensitive to habitat simplification. We examined how bird taxonomic and functional diversity respond to increasing agricultural pressure across landscapes of the Atlantic Forest in southeastern and northeastern Brazil. Data came from standardized surveys using mist-nets, point counts, and autonomous recorders in continuous forests, forest fragments within sugarcane and smallholder farms, vineyards, and eucalyptus plantations. We calculated Functional Richness, Evenness, Diversity, and Dispersion to characterize community-level FD. Fragmentation and isolation filtered out specialized and sensitive species, resulting in low FD in small fragments and monocultures. Conversely, heterogeneous mosaics with mixed land uses and over 60% native vegetation maintained high FD and distinct trait combinations, suggesting the coexistence of complementary functional types. Our findings highlight that heterogeneous, well-connected landscapes, especially those with large forest cover, help preserve ecological functions even in human-modified regions, offering valuable insights for conservation and agroecological planning.

We thank FAPESP – São Paulo Research Foundation), for funding project 2021/10195-0 (Call for Proposals (2021).

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 03 – Oral 13: Linking environmental change, biodiversity, and ecosystem function through functional traits

Drivers of raptor community structure in India: An integrated functional and spatial approach

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Raptors, including birds of prey and owls, are apex and mesopredators that serve as indicators of ecosystem health. Yet, studies on their community patterns in tropical South Asia remain limited. This study explores how habitat features, functional traits, and feeding interactions influence raptor communities across diverse Indian landscapes. Field surveys were conducted at 445 points across seven localities using standardized point counts within species-specific home-range buffers.

Areas with taller forests and higher water cover were preferred by Brahminy Kite, Lesser Fish Eagle, and Black-shouldered Kite, while Spotted Owlet favored high-NDVI regions. Deciduous forests supported Common Buzzard, Eurasian Kestrel, and Short-toed Snake Eagle. Croplands attracted Montagu's Harrier and Black Kite, and human-dominated zones were used by Changeable Hawk Eagle and Black Eagle.

Traits such as wing length, beak depth, and tarsus length were closely tied to habitat use and foraging style. Community-weighted traits showed clear separation among forest, wetland, and urban habitats. Although generalists overlapped in diet, spatial segregation reduced competition. These findings highlight the combined role of habitat heterogeneity, morphology, and spatial mechanisms in maintaining raptor diversity across tropical landscapes.

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DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 03 – Poster 1: Linking environmental change, biodiversity, and ecosystem function through functional traits

Direct seeding: An effective strategy for restoring reproductive functional diversity in the Cerrado

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Ecological restoration is critical in the Brazilian Cerrado, the world's most biodiverse savanna, where agricultural expansion has cleared over half of its native vegetation. Although a variety of ecological restoration techniques are applied in the Cerrado, their capacity to re-establish complex ecological interactions is not yet fully understood. We evaluated this by comparing plant communities, reproductive traits, and functional richness in areas restored by direct seeding (n = 20) versus natural regeneration (n = 9). Direct seeding consistently yielded significantly higher species richness, plant abundance, and functional richness. This superiority was reflected in specific traits, including a greater richness of andromonoecious species, a greater abundance of hermaphroditic plants, and species that offered nectar or no floral resources. Direct seeding promoted a higher richness of species pollinated by bees and wind, a greater abundance of plants pollinated by flies, and a greater richness of species dispersed by birds, wind, and epizoochory. The strong positive correlation between species richness and functional richness in these areas highlights the method's capacity to rebuild complex communities. We conclude that direct seeding is a good strategy for accelerating the recovery of functionally diverse plant communities, providing a robust foundation for ecosystem resilience in the Cerrado.

Funding: CNPQ (process #441166/2023-7) and FAPEG (Process #2025/10267000580)

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DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 03 – Poster 2: Linking environmental change, biodiversity, and ecosystem function through functional traits

Modulation of functional traits and growth in *Pericopsis elata* seedlings

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The low natural regeneration of many exploited tree species in Central Africa highlights the need to more precisely define appropriate silvicultural practices. Understanding how seedlings adjust their functional traits and growth in full sunlight and under the shade of other trees is essential to optimise enrichment planting protocols. A total of 230 *Pericopsis elata* seedlings were transplanted in sunlight and shade environments. Twenty-three morpho-physiological and chemical traits were measured, alongside growth dynamics. Statistical analyses revealed high mortality (10,7%) in sunlight during the first ten months after transplantation, with comparable mortality rates (13,5%) in both environments after three years in the field. However, logistic growth asymptotes were significantly higher in sunlight for diameter after 310 days and for height after 600 days of planting. PCA of functional traits revealed a conservative resource-use strategy in seedlings exposed to full sunlight, contrasting with a more acquisitive strategy under shade. Light environment explained over 58% of the variation in key traits such as specific leaf area, stomatal density, and maximum stomatal conductance; whereas mother tree accounted for less than 10% of trait variability. These findings clarify the optimal level of shading needed during the first year to protect and support early seedling growth, and highlight the importance of thinning from the second year to boost seedling performance and lower mortality.

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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 03 – Poster 3: Linking environmental change, biodiversity, and ecosystem function through functional traits

Fruit decomposition and removal in a subtropical forest biodiversity experiment

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Tree species richness enhances diversity at higher trophic levels and can increase ecosystem functioning. It may also shape the communities of decomposers involved in fruit decomposition and, through this, affects rates of fruit decomposition. However, such effects may be obscured by other environmental drivers, including forest structure, topography, and interactions among decomposer. To investigate these relationships, we placed ~900 plums across 96 plots along a tree diversity gradient in the world's largest forest biodiversity experiment (BEF-China) in subtropical China in autumn 2025. Fruits were exposed for four days, after which their removal and decomposition stages were assessed. While data analyses are ongoing, we hypothesize that fruit removal and decomposition rates will be higher in closed forests, on shallow slopes, and in plots of high tree species. Overall, this study aims to clarify how tree species richness and environmental factors jointly influence fruit removal and decomposition in a subtropical forest biodiversity experiment. By extending previous research on other forms of necromass (carrion, deadwood, litter), it contributes to a broader understanding of bottom-up effects of tree diversity on organic matter turnover.

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DOI: 10.30427/ecotrop202601
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Session 03 – Poster 4: Linking environmental change, biodiversity, and ecosystem function through functional traits

Local and landscape drivers of small mammal diversity in a forest-cashew mosaic in West Africa

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Forest conversion into agriculture is a major driver of biodiversity loss in the tropics. In Guinea-Bissau, the quick expansion of cashew (*Anacardium occidentale*) has led to extensive forest loss, yet its effects on native fauna remain poorly understood. We investigated how the expansion of cashew orchards influences small mammal diversity in Cantanhez National Park, West Africa. Small mammals were live-trapped across 24 sites (12 forest and 12 cashew orchards) over 5,760 trap-nights, identified morphologically and molecularly, and their diversity was related to local (canopy openness, understory obstruction, tree structure, palm and vine density) and landscape variables (forest and cashew cover, edge density). We captured 105 individuals from 7 species (5 rodents, 2 shrews). Species richness increased with understory obstruction, species abundance declined with higher cashew cover, and species composition varied with forest cover, canopy openness, and tree height. The most abundant species, *Praomys rostratus* (n = 72), was largely restricted to forests. Cashew expansion is driving the decline of the forest-dependent *P. rostratus* and promoting a shift towards generalist and open-area species. These results highlight that cashews sustain only a subset of generalist taxa and cannot replace native forests. Conservation efforts should prioritize preserving forest fragments and regulating cashew expansion to guarantee the persistence of forest-dependent biodiversity in the tropics.

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DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 03 – Poster 5: Linking environmental change, biodiversity, and ecosystem function through functional traits

Phenology and distribution of fine roots in a seasonal tropical dry forest in southern Ecuador

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As a consequence of global climate change, drought frequency and intensity in tropical forests is expected to increase. Tree species exhibit various strategies to endure periods of drought such as deep-rooting. 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 investigated fine root seasonality in the topsoil (0–20 cm) by monthly taking fine root samples at two different elevations (600 and 1200m a.s.l.) in the Laipuna dry forest reserve, southern Ecuador, from May 2022 to September 2023. Samples were analyzed for biomass, necromass, and morphological traits (fine root length, area, diameter, volume). We further assessed vertical fine root distribution at 5, 15, 30, and 75cm soil depth at both elevations. Climatic data (precipitation, air and soil temperature) were recorded simultaneously. Fine root biomass varied in response to soil moisture with high topsoil fine root biomass during the rainy season. Necromass was negatively correlated with precipitation and increased markedly during the dry season. At drier lower elevation fine root biomass was sharply decreasing with soil depth whereas this decrease was not that pronounced at the more humid upper elevation. The findings of our study will contribute to the understanding of how fine root phenology and distribution enable tree species to perform in increasingly drier environments in future decades.

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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 03 – Poster 6: Linking environmental change, biodiversity, and ecosystem function through functional traits

Towards a standardized framework for identifying leaf herbivory damage types

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Leaf herbivory by insects is a key ecological process influencing plant performance, food webs, and ecosystem functioning. The diversity of insect feeding traces, ranging from holes and chewed margins to mines, galls, surface scars, and punctures, reveal valuable information on plant-herbivore interactions and herbivore community structure. Grouping these traces into damage types (DTs) reflects distinct functional feeding guilds (FFGs) such as chewers, miners, gallers, or suckers, offering a promising proxy for assessing herbivore functional diversity. However, FFGs and DTs remain underexplored, with most studies focusing on external chewing damage, leaving the role of non-chewing guilds (e.g., miners, gallers, suckers, skeletonizers) uncertain. We conducted a meta-analysis of studies quantifying leaf area loss by different feeding guilds to test whether chewers cause more damage than non-chewers. Across studies, chewing herbivores removed significantly more leaf area, driven mainly by differences between chewers with miners and skeletonizers. Yet, this pattern likely reflects data scarcity for underrepresented guilds. Our results emphasize the need for standardized DT identification, harmonized data collection, and consistent reporting across feeding guilds. We advocate for a photographic DT guide developed through community participation in our LeafBites project on iNaturalist to improve herbivory monitoring and comparability across ecosystems and environmental gradients.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Thematic Sessions

Session 5: The use of camera traps in tropical ecosystems studies

Convener: Raphaelle Abensur

Automatic camera traps have become increasingly prevalent in recent years for studying natural populations and characterizing biodiversity, particularly in tropical ecosystems. Camera trapping is a non-invasive method that minimizes the need for continuous human presence in the field while enabling long-term, continuous monitoring of wildlife. This approach provides rich and diverse information on animal communities, including taxonomic diversity, species occupancy and occurrence, community structure, and activity patterns. In tropical forest ecology, camera traps are widely used to improve our understanding of ecological processes such as seed dispersal, species interactions, and animal movement. They also serve as valuable tools for monitoring species distributions, especially in the context of increasing human-wildlife conflict. The datasets generated through this method contribute significantly to conservation strategies and biodiversity assessments in tropical environments.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 5 – Oral 1: The use of camera traps in tropical ecosystems studies

Camera trap datasets for seed dispersal studies in Kenyan coastal forests

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Kenyan coastal forests show a high level of species richness, harboring over half of the country's threatened, forest-dependent plant and vertebrate species. These ecosystems face severe pressures from human disturbance, leading to forest degradation and habitat loss. Edge effects also alter the abundance and diversity of vertebrates at forest boundaries compared to interior areas. Animal-mediated seed dispersal is crucial for maintaining forest diversity, as many tropical trees rely on frugivorous vertebrates as seed dispersers. However, the mechanisms and functional dynamics of seed dispersal in Kenyan coastal forests remain poorly understood. This study aims to advance understanding of seed-dispersal mutualisms in the Arabuko-Sokoke Forest, the largest remaining tract of East African dry coastal forest. It investigates how edge effects and seed size influence vertebrate seed-disperser communities. Five fruiting tree species with varying seed sizes were selected. Each of the 49 tree individuals, located either at the forest edge or in the interior, was monitored using camera traps to record visiting terrestrial mammals during the day and night. The study expects to reveal differences in the composition and activity of seed-dispersing vertebrates between forest zones and across seed sizes. By improving knowledge of dispersal processes, this research contributes to identifying ecological factors that support the regeneration and long-term sustainability of Kenyan coastal forests.

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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 5 – Oral 2: The use of camera traps in tropical ecosystems studies

Nectarivorous bats as drivers of gene flow: Combining camera traps and molecular analyses

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Gene flow through pollination is a key process maintaining genetic connectivity in tropical forests. Nectarivorous bats are important long-distance pollinators, yet the mechanisms linking their foraging behavior with gene flow remain poorly understood. We combined camera traps and microsatellite-based genetic analyses in a Peruvian rainforest to link bat foraging behavior with pollen dispersal in the Neotropical liana *Marcgravia longifolia*, which flowers from the understory to the canopy. Camera traps across forest strata recorded nearly 8,000 bat visits, with highest visitation rates in the understory and midstory where floral resources were most abundant. Genetic paternity analyses of seedlings revealed pollen dispersal distances up to 1,350 m, with longer dispersal events in lower strata. We did not detect a spatial genetic structure, indicating extensive connectivity mediated by mobile bat pollinators. Our results demonstrate that nectarivorous bats are crucial agents of gene flow across vertical forest strata, linking plant individuals and maintaining genetic diversity. By integrating camera trap monitoring with molecular analyses, we show how pollinator behavior translates into functional outcomes for plant reproduction. This approach underscores the ecological importance of bats in tropical forests and illustrates the value of combining non-invasive monitoring with genetic tools to unravel complex ecological interactions.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 5 – Oral 3: The use of camera traps in tropical ecosystems studies

Using cameras to study the phenology of trees versus grass across tropical savannas and dry forests

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Seasonal rhythms in vegetative phenology, the timing of leaf production and loss, set the pace of ecosystem function in tropical savannas and dry forests. Research on phenology often takes place at single sites or via remote sensing data from earth observation satellites. The limited replication of the former impedes efforts to understand variation and its drivers, while the latter lacks the ability to differentiate the phenological rhythms of different vegetation components, such as trees versus grasses. Here, we use a standardised approach with phenocameras to document the distinct seasonal rhythms of tree crowns versus understorey plants across nine sites in South America and Africa, spanning mean annual precipitation from 400 to 1400 mm on both continents. We find that trees show relatively little variation in the length of their growing season, despite wide variation in water availability across the sites. The understorey shows more variation, which is driven by water availability as well as functional composition, i.e. dominance by grasses versus forbs versus shrubs. Overall, our study highlights idiosyncratic phenological patterns across sites, pointing to the need for ground-based monitoring across more sites across the dry tropics, to better understand this critical aspect of ecosystem behaviour.

This research is supported by FAPESP Process 2024/01680-0

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 5 – Oral 4: The use of camera traps in tropical ecosystems studies

Assessing non-volant mammal responses to community managed agroforestry in Amazonian Ecuador

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Forest regeneration and agroforestry are increasingly promoted as strategies that can function as Nature-based Solutions (NbS) for climate change mitigation and adaptation. Yet, their capacity to sustain mammal diversity remains poorly quantified. Here, we assess non-volant mammal assemblages across a land-use gradient of secondary forest, community-managed agroforestry, and pasture at the Ecuadorian Amazonian frontier. Camera traps, deployed across 18 sites for a total of 378 trap-days, captured 15 mammal taxa spanning five functional feeding guilds. Secondary forests supported the highest richness and diversity across all Hill numbers (q = 0-2), with carnivorous species found only in these sites. Frugivores and seed-dispersing taxa dominated agroforestry systems, while pastures were characterised by species poverty and the absence of key functional groups. Rarefaction and extrapolation curves confirmed higher diversity in secondary forests, and multivariate analyses indicated overlapping but compositionally distinct assemblages in both forest and agroforestry systems. These findings demonstrate that forests remain irreplaceable refugia for mammals, while agroforestry can provide functional contributions but cannot substitute for more complex, heterogeneous systems. Nevertheless, maintaining mosaics of regenerating forest alongside agroforestry systems may offer a complementary NbS pathway to unite conservation, food sovereignty, and livelihoods in frontier landscapes.

Merian Awards Candidate

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 5 – Oral 5: The use of camera traps in tropical ecosystems studies

Unsustainable hunting diminishes protected area effectiveness in tropical forests

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Protected areas (PAs) are fundamental to global strategies to halt biodiversity loss, especially in tropical regions suffering rapid deforestation and defaunation. Their importance has been reaffirmed through initiatives like the "30x30" target. However, safeguarding habitat alone is insufficient when wildlife within PAs is exploited through hunting. This is particularly true in regions like Southeast Asia, where many PAs are characterized by insufficient resources, lack of capacity, and ineffective management. We analyzed data from 1,658 camera-trap stations across 19 PAs and 12 non-PAs in the Greater Annamites ecoregion of Vietnam, the epicenter of the "Southeast Asia snaring crisis". Our findings reveal that decades of intensive snaring has led to severe defaunation of terrestrial mammal and bird communities both inside and outside PAs. Many medium- and large-bodied species are locally extirpated. Species richness was not significantly higher in PAs than in non-PAs. Regardless of protection status, larger and more remote sites retained higher richness. These findings underscore how intensive hunting can impede PA effectiveness. Vietnam likely reflects broader tropical patterns where overexploitation persists. To achieve global biodiversity goals, conservation efforts must address wildlife overexploitation alongside to habitat protection.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 5 – Oral 6: The use of camera traps in tropical ecosystems studies

camtrapR: From data management to interactive ecological analysis of camera trap data

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Camera trapping has become an indispensable tool in wildlife monitoring, particularly in tropical regions where wildlife is threatened by habitat loss and hunting. Yet, these regions often lack the expertise to perform robust statistical analyses of large amounts of camera-trap data locally, thus depending on collaborators from regions with more developed scientific infrastructure. The widely used R package camtrapR was originally developed for managing camera trap data. We introduce a major update that transforms camtrapR into a comprehensive analytical platform. The centerpiece of the update is a novel code-free dashboard that guides users through common analytical approaches for camera trap data. In the dashboard, users can perform exploratory analyses, such as mapping species detections. But most importantly, it supports the interactive construction and fitting of single-species and community occupancy models. The dashboard's covariate preparation tools generate inputs for both model fitting and spatial predictions of species occupancy and richness. We provide an overview of these functionalities using a case study of terrestrial vertebrates in the tropical forests of the Annamite Mountains, Vietnam. By integrating a powerful, code-free interface with advanced modelling functions, this major update to camtrapR aims to make robust and reproducible camera trap data analysis accessible to a wider audience, including ecologists, wildlife managers, and students.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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Session 5 – Poster 1: The use of camera traps in tropical ecosystems studies

Monitoring frugivorous vertebrates along different human disturbance in French Guiana forests

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Automatic camera traps are widely used to characterize biodiversity and to study the patterns of species presence, abundance, and distribution. We deployed camera traps to collect data on frugivorous vertebrates from 2017 to 2023 under fruiting nutmeg trees (*Virola sp.*), along forest sites subjected to different levels of human disturbance in a Guianan forest. The study sites were the Nouragues Natural Reserve (control site = no disturbance), the Bonaventure eco-touristic camp (historically logged and mined = intermediate disturbance), and forest patches in ecological corridors crossing National Road 2 (hunting, deforestation, and connectivity loss = high disturbance). We compared frugivorous vertebrate diversity (taxonomic richness, Shannon, Simpson, and Piélou evenness indices), composition, and taxon occurrences along the disturbance gradient. We observed a trend showing a decrease in taxonomic richness on the most disturbed study site. Assemblage composition also varied across sites, providing insights into the potential sensitivity of certain taxa to disturbance, although more sites need to be added to the study to isolate disturbance effect. As seed dispersers, frugivorous vertebrates play a critical role in forest ecosystem dynamics. Understanding the response of their assemblages to disturbance in tropical ecosystems is essential for designing adapted conservation programs.

Merian Awards Candidate

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 5 – Poster 2: The use of camera traps in tropical ecosystems studies

Terrestrial feeding in an arboreal New World primate revealed by camera trapping

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Terrestrial activity is very rare in Neotropical monkeys, in contrast to African and Asian primates, where species like baboons, macaques and gorillas spend most or all activities on the ground. Here we report terrestrial feeding on fruits of the palm *Mauritia flexuosa* by squirrel monkeys, *Saimiri macrodon*, recorded through camera trapping at the Estación Biológica Quebrada Blanco, Peruvian Amazonia.

To document ground visitors of *M. flexuosa* palms, we placed a camera trap 5 m from the trunk of a palm where intact fruits and fruits with the hard husk partially or completely removed lay on the ground around the trunk. The camera trap was open for 360 h between 8 and 23 August 2022; video length was set at 20 sec, lag at 10 sec.

On 21 consecutive videos from 18 August 2022 variable numbers of *S. macrodon* were visible. Several individuals came down to the ground to pick up palm fruits, then jumped up to narrow trunks or moved out of sight. Other individuals were reluctant to go down to the ground. The quality of the recordings did not allow to distinguish whether the monkeys picked fruits with the husk intact or removed. Since squirrel monkeys are dentally adapted for soft fruit-feeding, it is more likely that they picked fruits with removed husks.

Our observations underline that camera trapping is an important tool for revealing rare (?) behaviors, possibly not shown in the presence of humans, that nevertheless may be important for understanding aspects of aut- and synecology.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 5 – Poster 3: The use of camera traps in tropical ecosystems studies

Lemurs and birds rarely visit *Ravenala sp.* plants on degraded land in north-eastern Madagascar

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The genus *Ravenala* (Strelitziaceae) is endemic to Madagascar and includes six arborescent herb species. *Ravenala sp.* is an iconic Malagasy plant used by people in many ways and often dominates formerly forested land in north-eastern Madagascar. Our estimates from high-resolution satellite imagery (WorldView-2) indicate densities of up to 84 plants per hectare. We assessed its value as a habitat plant for mammals and birds on such degraded land, focusing on *R. madagascariensis*. This species forms clonal groups whose crowns are positioned close together, often at the same height, allowing camera-trap observations without artificial structures. In an area of approximately 8 ha dominated by *R. madagascariensis*, we installed camera traps to monitor 18 crowns of this species and 14 traps in co-occurring trees within a 10 m radius. A total of 4,195 camera days in *R. madagascariensis* and 3,238 in trees were available for analysis. Dwarf lemurs (*Cheirogaleus sp.*) visited *R. madagascariensis* significantly less often than neighbouring trees. Likewise, birds visited R. madagascariensis less frequently, and fewer bird species were observed (four vs six in trees). Only the introduced mammal *Rattus sp.* used *R. madagascariensis* and trees at comparable rates. For the studied taxa, R. madagascariensis therefore does not provide habitat functions equivalent to trees. Former forest land dominated by R. madagascariensis may thus be suitable for tree-based restoration.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 5 – Poster 4: The use of camera traps in tropical ecosystems studies

Novel distance measuring approach for camera trap distance sampling

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Camera trap distance sampling (CTDS) revolutionised wildlife population estimation by eliminating the need to distinguish individual animals of the same species, but instead relying on detection probability based on observed distances. This approach enables robust abundance estimates for species lacking distinctive markings and facilitates multi-species surveys, overcoming limitations of traditional methods like capture-recapture.

The accuracy of CTDS hinges on precise detection distance measurement. Conventional methods – manual comparison with reference images or size-based calculations – are error-prone due to perspective and terrain variability. Our novel approach projects the camera's field of view into a 2D plane, focusing on the ground-contact point of animals. By integrating reference images with known distances from multiple axes, we reconstruct scene topography and generate a depth map, enabling reliable distance calculation. While this method excels in sloped terrains and struggles with very close animals.

We tested this method during the 2024 rainy season in Ethiopia's Bale Mountains National Park, deploying 29 camera traps inside the Harenna Forest. Despite equipment challenges from heavy rain, the absence of pastoralists increased detection likelihood for cryptic species. Preliminary results confirm the method's robustness in estimating detection distances, offering promising improvements for density estimates.

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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

Thematic Sessions

Session 6: Interdisciplinary perspectives on agrobiodiversity and ecosystem restoration

Conveners: João de Deus Vidal Junior, Enrico Ille, Alexandra Müllner-Riehl, Abubakar Bello

The restoration of vegetation cover plays a critical role in climate mitigation, adaptation and policy recommendations. However, due to the complexity of processes, impacts, and perspectives involved, interdisciplinary approaches are necessary to document and evaluate restoration efforts and the changes they cause in (agro)biodiversity. This session aims to provide a platform to researchers from different fields of knowledge (such as social sciences, life sciences, geography and geosciences) to discuss different points of view about agrobiodiversity and restoration initiatives in different parts of the globe. We welcome submissions about changes in land, biodiversity, and livelihoods associated with restoration practices, to discuss challenges and opportunities for further research.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 6 – Oral 1: Interdisciplinary perspectives on agrobiodiversity and ecosystem restoration

What species are used by restoration projects and what does that mean for the Sahel

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Ecosystem restoration is a key strategy for mitigating biodiversity loss and climate change. In dryland regions like the Sahel, large-scale regreening efforts aim to reverse desertification, enhance vegetation cover, and improve ecological resilience. These efforts involve the introduction or re-establishment of plant species, but the selection of species and restoration practices varies widely across interventions. Although such projects play a major role in national environmental goals, little is known about how species selection affects restoration outcomes. Here, we document different aspects of the species used across regreening projects in Nigeria to understand the rationale and impacts on local restoration. We combine field surveys, interviews, project documentation, and satellite-derived data to provide a database with commonly used species. Our results show that while most projects still rely on *Eucalyptus* and *Azadirachta indica*, native species are becoming more frequently utilised, with objectives shifting from landscape management to climate change mitigation. Our study shows that species selection influences the effectiveness of restoration in achieving different goals, and that the policy-to-practice translation is driven mostly by the interaction between farmers, nurseries, and project offices. These insights can inform regreening efforts across the Sahel, where scaling up successful models depends on aligning goals with ecological knowledge and local practices.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 6 – Oral 2: Interdisciplinary perspectives on agrobiodiversity and ecosystem restoration

When farmers and foresters meet: Choosing the right trees for climate-resilient agroforestry

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Cocoa farmers value companion trees in their plots for the ecosystem services they provide. Many wish to increase tree number and diversity (cultivated and forest trees) to support livelihoods, sustain productivity, and adapt to climate-related stress. Meanwhile, numerous governments promote agroforestry and tree planting, mainly with forest species in cocoa plots. On this matter, farmers and forest practitioners hold complementary knowledge yet rarely collaborate. We build on research on knowledge co-production to initiate co-designed agroforestry options in the field. Interviews were conducted with cocoa farmers and forest practitioners in seven semi-deciduous cocoa-growing areas of Côte d'Ivoire prone to drought. Actors first reflected on their own knowledge, then shared and compared it to identify convergence and divergence. A tree attribute ranking exercise was conducted individually and collectively with both groups, and a Plackett–Luce model evaluates the results. Discussions reveal varied perceptions and preferences regarding tree attributes. Some elicit shared evaluations, reflecting common understanding of their importance, while others reveal divergent assessments, indicating differing perceptions of value or function. Future co-design discussions must build on these agreements and disagreements to create inclusive, context-specific, and climate-resilient agrobiodiverse systems.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 6 – Oral 3: Interdisciplinary perspectives on agrobiodiversity and ecosystem restoration

The NaijaFLO database and the future of floristic knowledge in Tropical Africa

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Africa's plant diversity remains incompletely documented, constrained by persistent Linnean and Wallacean shortfalls that obscure the true extent and distribution of its flora. These gaps limit accurate biogeographic inference, conservation prioritisation, and ecological modelling. Nigeria, one of the continent's most species-rich countries, typifies this challenge. Here we introduce NaijaFLO, the Database of Vascular Plants of Nigeria, a comprehensive, specimen-anchored resource developed at the German Centre for Integrative Biodiversity Research (iDiv) in collaboration with Nigerian and international experts. NaijaFLO consolidates herbarium records, verified field

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observations, and authoritative taxonomic sources (IPNI, POWO, WFO, LCVP, APD) into a harmonised, Darwin Core–compliant dataset. It documents 7,920 taxa (7,528 species) across 235 families and 1,888 genera, including 6,347 native and 88 endemic taxa, each supported by at least one vouchered specimen or expert-verified record. Freely accessible via the iDiv PlantHub and GBIF under a CC BY 4.0 licence, NaijaFLO represents the first fully verified national flora for Nigeria. It provides a model for integrating dispersed floristic data into interoperable, open infrastructures. Beyond Nigeria, NaijaFLO highlights the transformative potential of specimen-based national databases to illuminate biodiversity "dark spots", strengthen African herbaria, and advance floristic research across the tropics.

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DOI: 10.30427/ecotrop202601
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Session 6 – Oral 4: Interdisciplinary perspectives on agrobiodiversity and ecosystem restoration

Hotspots of timber species declines in Nigeria: evidence from species distribution models

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The temperature increase predicted for the end of the 21st century will affect global biodiversity distribution, natural resources, and ecosystem services. Given human dependence on certain species and regional variation in environmental change, impacts will differ across areas. Timber availability is directly tied to the occurrence of specific tree species of high wood quality and abundance, and sustainable access depends on how climate change alters current habitats. Understanding changes in the distribution of timber species may provide key insights for adaptation and sustainable management.

Using species distribution models, we estimated current and future habitat suitability for 107 native timber species under three climate scenarios, accounting for land use in Nigeria. Current richness is highest in southern forest biomes, while northern savannas show lower richness. Future projections reveal varying trends: under all SSPs, species richness changes range from slight increases to localized declines in the south. Up to 78% of timber species may lose suitable habitat under SSP1-2.6, with an average net loss of 36%, while SSP3-7.0 and SSP5-8.5 show smaller losses (27% and 23%). These results highlight critical conservation areas and the importance of sustainable forest management to mitigate habitat loss and maintain ecosystem services. However, southern forests face rapid deforestation and land degradation, threatening their capacity to buffer habitat loss in the north.

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DOI: 10.30427/ecotrop202601
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Session 6 – Oral 5: Interdisciplinary perspectives on agrobiodiversity and ecosystem restoration

Spatiotemporal dynamics and cross-boundary connectivity of ecological networks in patchy landscape

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Habitat fragmentation and connectivity loss pose escalating challenges for biodiversity conservation, yet their drivers and interactions with governance remain poorly quantified. Here we assessed trends in fragmentations, spatio-temporal distribution of forest patches, and structural connectivity in northern Ethiopia over four periods,1985, 1994, 2009 and 2023, and spanning the boundaries among three administrative regions with differing landscape governance structures (Amhara, Tigray and Afar). We analysed data using a combination of remote sensing, fragmentation metrics and morphological spatial pattern analysis, and graph-based connectivity indices. Results indicate a consistent trajectory of landscape simplification, with mean patch area declining by 37%, core habitat shrinking by 54%, and the largest patch dominance eroding by nearly half. Connectivity indices confirmed a nonlinear collapse, with probability of connectivity falling by 85% and the number of disconnected subnetworks increasing from 7 to 10, particularly between 1994 to 2009. Overlay with climatic and governance data shows that connectivity losses were most severe where rising climate stress coincides with dense administrative boundaries, with a negative three-way interaction (core X climate X boundary). Scarce core habitat, climate stress, and dense borders erode connectivity. Administrative-structural fragmentation harms biodiversity and services; climate smart, cross boundary action is needed.

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DOI: 10.30427/ecotrop202601
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Session 6 – Oral 6: Interdisciplinary perspectives on agrobiodiversity and ecosystem restoration

Monitoring soil cover changes in restoration projects to define management thresholds

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Vegetation monitoring is a key step in restoration projects. It allows for the evaluation of progress, indicates management needs, and verifies if the vegetation has reached the levels required by the project or legislation. Direct seeding using green manure and native species with different life cycles is a method increasingly used in large-scale projects in Brazil. This work aims to evaluate how soil cover has changed across different monitoring events to indicate critical values that influence the recovery process. Within the Caminhos da Semente Initiative, a monitoring protocol was developed to track areas implemented by the project and its partners, where soil cover is collected using the point-intercept method along transects. We evaluated the percentage cover change of different life forms in 49 projects with at least two monitoring events, ranging from 1 to 35 months after restoration interventions. In 42% of the areas, the cover of shrub and tree species increased to the detriment of exotic grasses. However, when the percentage of these invasive species was higher than 35%, their cover increased or remained the same in the following monitoring, indicating that these problem species must be managed before reaching this threshold.

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DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 6 – Oral 7: Interdisciplinary perspectives on agrobiodiversity and ecosystem restoration

Soil Organic Carbon of soils under pressure and land use change in Kilifi County, Kenya

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Soil organic carbon (SOC) is essential for climate change mitigation and global food security. Accurate measurements help predict future climate scenarios and assess sequestration potentials. This study explores SOC in Kilifi County, Kenya, where population growth and poor land management stress ecosystems. SOC was sampled in sacred forests (Kayas) and adjacent subsistence farms using composite samples up to 1m depth. SOC content was measured by wet oxidation and Loss On Ignition (LOI). Stocks were calculated, and multivariate variance analyses examined links between SOC, soil properties and management, while a partial least square regression modeled topsoil SOC. Forest soils had lower density and SOC than farms. To 1m depth, mean SOC stocks were 12.94 Mg ha-1 for farms and 8.63 Mg ha-1for forests, suggesting that local factors or management practices enhance SOC in agricultural soils. Despite anticipated effects of management, no significant influence was detected over the full 1m soil depth, likely due to the inherent difficulty of quantifying management practices in subsistence farming. The study advances understanding of SOC dynamics and sequestration potential in Kilifi and along the Kenyan coast. Improving the accuracy of LOI-based SOC determinations remains essential, as no standardized clay correction exists to account for structural water loss. The research highlights the need of local studies, since the factors driving higher SOC on farms are still unclear.

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Session 6 – Poster 1: Interdisciplinary perspectives on agrobiodiversity and ecosystem restoration

Resistance as agency: Reimagining participation in forest landscape restoration in Tigray, Ethiopia

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Forest landscape restoration programs play a vital role in addressing environmental degradation; however, when implemented through top-down approaches, they often face community resistance, revealing complex social dynamics shaping both ecological and social outcomes. This qualitative study examines participation and resistance in Tigray, Ethiopia, using interviews, focus groups, and participatory observations. Drawing on James Scott's theory of everyday resistance and the ABC framework (Avoidance, Breaking, Constructive), it uncovers diverse strategies influenced by socioeconomic disparities and power relations. While some farmers initially welcomed short-term employment and environmental gains, many later voiced frustrations over land restrictions, centralized planning, and unmet promises. Resistance ranged from covert non-compliance to overt protest and local governance alternatives. Rather than viewing resistance as an obstruction, the study interprets it as a lens into community priorities, political agency, and participatory shortcomings. It argues that recognizing resistance is vital for reimagining equitable and inclusive restoration under the UN Decade on Ecosystem Restoration.

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DOI: 10.30427/ecotrop202601
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Session 6 – Poster 2: Interdisciplinary perspectives on agrobiodiversity and ecosystem restoration

Forest cover above legal minimum: A necessity for Brazilian drylands landscape

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Drylands cover over 40% of the Earth's surface and support more than 2 billion people. In these regions traditional agriculture often drives intensive degradation, resulting in loss of productivity. In Brazil's Caatinga dryland region, these practices have already led to severe desertification. A key challenge lies in forest cover legislation: Brazilian law mandates a minimum of 20% of native area, while recent proposals advocate for 50% to significantly enhance ecosystem services (ES) provisioning. Therefore, this study aims to assess how land use change impacts ES provisioning in agricultural landscapes within the Cariri Paraibano (a Caatinga sub-region) under four land-use scenarios: Current, Law (20% forest cover), LawAgr (law+50% agriculture cover) and Sustainable Agroscapes (SAL's) (50% forest cover + 50% agriculture cover). We hypothesize that SAL's will yield the best ES provisioning. We also examined these effects based on property size. Using geoprocessing, we employed the InVEST model to evaluate scenario impacts on soil loss, carbon storage, and agricultural productivity. The results show that the Law Scenarios failed to reverse the historical degradation trend. We conclude that adopting SAL's is crucial for reducing 75% of soil loss, increasing 58% of carbon storage and 117% of agricultural production. Highlighting the need for forest cover to optimize essential services particularly when implemented on small properties.

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Session 6 – Poster 3: Interdisciplinary perspectives on agrobiodiversity and ecosystem restoration

Tropical station La Gamba: Integrating research, conservation, and education in southern Costa Rica

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The Tropical Station La Gamba of the University of Vienna is located at the edge of Piedras Blancas National Park in southern Costa Rica – one of Central America's most biodiverse rainforest regions. Established in 1993, the station has developed into an internationally recognised hub for tropical research, conservation, and environmental education. In a landscape affected by land use, deforestation and climate change impacts, the station collaborates with local and international partners to promote biodiversity protection, habitat restoration, and sustainable resource use.

The Tropical Station La Gamba combines long-term ecological monitoring, experimental plots, and remote sensing to study the dynamics of tropical ecosystems. Core projects focus on reforestation, sustainable agriculture, and restoring habitat connectivity through the Biological Corridor La Gamba (COBIGA). Training courses, field programmes, and workshops connect ecological research with conservation practice, translating scientific evidence into policy advice and regional land-use planning.

Over three decades, the Tropical Station La Gamba and its partners have established extensive reforested and restored areas that safeguard biodiversity, sequester carbon, and strengthen ecosystem resilience. The station demonstrates how integrated tropical field research can link knowledge, education, and collaboration to foster resilient landscapes, thriving communities, and a sustainable future.

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Session 6 – Poster 4: Interdisciplinary perspectives on agrobiodiversity and ecosystem restoration

Where to restore what? Differentiated tree-based restoration priorities in north-eastern Madagascar

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The tropical rainforest biome ranks high in priorities for ecosystem restoration. Restoration to forests should be the goal for environmental stewardship but may contribute little to fulfil people's socio-economic demands. Such co-benefits can be provided by agroforestry, which makes rehabilitation through agroforestry an alternative and additional goal in tropical human-dominated landscapes. We addressed the question 'where to restore what' in a biodiversity hotspot in north-eastern Madagascar by generating priority area maps for forest restoration and tree-based land rehabilitation through agroforestry. We used a weighted overlay with ecological and socio-economic criteria from remote sensing products and other sources for a spatially explicit analysis. Restoration opportunities (1.54 million ha) corresponded to 69% of the study region; and top priority areas represented 7% for forest restoration and 37% for agroforestry, indicating a huge potential. Our estimations of restoration opportunities exceed a previous global assessment, probably due to more recent data sources and different sets of criteria applied. The new products may enable more fine-scale planning and foster differentiated restoration efforts, combining forest restoration with agroforestry for multifunctional landscapes and benefiting nature and people.

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DOI: 10.30427/ecotrop202601
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Thematic Sessions

Session 7: Tropical ecosystems through time: What the past tells us about the future

Conveners: Gregor Mathes, Liesa Cosman, Hermann Behling, Antonia Reinhardt

Tropical ecosystems hold a large share of global biodiversity and provide essential ecological services. Yet they are highly vulnerable to deforestation, climate shifts, and biodiversity loss. While ecological monitoring over recent decades offers valuable insights, a thorough understanding of present-day dynamics and future trajectories requires much longer temporal perspectives—spanning centuries to millennia and beyond. This session offers an interdisciplinary forum for researchers studying tropical and subtropical ecosystems through a wide range of temporal lenses and methodological approaches. We aim to bring together archaeological, paleoecological, paleontological, and ecological perspectives on tropical biodiversity responses to environmental and human pressures over time. We particularly encourage contributions from early-career researchers and seek to build a diverse group of presenters. Understanding the past is not only a scientific imperative but also a practical tool for anticipating ecological tipping points, guiding conservation efforts, and shaping a more resilient future for tropical ecosystems.

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DOI: 10.30427/ecotrop202601
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Session 7 – Oral 1: Tropical ecosystems through time: What the past tells us about the future

Long-term dynamics of Amazonian rainforest and wetland ecosystems and the role of climate, sea-level

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The Amazon rainforest is the largest rainforest ecosystem on Earth, representing nearly 50 % of the Earth's tropical rainforest area. Consequently, it plays a significant role in global climate, hydrological cycle, carbon cycle and biodiversity. The increasing number of pollen and charcoal records from different regions in Amazonia shed more light into past vegetation and climate changes as well as human impacts during the late Quaternary. In respect to the issue of global change the question is raised how stable the Amazon rainforest ecosystems are and how far they react on disturbance by climate, sea-level, fire and human impact. Palaeoecological studies based on pollen analysis in different ecosystems in the central and eastern part of Amazonia and neighbouring regions provide inside on long-term vegetation dynamics and the response to environmental change to understand modern and future environmental changes.

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Session 7 – Oral 2: Tropical ecosystems through time: What the past tells us about the future

800 years of Indigenous and colonial influence on southern Amazonian forests

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Although severe, widespread, and recently occurring, the impacts left by colonial activities in Amazonia is poorly known. We present an 800-year paleoecological history of Paraiso Lake in Rondônia, Brazil. Using fossil pollen and phytolith to track vegetation and crop occurrence, and charcoal a proxy for fire, we found three different phases of human occupation in the region. Before 1492 CE (European arrival), maize, Manihot and squash were cultivated by Indigenous peoples, and fire was recorded in the landscape at its highest values. Forest taxa, however, comprised 80-100% of the total vegetation abundance during this phase. After European arrival, maize becomes rare, reappearing only after 1600 CE and charcoal gradually declines, indicating decline of the Indigenous population. In response, the early successional taxa *Cecropia*, palms, and grasses increase in abundance. A third phase marks the largest change in vegetation. By the 1850 CE charcoal occurrence increases, maize, and yucca become frequent again. *Cecropia* and grasses reach its highest abundances, pointing to forest disturbance without precedent in the 800 years registered in this record. This phase corresponds to the Rubber boom, a period marked by extreme population increase, the establishment of large cities, and social and territorial reorganization in Amazonia. This record shows how colonial activities have affected modern forests, influencing vegetation structure and successional stage documented within them.

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DOI: 10.30427/ecotrop202601
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Session 7 – Oral 3: Tropical ecosystems through time: What the past tells us about the future

Palaeoecological insights into long-term climate and human impact in southern Brazil's highlands

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Understanding the long-term interplay between climate, vegetation, fire, and human activity is key to contextualizing present-day ecological dynamics in southern Brazil. In this study, we present palaeoecological data from two sediment cores retrieved from the highland regions of the Brazilian Atlantic Forest: The Matematico and Parna core. The lacustrine core Matematico (late Holocene) combines pollen, NPPs, charcoal, and compound-specific hydrogen isotopes (δ^2H) to reconstruct vegetation and fire dynamics over the last 3,500 yr bp (years before present). Results show two phases of Araucaria Forest expansion, initially climate-driven and later coinciding with increased fire and archaeological evidence of Southern Jê activity, suggesting possible anthropogenic influence. In contrast, the peat core Parna offers a unique long-term perspective, potentially spanning 70,000 yr bp. High-resolution analyses of pollen, charcoal, NPPs, and XRF reveal natural vegetation dynamics throughout the late Pleistocene and Holocene, with human impact evident only in the last ~1,000 yr bp. Together, these records provide a multi-scalar view on ecological resilience, forest-grassland dynamics, and the timing and extent of human influence in one of the world's most threatened biomes.

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DOI: 10.30427/ecotrop202601
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Session 7 – Oral 4: Tropical ecosystems through time: What the past tells us about the future

Late-Holocene vegetation change and human impacts in northern Cuba

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The insular Caribbean, a global biodiversity hotspot, faces growing pressures from environmental stressors and human activities such as agriculture and coastal overexploitation, yet paleoenvironmental research remains scarce. This study examines long-term vegetation dynamics and human–environmental interactions at a coastal lagoon, Laguna Rincón, in northern Cuba. By applying a multi-proxy approach of pollen, charcoal, and elemental data (XRF), this study aims to define environmental baselines and infer anthropogenic changes.

Preliminary results suggest mangrove colonization by 1,500 cal. yr BP and the subsequent expansion of dry-evergreen forest (e.g., Celtis sp.) over the last millennium. Drier conditions during the Little Ice Age (~1550–1850 CE) are reflected by increased Bursera simaruba and Rhizophora mangle pollen, and elevated Br and Cl values, which may indicate drying of the wetland. The last two centuries recorded intensified human activity, evidenced by maize pollen, high charcoal content, and indicators of erosion (high Cu and Al values), likely due to deforestation. Around ~1250 CE, the pollen and charcoal data suggest possible pre-Columbian human impacts, which will require further analysis to confirm. This study represents one of the few high-resolution paleoecological reconstructions for Cuba and may guide future restoration efforts by providing information on the sensitivity of coastal ecosystems to abrupt environmental change and anthropogenic impacts.

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DOI: 10.30427/ecotrop202601
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Session 7 – Oral 5: Tropical ecosystems through time: What the past tells us about the future

Tracking the long-term dynamics of Seychelles' endemic palm forest

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Praslin island (Seychelles) harbours a unique assemblage of the six endemic palms of the archipelago, including the emblematic "Coco de Mer" (*Lodoicea maldivica*). Palm forests are believed to have dominated the island's landscape in the past but are currently restricted to fragmented patches, including the UNESCO World Heritage Site Vallée de Mai. To investigate the temporal dynamics and drivers of vegetation change in the island, we analysed microfossils (fossil pollen and charcoal) and sedaDNA from sediment cores spanning the last 8,000 years, representing the first palaeoecological analysis from the archipelago. Preliminary results indicate that palms were more widespread and abundant in the past, forming a more continuous forest cover. Shifts in vegetation appear to be twofold: 1) linked to environmental variability such as drying trends over the past few millennia, and 2) the arrival and settlement of the islands about 300 years ago. This long-term perspective highlights that sustaining the palm diversity of Vallée de Mai requires strategies that integrate the species' ecological history, the role of disturbance, and the ongoing threat of climate change and invasive species. Hence, understanding these long-term trajectories is critical for the preservation of this ancient palm forest.

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DOI: 10.30427/ecotrop202601
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Session 7 – Oral 6: Tropical ecosystems through time: What the past tells us about the future

Geochemical traces of peatland change in the Congo Basin, from past to present

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Tropical peatlands, formed as accumulations of partially decomposed plant organic material (OM), account for 16% of terrestrial soil carbon despite covering 0.25% of land area, and comprise multiple macromolecules, each with different decay rates.

The fate of OM within the peat profile remains poorly understood, as original plant material signatures change in the peat column. While rates of decomposition are primarily driven by the substrate's chemical composition, along with environmental conditions (e.g. temperature and water saturation), long-term peat preservation is governed by sustained environmental conditions and subsequent decomposition processes. The organic composition of peat therefore provides valuable insights into decomposition processes, often varying substantially with depth, allowing it to reflect past environmental conditions and events.

Our research focuses on peatlands in the Congo Basin that experienced a major drought and where peat loss released substantial amounts of CO_2. We use geochemical methods such as FTIR and py-GC/MS to characterise peat organic geochemistry throughout the column, revealing changes in composition through time and during peat loss events. Results suggest that the nature of peat has changed through time, which has implications given reduced rainfall projections for the region. Understanding these past events offers valuable analogues for understanding the resilience of modern peatlands to environmental change.

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DOI: 10.30427/ecotrop202601
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Session 7 – Oral 7: Tropical ecosystems through time: What the past tells us about the future

What the past tells us about the future: environment shifts may trigger pollinator shifts

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More than 85% of flowering plants rely on animal pollinators for reproduction, and shifts among functional pollinator groups (e.g., bees, birds) may contribute to reproductive isolation and speciation. To what extent such pollinator shifts spur diversification, or happen as a result of other changes in a species' ecology (e.g., niche/range expansions), remains largely unexplored. Because ecological studies have demonstrated strong, non-random associations between pollination strategies and the abiotic environment (e.g., more hummingbird-pollination in tropical mountains), it is high time to test for evolutionary generalities in the sequence of environment and pollinator shifts, critical for forecasting changes in biotic interactions in light of global change.

Using the pantropical plant family Melastomataceae as a model, I will explore four hypotheses on the potential relation (or lack) of environment shifts and pollinator shifts, and assess whether one of the two likely acted as a precursor for the other. With our dataset spanning more than 400 species of Melastomataceae across all genera, I will show that evolutionary modelling provides compelling evidence for environment shifts (colonization of tropical mountains) preceding, and likely driving evolutionary pollinator shifts (from bee to vertebrate pollination). These modelling results are backed by experimental tests of pollination efficiency, and environment-trait associations.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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Session 7 – Oral 8: Tropical ecosystems through time: What the past tells us about the future

Fossil-calibrated predictions of tropical extinctions

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Climate change poses a significant threat to global biodiversity, yet predicting species extinctions remains challenging. Most projections rely on species distribution models (SDMs), which estimate realized niches based on modern occurrences and climate and extrapolate them into future habitat using climate projections. However, the predictive accuracy of SDMs for extinction risk remains unverified due to limited ground-truthing; in contrast, the fossil record offers an independent benchmark that can be used to both validate and forecast extinction predictions. Here, we use fossil data of planktonic foraminifera to estimate species' past thermal niches and assess extinction risk under climate change. We show that past climate-driven extinctions over the last ~66 million years were largely predictable from these niche characteristics. Projecting our niche estimates into the future reveals spatiotemporal extinction risk patterns that complement traditional SDMs, highlighting severe threats to biodiversity under anthropogenic warming, particularly in the tropical oceans.

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DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 7 – Oral 9: Tropical ecosystems through time: What the past tells us about the future

Projecting coral reef futures from past responses to climate change

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Coral reefs are among the most climate-sensitive ecosystems on Earth, yet their deep-time record provides essential context for understanding their future under ongoing global warming. Throughout the past 500 million years, reef crises have repeatedly coincided with intervals of rapid carbon release and ocean warming.

This study aims to evaluate the relationship between coral extinction and the loss of reef ecosystems through geological time, testing the hypothesis that reef collapse can occur without substantial taxonomic extinction of reef-building corals.

We analyzed long-term trajectories of reef development using the PaleoReefs Database, which records global patterns of metazoan reef growth, and extinction rates of reef taxa from the Paleobiology Database. These data reveal that while major reef crises consistently reduced carbonate production and framework construction, coral diversity often declined only modestly.

Our findings highlight a persistent disparity between coral survival and reef ecosystem loss. The fossil record implies that although coral species may endure the present warming, functional reef ecosystems are unlikely to recover until long-term climate stabilization, potentially over tens of thousands of years, has occurred.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 7 – Poster 1: Tropical ecosystems through time: What the past tells us about the future

Unravelling patterns and drivers of fire activity in Amazonian Bolivia over the past 6,000 years

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Understanding the drivers of past fire activity provides crucial context for managing contemporary fire regimes in the Bolivian Amazon, where intensifying drought and land-use disturbance heighten ecosystem vulnerability. This study addresses a key question: over multi-millennial timescales, what controls fire in seasonally flooded savanna environments—climate, humans, or their interaction?

To disentangle these influences, I present a comparative palaeoecological analysis of lake records from the Llanos de Moxos, a seasonally flooded forest–savanna mosaic the size of England. Two contrasting settings were selected: (i) savannas lacking evidence of pre-Columbian earthworks (low human impact) and (ii) areas with networks of mounds, causeways, and canals built by the Casarabe culture (high human impact)—the most complex pre-Columbian society yet identified in Amazonia. The records, spanning 4–6 ka BP, capture the mid-Holocene dry period, enabling examination of climatic impacts on fire regimes – both direct (ignition, flammability) and indirect (fuel load). Using a multi-proxy approach, this study integrates pollen for vegetation history, charcoal for fire type and intensity, and plant-wax isotopes ($\delta^{13}C$, δD) for precipitation history. Comparing these records with archaeological evidence, we can evaluate the separate and interactive roles of climate, vegetation, and humans in shaping long-term fire dynamics—providing essential baselines for conservation and fire management.

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ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Thematic Sessions

Session 8: Species interaction and ecological networks across varying abiotic and biotic contexts

Conveners: Agnes Dellinger, Elisa Barreto

Studying interactions between organisms is challenging, particularly in diverse tropical ecosystems. Whether interaction networks are shaped in their structure and function by extrinsic factors, such as the sheer diversity of species, or by intrinsic factors, such as the traits of interacting partners, remains a major field of study. In addition, the extent to which interaction networks vary across environmental contexts generated through i.e., habitat heterogeneity, climatic conditions, or biotic factors like competition and facilitation within communities, remains largely unexplored at broad spatial and temporal scales. In this symposium, we aim to unite researchers working on ecological interaction networks of all types (i.e., mutualistic, antagonistic, plant-pollinator, plant-disperser, ant-plant, and mycorrhizal systems), with a focus on exploring the drivers of network structure. We welcome contributions on fundamental network theory, trait-matching models for interaction partners, as well as attempts to quantify generalities in network and species interaction patterns across abiotic or biotic environmental gradients

2026 VOL. 28:202601
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Session 8 – Oral 1: Species interaction and ecological networks across varying abiotic and biotic contexts

Global vulnerability of seed dispersers to human modification of habitats

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Seed dispersal interactions sustain the regeneration of plant species and enable their range shifts in response to global change. Animals play a key role in ensuring this function, yet global assessments of the vulnerability of seed dispersers remain scarce. Vulnerability to human-driven habitat modification is best described through three complementary components: the exposure to modification, the sensitivity of communities to it, and their capacity to adapt by altering fruit consumption. Together, these dimensions indicate which seed disperser communities are most at risk and therefore demand intensive conservation attention. In this global analysis, we quantified each vulnerability component across 1°×1° grid cells, examined their spatial covariation, and combined them into a standardized index of total vulnerability. We identified global hotspots and evaluated the relative contributions of each component. Overall, seed disperser communities showed low average vulnerability, with few classified as highly vulnerable across all three components simultaneously. Instead, vulnerability was most frequently driven by high exposure rather than strong sensitivity or limited adaptability. These results highlight clear spatial interlinkages among vulnerability components and reveal priority localities where targeted conservation interventions are essential to maintain the diversity of seed disperser communities and the critical ecological functions they provide into the future.

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DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 8 – Oral 2: Species interaction and ecological networks across varying abiotic and biotic contexts

Correlation between beak traits and food taken in tropical birds

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Birds adapt to elevational gradients through various mechanisms, including changes in morphology, physiology, and trophic interactions. We hypothesized that bird diets vary with elevation and that morphological traits, particularly beak dimensions, reflect these dietary shifts. To test this, we sampled over 1,000 individuals along a 3,500 m elevational gradient in Papua New Guinea, measured their beak traits, and identified consumed prey items. We found significant correlations between beak morphology (especially beak width) and the taxonomic composition of ingested insects. Within individual species occurring across multiple elevations, both diet composition and prey size varied systematically with elevation. The size of arthropod prey closely matched the body and beak size of birds, indicating fine-tuned morphological adaptation to available food resources. Moreover, the proportion of plant material in the diet increased towards higher elevations, suggesting a gradual shift in trophic niche. We discuss the implications of these elevational shifts for bird–prey interactions and potential cascading effects on montane food webs.

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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 8 – Oral 3: Species interaction and ecological networks across varying abiotic and biotic contexts

Volatile signals facilitate plant–frugivore interaction

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Seed dispersal is a key process for angiosperm reproduction. Plants use multimodal signals to communicate with frugivores. Fruits have evolved matching traits to attract frugivores; among these, scent often signals ripeness and may indicate quality. Yet which volatile components function as signals, and how they convey to frugivores, remains unclear. Aliphatic esters, commonly found in ripe fruit of chemically communicative species, also show positive correlations with sugar content within species, suggesting that they may function as honest signals. Using figs (*Ficus spp*., Moraceae) across Madagascar, we test whether aliphatic esters act as honest signals and whether scent traits are adaptive. We[1] quantify fig–frugivore interaction networks using camera traps,[2] reconstruct fig phylogeny,[3] extract volatiles and nutritional rewards using gas and liquid chromatography, and[4] sequence the alcohol acyltransferase gene and pinpointed its association with dispersal mechanism. We use these datasets to test whether aliphatic esters are significantly more common in species that rely on dispersal by primates than in those dispersed by visually oriented birds. Across multiple species, the abundance of aliphatic esters is positively correlated with sugar levels, suggesting that these compounds may signal fruit quality. Finally, we examine whether increased alcohol acyltransferase activity in ripe, primate-dispersed fruits underlies generating aliphatic esters.

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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 8 – Oral 4: Species interaction and ecological networks across varying abiotic and biotic contexts

Aromatic delight: Revealing diversity and function of fruit microbiome in seed dispersal

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Seed dispersal is viewed as a bipartite interaction between animals and plants. Fruit scent plays a major role in "advertising" ripeness and facilitating fruit selection, with aliphatic esters being the protagonists, communicating ripeness and sugar content. Crucially, alcohols and acids are ester precursors and products of microbial fermentation, also linked to sugar levels. Thus, compounds critical for plant chemical signalling are products of microbial activity, suggesting that microbes potentially co-evolved with animals and plants to support scent-driven seed dispersal, turning a bipartite interaction into a tripartite one. Here, we test a trade-off hypothesis: plants relying on scent-driven animal seed dispersers evolved to tolerate microbial activity to increase attractiveness at the cost of a faster fruit decay. We tested the link between microbes and esters in Madagascar where microbial communities in wild *Ficus* species are studied for the first time. Amplicon sequencing for community profiling revealed a diverse community of fungi and bacteria, and beta diversity indicates a substantial difference among *Ficus* species. Notably, fermenting microbial taxa of Saccharomycetales, an order associated with ester rich aromas, were identified only in *Ficus* species that are known to rely on scent-driven seed dispersal. Our results reveal an overlooked function of the fruit microbiome, which may be critical for facilitating seed dispersal and therefore ecosystem functioning.

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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 8 – Oral 5: Species interaction and ecological networks across varying abiotic and biotic contexts

When tails go missing: How islands reshape skipper wings

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Islands offer a natural laboratory to explore how environmental pressures shape morphological evolution, and butterflies are a classic system for testing these differences. On small, remote islands predation is often reduced, so prey may invest less in anti-predator defences. Skippers (Hesperiidae) exhibit among the fastest startle responses in the animal kingdom and possess several secondary defences likely to counter avian predators (i.e., hindwing tails, unpalatability, possibly even iridescence).

Around nine Eudaminae lineages independently colonised the Caribbean and Galápagos islands and show striking changes in wing shape and size relative to mainland relatives, raising the question of what drives phenotypic evolution. We compiled genetic distances to control for phylogeny, collected subspecies-level morphometrics of islands and corresponding mainland populations/species, and correlated morphological differences with island metrics (remoteness, area, insectivorous bird diversity, endemism).

Most lineages are smaller on islands, but only those on smaller islands (Lesser Antilles, Galápagos) have reduced hindwing tails relative to body size. This pattern likely underlines the relaxed selection pressure for hindwing tails due to less skilled avian predators, supporting a defensive role for tails. This study broadly illustrates how altered islands and especially predator regimes can reshape morphology in butterflies.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
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Session 8 – Oral 6: Species interaction and ecological networks across varying abiotic and biotic contexts

How floral morphology partitions pollinators in buzz-pollinated Melastomataceae assemblages

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Buzz pollination is a specialized pollination strategy found in approximately 8% of angiosperms and is the dominant syndrome within the diverse family Melastomataceae. In buzz-pollinated flowers, bees apply high-frequency (>200 Hz) mechanical vibrations to expel pollen from small poricidal openings. Experimental studies have shown that this process is sensitive to vibration parameters—such as frequency, amplitude, and duration—that vary among bee species as well as floral traits like pore shape and the stamen's resistance to bending. However, little is known about how communities of sympatric buzz-pollinated plants partition this "buzzing landscape" or which floral traits influence pollinator visitation. Here, we combine network analysis across sympatric Melastomataceae assemblages with pollinator vibration data and functional floral traits to examine how floral morphology relates to the partitioning of the pollinator community. This work advances our understanding of the ecological relationships between buzz-pollinated flowers and their pollinators and offers new insight into the evolutionary diversification of this pollination strategy.

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DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 8 – Oral 7: Species interaction and ecological networks across varying abiotic and biotic contexts

Global drivers of plant-pollinator interaction specialization in gardens

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The frequency of plant-pollinator interactions is shaped by abiotic and biotic factors. When applied to gardens, area, degree of urbanization, and climate likely influence species richness and interaction specialization. We hypothesize that specialization will be higher in gardens with high species richness and warmer, humid climates. We further predict that both plant and pollinator richness increase in larger and less urbanized sites. We used a global dataset of plant–pollinator interactions in garden environments to assess drivers of plant specialization. We considered garden characteristics such as size and urbanization, temperature, precipitation, species richness and phylogenetic relatedness as drivers, within a causal framework. Our analysis of 40 plant–pollinator networks revealed that plant species richness was significantly influenced only by garden size and the degree of urbanization, with larger gardens in suburban areas hosting more plant species than both rural and highly urbanized ones. Plant richness and precipitation positively influenced pollinator richness, but no association was found between specialization and environmental variables. Our results suggest that distinct factors drive species diversity and interaction specialization in gardens.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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Session 8 – Oral 8: Species interaction and ecological networks across varying abiotic and biotic contexts

Bill length and biotic context explain variation in hummingbird specialization in mutualistic network

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How selectively an organism forages relative to partner availability, termed ecological specialization, shapes community structure and ecosystem stability. Although many studies link specialization in mutualistic networks to traits and environment, most use temporally or spatially aggregated interactions, overlooking within-species variation across contexts. We combined a trait-based approach with fine-scale plant–hummingbird interaction data to define each hummingbird's interaction niche—the set of floral traits it can exploit. Using this, we quantified resource availability and a proxy for competition for each hummingbird species at each sampling event, which, together with morphological traits, elevation and sampling effects, explained 58% of the variation in pollinator specialization (d'). We found that specialization varied markedly within species, reflecting the local ecological context experienced during each sampling event. Specialization increased with bill length, proportion of plant richness fitting the hummingbird niche, elevation, and hummingbird functional diversity, but decreased with total and niche-specific floral abundance. These patterns indicate that while greater partner diversity and trait divergence promote niche partitioning, resource abundance tends to relax it. Together, our findings show that pollinator specialization is a flexible outcome resulting from the interplay of feeding traits and the ecological context.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 8 – Oral 9: Species interaction and ecological networks across varying abiotic and biotic contexts

Dietary DNA and prey traits reveal fine-scale niche partitioning in Neotropical top predatory fish

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Neotropical rivers harbour an exceptional diversity of top predatory fish, whose coexistence likely depends on trophic niche partitioning, as the high connectivity and habitat overlap of these systems constrain their spatial and temporal segregation. Predators such as piranhas, silver croaker, smooth-back river stingray, and giant wolfish are ecologically, culturally, and economically important for local communities. However, their feeding ecology remains poorly understood, as conventional diet analyses provide limited and fragmentary information, often with taxonomic resolution too coarse to reveal the mechanisms that reduce resource competition.

We combined dietary DNA metabarcoding of a dozen fish predators with functional trait analysis in a major French Guiana river to investigate how they select prey based on morphology, ecology, and behavior, as well as predator–prey trait matching. This integrative approach not only refines our understanding of dietary overlap and resource use but also uncovers subtle trophic segregation that remains undetectable when relying solely on prey taxonomic composition, given the high biodiversity and taxonomic complexity of tropical prey communities. Our results also shed light on the top-down processes structuring tropical fish communities and provide insights for the conservation and sustainable management of these fragile freshwater ecosystems, which face multiple pressures such as overfishing, water pollution, and habitat degradation.

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DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 8 – Oral 10: Species interaction and ecological networks across varying abiotic and biotic contexts

Beyond pairs: How modifier species alter trophic interactions and shape community dynamics

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Trophic interactions are typically studied in a pairwise manner. However, growing evidence suggests that such an approach is often insufficient for understanding and predicting community dynamics. Trophic interaction modifications (TIMs) occur when a third species indirectly alters the strength of a predator–prey interaction. While TIMs are common in natural systems, their mechanisms and long-term consequences remain poorly understood.

We experimentally quantified the density-dependent effect of a third, non-consumable species on a predator's functional response in two ciliate communities. Each community comprised a predator (*Spathidium* sp.), prey (*Colpidium striatum* or*Dexiostoma campylum*), and a 'modifier' (*Paramecium caudatum*). We generated response surfaces for consumption by varying the density of the prey and the modifier in a fully factorial manner.

In both communities, increasing modifier density weakened trophic interaction strength, due to a negative effect on the predator's search clearance rate, though the effect magnitude depended on community context. Simulations indicate quantitative differences, such as time to extinction and population cycle period, between models that account for TIMs or include only pairwise interactions. Our findings demonstrate that TIMs may be important for understanding and predicting community dynamics, highlighting the need to move beyond focal species pairs to comprehend the consequences of species interactions in communities.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 8 – Oral 11: Species interaction and ecological networks across varying abiotic and biotic contexts

How have the biogeographic shifts shaped fruit evolution and diversification in *Aglaia* (Meliaceae)?

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Aglaia is the most speciose genus in the mahogany family (Meliaceae), endemic to the tropics of India, South-east Asia, Australia and the Pacific Islands. Fruit morphology is highly variable across the range of *Aglaia*, with many species specialised for primate, bird, or Cassowary dispersal syndromes. It remains to be understood how this fruit diversity evolved, and whether the different fruit types have switched in conjunction with the biogeographic and disperser-community shifts across Sunda, Sahul and Wallacea.

To investigate the relationship between fruit traits, dispersal syndrome, and biogeography, we are reconstructing the phylogeny of all *Aglaia* species and closely related genera using a target-capture approach. We have designed a custom bait kit for the Meliaceae, to be able to deal with the complex history of allopolyploidisation within the family.

Fruit morphology of *Aglaia* will then be analysed through detailed fruit developmental and anatomical studies. To complete the identification of key fruit traits defining the dispersal syndromes, we are going to analyse volatile organic compounds emitted by fruits.

After reconstructing the biogeographical history of *Aglaia* and the ancestral state of its fruits, we are going to test for correlations of biogeographic shifts with shifts in fruit characters' evolution. Ultimately, this study aims to gain new insights into the effects of the Sunda-Sahul Biotic Exchange on plant diversification in this megadiverse tropical region.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 8 – Oral 12: Species interaction and ecological networks across varying abiotic and biotic contexts

Ecology and evolution of acarodomatia in Pyxidantheae (Melastomataceae)

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An understudied mutualism is the one between mites and plants that form acarodomatia. Acarodomatia are structures that usually develop on leaf undersides where major veins converge and they have been documented in over 2500 plant species. Domatia house potentially mutualistic mites that either prey on smaller herbivorous mites or feed on fungal spores, keeping the leaves of its host healthy and free from pathogens. In return for their services, they are provided with a space in which to hide, molt, lay eggs, and protect their young. Especially in the tropics, plant-mite interactions remain understudied, limiting our understanding on the ecological and evolutionary significance of these interactions.

We here chose the neotropical plant tribe Pyxidantheae (Melastomataceae), characterized by an exceptional morphological diversity of acarodomatia, to study the ecology and evolution of plant-mite interactions. We found that the presence and type of domatia is an evolutionarily highly labile trait which was gained and lost multiple times, and does not show associations with macroclimatic variables. Instead, microclimatic conditions such as sun exposure seem to play a major role in domatia development. Importantly, our data suggest that domatia develop (or not) in response to seasonal climatic fluctuations, requiring future studies to investigate whether domatia are beneficial in certain seasons (e.g., wet) only.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 8 – Oral 13: Species interaction and ecological networks across varying abiotic and biotic contexts

Flower evolution and diversity in Pyxidantheae (Melastomataceae): shifts in pollinators and shape

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Animal pollination is a key driver in the evolution of flowers. Interactions between plants and pollinators have led to striking morphological adaptations among functional pollinator groups, but diversification of flowers within a single group remains less explored. The Neotropical tribe Pyxidantheae (Melastomataceae) is mostly buzz pollinated by bees, a specialized system, yet its species show remarkable variation in floral form. The tribe also has three independent shifts to vertebrate pollination at high elevations. Our study aims to understand how floral diversification arises within the same functional group of pollinators and which traits are important in the process. We assembled a matrix of floral morphological characters to discover which traits best predict pollination syndromes, both across and within buzz-pollinated species, and to estimate how floral disparity has evolved. Preliminary results suggest that floral orientation distinguishes bee- from vertebrate-pollinated species and stamen arrangement and morphology differentiate buzz-pollinated species. Our data indicate that the tribe has evolved a specialized mode of pollen release within an already specialized system, likely related to the co-occurrence of species pollinated by the same functional group. This study shows that even within specialized pollination systems, as buzz pollination, floral diversity can evolve through complex evolutionary and ecological dynamics beyond major pollinator shifts.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 8 – Oral 14: Species interaction and ecological networks across varying abiotic and biotic contexts

Ground-water influences on vegetation patterns in cushion peatlands of the tropical high Andes

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High-elevation peatlands in the Central Andes are important carbon sinks and are highly vulnerable to hydrological shifts driven by climate change and land use. Reduced water availability alters plant community composition, indirectly affecting carbon accumulation. These ecosystems are formed by vascular cushion plants, such as *Distichia muscoides* and *Oxychloe andina*. Cushion plants are known to facilitate other species. Small-scale species co-occurrence patterns can reveal interspecific interactions. As environmental condition becomes more severe, specifically water shortage, enhances positive interactions, causing plants to form multiple-species clumps. This clustering affects the peatland's carbon sink capacity.

We examined the effects of water supply on plant community structure, expecting more homogeneous plant distribution in peatlands with high groundwater levels. Twelve peatlands were selected across the humid Eastern and dry Western Cordilleras of the Bolivian Andes. Water tables were monitored with piezometers, and vegetation was assessed in associated plots. C-scores (co-occurrence index) were calculated to infer dominant interaction signals.

Results show that peatland plant diversity was lower in the dry West than in the humid East. The C-score was lower in plots with lower water levels, suggesting more homogeneous vegetation and less aggregation in dry habitats. This also highlights that changes in vegetation aggregation may also have different influences on the carbon accumulation.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 8 – Oral 15: Species interaction and ecological networks across varying abiotic and biotic contexts

Species-specific termite impacts on dipterocarp seedling performance via soil in tropical rainforest

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Termite mounds represent patches of distinct soil conditions within otherwise nutrient-poor tropical rainforest soil, and hence potentially influence plant communities on a small scale. The few studies exploring the impacts of these mounds on plants offer limited experimental evidence. Further, they have not studied differing effects between interacting species, neither for termites nor plants. Here, we experimentally explore whether termites could help maintain high tropical tree diversity, through their influence on soil properties possibly altering plant performance. Seedlings of five different dipterocarp trees (n=160 per sp) were planted in pots enriched with soil from the mounds of one of two termite species (*Dicuspiditermes* & *Macrotermes sp*) with differing mound building ecology, and also in control soil. After only eight months, seedlings of different species showed differing responses to enrichment in relative growth rate and leaf turnover. Physiological (stress) differences were also present, as measured by chlorophyll content and the efficiency of light use (Phi2). Overall, seedlings planted in *Dicuspiditermes* soil generally performed better than those in *Macrotermes* soil, although plant species differed in the strength of this effect. Taken together, our findings of differential responses between seedling species indicate that heterogeneity in soil properties generated by termites potentially helps maintain tropical tree diversity in this highly diverse system.

Merian Awards Candidate

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 8 – Oral 16: Species interaction and ecological networks across varying abiotic and biotic contexts

Wood identity and abiotic drivers override insect effects in short-term tropical deadwood decay

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Trophic interactions are central to ecosystem functioning, yet their influence on decomposition remains uncertain in subtropical ecosystems. We worked on fresh deadwood of 4 different species laid out in 64 plots for one year along a tree richness gradient in an experimental forest in south-eastern China, with and without access of insects. We quantified diversity, abundance and co-occurrence of termites, beetles and ants. Through GLMs, network analyses and a piecewise structural equation approach, we modelled direct and indirect pathways linking insect diversity and communities, wood traits, environment and microclimate to deadwood decomposition.

Decomposition was mostly driven by wood identity and microclimate, while insect activity and diversity exerted weak and inconsistent effects. Termites were more abundant in soft wood and beetles in oak wood. Co-occurrence analyses revealed some weak facilitative patterns, but decay rates were not affected by a specific insect group presence. This suggests that, despite multitrophic interactions within saproxylic networks, the functional outcome — wood decomposition — is largely constrained by abiotic and environmental properties rather than by biotic structure alone.

Our study highlights how biotic influences on decomposition are context-dependent and often secondary to substrate and microclimatic factors, yet underscores the importance of considering multitrophic networks to understand how biodiversity shapes ecosystem functioning.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 8 – Oral 17: Species interaction and ecological networks across varying abiotic and biotic contexts

Insects and non-woody plants slow down tropical forest succession: a community-wide experiment in Papua New Guinea

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We test the hypothesis that succession in tropical rainforests is determined by plant competition, rendering top-down control by insect herbivores insignificant. During 18 months of succession, we removed insects and non-woody plants from replicate 5×5 m plots in an intercrossed experiment at 700 and 1700 m elevation in New Guinea. Insect removal increased biomass, reduced species diversity and altered the species composition of woody plants, but only at the lower elevation. The removal of non-woody plants increased the biomass and changed the species composition of woody plants at both elevations. The removal of insects at lower elevation and the removal of non-woody plants at both elevations increased the biomass of woody plants, accelerating succession to forest. Insects at 700 m elevation and non-woody plants at 1700 m elevation altered the succession trajectory by changing the composition of woody plant species. Thus, the importance of top-down insect herbivory decreased and the importance of bottom-up plant competition increased with increasing elevation.

Merian Awards Candidate

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 8 – Oral 18: Species interaction and ecological networks across varying abiotic and biotic contexts

Energetic structure and ecosystem functions of Amazonian food webs along road-disturbance gradients

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Road expansion is a major driver of deforestation and biodiversity loss in the Amazon, altering how species interact and how energy flows through ecosystems. In this study, we built predator–prey interaction networks and quantified energy fluxes—as proxies for predation and herbivory functions—from camera-trap data of mammals and birds across a gradient of distance to roads. Energy fluxes were estimated with the fluxweb package, integrating species traits, metabolic demands, and trophic links. We then applied structural equation models (SEM) to assess how road proximity influences trophic energy transfer through its effects on community structure. Results show that predation fluxes are higher near roads, driven by a direct influence of road proximity and reinforced by greater species biomass and richness, although these do not mediate the effect. In contrast, herbivory fluxes increase at sites farther from roads, mediated by higher herbivore richness and biomass in those areas. These opposing trends point to a redistribution of trophic energy across human-impact gradients, where roads intensify predation but diminish herbivory, reshaping the energetic balance of Amazonian food webs and highlighting energy fluxes as a powerful framework to link biodiversity change to ecosystem processes.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 8 – Oral 19: Species interaction and ecological networks across varying abiotic and biotic contexts

A gut feeling? Foraging dynamics and microbiome shifts under nutrient stress in leaf-cutting ants

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Anthropogenic stressors reshape plant nutrient composition, altering the nutritional ecology of key herbivores and their mutualists. Leaf-cutting ants (LCAs) maintain a tripartite mutualism with a cultivated fungus and its associated microbiome, thus sustaining colony growth and stability. To assess impacts of nutritional imbalance/shortage on ant–fungus interactions, we investigated two aspects of colony response dynamics in *Atta colombica* – ant foraging decisions and compositional shifts in fungal garden microbiomes (FGMs). Paired starved and nourished subcolonies were compared in dual-choice pickup and allocation assays. To characterize bacterial and fungal communities, the 16S rRNA and ITS2 of FGM samples were sequenced. Starved foragers showed complex behaviors: while indifferent in their choice of leaf quality, they went on to preferentially supply the deprived garden before redistributing resources according to local needs. Microbial profiling revealed stable overall diversity but lineage-specific shifts in bacteria suggesting functional reorganization under stress, alongside increased frequency of a specialized parasitic fungus. These findings show that short-term nutritional stress elicits behavioral and microbial responses within the biotic network. Collective flexibility in foraging and allocation may buffer nutrient deficits and limit microbial opportunism. This behavioral feedback likely reinforces symbiotic balance across the multipartite mutualism.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 8 – Poster 1: Species interaction and ecological networks across varying abiotic and biotic contexts

Does the importance of biotic interactions change across elevations in the tropics?

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The emergence of biodiversity gradients across large spatial scales like latitudes or altitudes have puzzled ecologists since Humboldt. As the biodiversity is usually the largest in seemingly benign, tropical areas, one possible mechanism influencing this pattern might be the relative importance of biotic interactions (e.g. competition or mutualism) in comparison to abiotic conditions (e.g. temperature or precipitation). These are expected to be more important in areas with higher biodiversity, which are at low or intermediate levels of elevation. The research presented here aims to explore the importance of competitive and mutualistic interactions within a hummingbird-plant network across elevational gradients at different study sites in South America, using an extensive long-term dataset about species occurence and mutualistic interactions. Expectations are that higher levels of competition at lower elevations should lead to stronger niche partitioning and more specialised and species-specific mutualisms than at higher elevations. To test this, we also propose a new method to measure the niche overlap of multiple species.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 8 – Poster 2: Species interaction and ecological networks across varying abiotic and biotic contexts

How to deal with pollen thieves: strategies along an elevational gradient

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Flowers attract pollinators through colorful displays, varied scents, and rewards (e.g., pollen, nectar). However, these signals may also attract floral antagonists such as robbers (damaging anthers to access pollen) and thieves (extracting pollen without touching the stigma). In pollen flowers, high visitation by antagonists may reduce reproductive success due to pollen loss. Unlike flower-pollinator interactions, flower-antagonist interactions remain poorly studied, leaving variation across environmental gradients, and floral traits adaptive in deterring antagonists unclear.

We studied five species of the pollen-rewarding genus *Pleroma* (Melastomataceae) to (I) quantify mutualistic (pollination) and antagonistic (theft, robbing) interactions across an elevational gradient, and (II) compare stamen structural defenses (e.g., crystal-oxalate druses, reinforced epidermis, secretory glands). Fieldwork took place in the Atlantic Rainforest at five elevations (17–2300 masl) between January and April 2025. We studied stamen defense traits via microtome sections and CT scans.

All species exhibited the buzz-pollination syndrome and stamen dimorphism. Buzzing bees were the most common visitors. Large bees buzzed all stamens and usually contacted the stigma (pollinators), while small bees most often buzzed a single stamen, rarely contacted the stigma, thus acted as antagonists (thieves). Preliminary results indicated frequent structural defenses, possibly explaining low robbery rates.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 8 – Poster 3: Species interaction and ecological networks across varying abiotic and biotic contexts

What drives the chemical adaptations of cavity-nesting wasps in a tropical mountain ecosystem?

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Cuticular hydrocarbons (CHCs) prevent desiccation and mediate complex chemical communication among conspecific and between antagonist insect species. Some cuckoo wasps (Hymenoptera: Chrysididae) mimic their host's CHC profile to escape detection during or after oviposition. However, the occurrence of this strategy has only been studied in cuckoo wasp species occurring in temperate regions. Whether or not it is also applied by species occurring in tropical regions, where a different temperature profile could constrain CHC profile variation, is unknown. To this end, we studied the CHC profiles of host-brood parasite species pairs raised from trap nests from three habitats on Mt. Kilimanjaro, Tanzania. Hosts and their brood parasites were taxonomically identified by morphospecies assignment and mitochondrial COI barcoding. GC-MS accrued CHC profile data, and profile similarities were assessed using distance matrix permutations. We obtained 133 mostly saturated straight-chain and methyl-branched CHCs from 139 aculeate wasps (56 hosts, 83 brood parasites) of 15 species. There were no statistical variations in CHC richness, saturation, and mean chain lengths between hosts and brood parasitoids, with significant clustering of certain host and parasitoid CHC profiles on an ordination scale.

We aim to further explore these results to establish the ecological factors that could explain the observations on knowledge contribution in host-brood parasite ecology in the tropics.

Merian Awards Candidate

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 8 – Poster 4: Species interaction and ecological networks across varying abiotic and biotic contexts

Diet divergence between sexes in island endemic birds of São Tomé

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Due to their relative isolation and unique ecosystems, tropical islands are excellent environments in which to study evolution, and island species are generally expected to be more generalist than their mainland counterparts due to factors such as reduced interspecific competition and increased population density. Although species may be more generalist overall on islands, it has been found that individuals become more specialised, thereby limiting intraspecific competition. This pattern is expected to translate to greater differentiation in diet between sexes of island birds. In this study, we compare the diets of males and females from several bird species endemic to the island of São Tomé that exhibit varying levels of morphological dimorphism. The analysis is realised through a combination of HTS and faecal metabarcoding techniques to analyse diet composition, molecular methods for sex determination, and morphometric data for 182 sampled individuals representing 8 species. We hypothesise that regardless of whether or not species exhibit clear sexual dimorphism or appear to be monomorphic, differences in diet will reveal behavioural or ecological divergence and cryptic dimorphism among insular species, likely as a strategy to reduce intraspecific competition.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 8 – Poster 5: Species interaction and ecological networks across varying abiotic and biotic contexts

A scent of trouble: Is ammonia a cue for hygienic behavior in leaf-cutting ants?

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Leaf-cutting ants rely on their fungus garden for colony survival and maintain it through hygienic behaviors guided by olfactory cues. Garden worker ants groom and tend the fungus, whereas refuse workers remove contaminated material to refuse dumps. During antagonism with the specialized pathogenic fungus *Escovopsis weberi*, mutualistic *Actinomyces* release volatile, antifungal ammonia, which may act as a cue for microbial disturbance. We examined whether ammonia triggers protective behavior (avoidance in gardeners to protect the garden) and hygiene-related behavior (attraction in refuse workers to facilitate removal) for the colony. Dual-choice assays revealed that gardeners significantly avoided ammonia at 10nmol, showing a marked (~20%) avoidance. Subcolony observations showed that E. weberi infection caused hygiene stress, increasing refuse accumulation and reducing garden vitality, with gardeners showing a mild (~10%) but non-significant avoidance even at 0.02nmol, mirroring orientation trends in full-colony assays. Hygiene of refuse strongly shaped the response of refuse workers, where poor hygiene led to ~20% attraction at lower ammonia levels, suggesting increased cue sensitivity under stress. These findings suggest that ammonia may act as a semiochemical linking microbial stress to hygienic behavior, helping gardeners avoid infection and refuse workers remove contaminated material, thereby reinforcing homeostasis within the fungus–ant–microbe system.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 8 – Poster 6: Species interaction and ecological networks across varying abiotic and biotic contexts

Ant arboreality in economically and ecologically valuable tropical canopies.

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Rainforests span approximately 7% of Earth's land surface yet sustain nearly half of all terrestrial life. However, the rainforest canopy remains one of the least-studied environments on Earth, and the biodiversity of Central Africa is the least of all tropical rainforests. A single rainforest tree can host up to 40 species of ants, highlighting the extraordinary richness of life within the canopy.

This project aims to explore the last frontier of ant diversity and uncover their evolutionary adaptations across 30 ecologically and economically important tree species. Our initial efforts reveal a correlation ($r=0.402$, $p<0.05$) between species richness and diameter at breast height (DBH), with the Myrmicinae subfamily being the richness group. We will use morphology and DNA barcoding to confirm species identification and micro-CT to examine morphological traits associated with arboreal life.

To explore interactions among species within the ecosystem, we will use DNA metabarcoding to analyze food web relationships between different species. Given the unique environmental conditions of the rainforest, such as variations in light and temperature, we aim to determine how these microenvironments affect species diversity across the different study areas. This research will help fill major knowledge gaps in tropical forest ecology and ant biodiversity within one of Africa's most unique and understudied bioregions.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Thematic Sessions

Session 9: Recovery and restoration of tropical forests following anthropogenic disturbances

Conveners: Martin Ehbrecht, John Paul Okimat

Tropical forests provide crucial ecosystem services, support local livelihoods, and are essential for biodiversity conservation. Anthropogenic disturbances, such as logging, can impair their functioning and capability to deliver important ecosystem services. Depending on the level of degradation, tropical forests may either recover naturally or need active restoration interventions to revive essential ecosystem functions and services. Strategies for restoring specific ecosystem functions and services can occur at the species, stand, or landscape level, depending on the particular functions or services that need restoration. The session aims to offer a platform for presenting recent advancements in the research field of tropical forest recovery and restoration across various spatial scales. Submissions on active and passive restoration approaches, and how they aid the recovery or restoration of specific ecosystem functions or services at the species, stand, or landscape level, are welcome. In this context, contributions that consider the natural dynamics, resilience, and successional trajectories of tropical forests, and their implications for restoration strategies, are also encouraged.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 9 – Oral 1: Recovery and restoration of tropical forests following anthropogenic disturbances

Spatiotemporal dynamics of wildfires and landscape structure in the Brazilian biomes

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Brazil has been experiencing unprecedented wildfires, fueled by a complex interplay between human activities and climate extremes. Forest fragmentation intensifies fire risks by drying out vegetation and increasing flammability at edges, facilitating deeper fire penetration into forests. This study aimed to characterize the spatiotemporal dynamics of landscape structure and fires across Brazilian biomes. We analyzed two primary datasets: Burned Area from the Global Fire Atlas and Land Use and Land Cover from MapBiomas. To evaluate change dynamics between 2003 to 2024, we applied Mann-Kendall trend analysis and used a Decision Rule classifier to the integration process. The years 2010 (382,057 km²) and 2007 (382,163 km²) showed the highest fire occurrence in Brazil, affecting mainly Cerrado and Amazon biomes. Our findings reveal critical trends in fire occurrence and landscape changes across Brazil, primarily driven by human actions. Increased fire rates overlapped with positive trends in the number of forest patches (27%) and edge forest density (26%), but with negative trends in mean patch area (37%) and percentage of forest (23%). Pampa, Cerrado, and Atlantic Forest biomes showed the most significant overlaps. Overall, fire and fragmentation interact in complex ways, fire can both create and destroy habitats, influencing landscape and edge traits, while fragmentation alters fire dynamics by increasing edge flammability, human access, and ignition sources.

Merian Awards Candidate

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 9 – Oral 2: Recovery and restoration of tropical forests following anthropogenic disturbances

Human disturbance collapses ecosystem productivity in the Caatinga dry forest

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Tropical Dry Forest (TDF) can be pushed to a new and irreversible alternative stable state, characterized by reduced aboveground biomass and lower ecosystem productivity. In more critical scenarios, the system can collapse through desertification processes. Therefore, this study aims to assess the impacts of human disturbances on aboveground biomass and productivity in Caatinga, the largest continuous TDF in South America. In a chronosequence of regeneration, considering metrics of vegetation establishment, bioclimatic patterns, and soil attributes. Our findings reveal that regenerating areas fail to recover both AGB (with only approximately 10% of the old-growth biomass restored) and productivity (regenerating areas achieved only half of the old-growth productivity), to levels observed in old-growth forests, even after five decades of natural regeneration. This suggests stagnation in the recovery process, potentially indicating an ecological threshold or plateau in ecosystem resilience. This study offers insight into comprehending the regenerating process of TDF. Our results suggest that natural regeneration may not restore aboveground biomass or productivity, indicating a possible shift to a shrub-dominated or degraded stable state. These findings emphasize the urgent need for active restoration policies, especially in the Caatinga biome.

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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 9 – Oral 3: Recovery and restoration of tropical forests following anthropogenic disturbances

Human disturbances can reframe seed recruitment dynamics of a Caatinga dry forest

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Severe anthropogenic impacts have degraded many tropical ecosystems, including Brazil's Caatinga dry forest. Historically, vast areas have been cleared for agricultural practices, diminishing crucial ecosystem functions. This study investigates the processes underlying the regeneration of a Caatinga dry forest following acute and chronic anthropogenic impacts by analyzing seed recruitment across a chronosequence of regenerating areas. Our results indicate that while seeds from both the seed rain and soil seed bank are abundant, their composition differs across regeneration stages, being dominated by pioneer species, such as those of the Croton genus. Specifically, species composition in regenerating forests was clustered, whereas old-growth forests exhibited greater species richness. These findings suggest that older regenerating plots may not necessarily progress toward mature forest characteristics, potentially stagnating due to an inconsistent supply of seeds from diverse species. This chronosequence approach enhances our understanding of how anthropogenic pressures modulate ecological processes in dry forest environments, providing insights that support more effective conservation and land management strategies in the Caatinga.

Merian Awards Candidate

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 9 – Oral 4: Recovery and restoration of tropical forests following anthropogenic disturbances

Multidimensional recovery of young secondary forests in human-modified tropical landscapes

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Tropical forests are disappearing rapidly due to agricultural expansion, yet they can recover naturally after land abandonment. Recovery rates, however, vary widely across space, as climate and land-use history set the conditions that shape long-term successional trajectories. Here, we analyse how the start (i.e., initial values) and speed (i.e., rates of change) of succession differ across six tropical landscapes spanning different continents, countries, and climates. We established 122 permanent plots in recently abandoned agricultural fields and monitored the first five years of recovery for 12 forest attributes related to structure, diversity, function, and symbioses. Structural and diversity attributes increased over time, whereas functional and symbiotic attributes showed little change. In landscapes with less intensive land use, succession started with more developed woody vegetation and progressed rapidly toward structurally complex, diverse forests. Climatic conditions further modulated successional pathways: wet forests with benign environments favoured fast-growing pioneers that accelerated structural development, whereas dry forests with hot and dry conditions imposed strong environmental filters selecting drought-adapted slow-growing species. Our findings indicate that climate and land-use legacies jointly determine the start and speed of multidimensional tropical forest recovery.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 9 – Oral 5: Recovery and restoration of tropical forests following anthropogenic disturbances

Recovery of tree diversity following selective logging in Afrotropical forest

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Anthropogenic disturbances such as selective logging reshape tropical forest ecosystems by altering both biodiversity and soil conditions. While environmental filtering is recognized as a key driver of forest recovery, its role, particularly through soil properties, in determining recovery trajectories following selective logging remains understudied in Afrotropical rainforests. We investigated tree diversity recovery across a time-since-logging gradient (30, 50, and 70 years since logging, plus an unlogged reference) in the Budongo Forest Reserve, Uganda. Using forest inventory and soil data (carbon, nitrogen, pH, and CEC) from 403 permanent plots, we examined how soil properties shape post-logging recovery. We hypothesized that soil-based environmental filtering weakens with time-since-logging. Preliminary results reveal significant variation in soil properties among compartments, with higher fertility in recently logged compartments and weak but variable relationships between soil attributes and species richness. We will present further results integrating soil-trait interactions and the coupling of taxonomic and functional diversity across compartments, and implications for forest resilience and management.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 9 – Oral 6: Recovery and restoration of tropical forests following anthropogenic disturbances

Recovery of diversity during tropical forest restoration at Kibale National Park, Uganda

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Tropical forests belong to the Earth's most biodiverse ecosystems, yet, a large proportion of them is in degraded state, or has been already cleared. As a consequence, there is a remarkable need to restore tropical forests. Our objective was to study the recovery patterns in diversity of tree and fruit-feeding butterfly communities across large-scale rainforest restoration areas in Kibale National Park, Uganda. Tree communities were studied in 2013 and 2021 at 45 actively restored forest study sites (4–26 years of age) and 10 primary forest reference sites. Fruit-feeding butterflies were studied in 2011–2012 and 2020–2021. Our results show increased tree diversity along the forest age gradient, together with increase in basal area, tree height and community similarity to primary forest. For fruit-feeding butterflies, different diversity facets recovered at different paces, and over time, fruit-feeding butterfly communities became increasingly similar to communities in primary forest reference sites. Together, our findings show that active restoration facilitates the recovery of both tree and fruit-feeding butterfly diversity during the first three decades after restoration planting.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 9 – Oral 7: Recovery and restoration of tropical forests following anthropogenic disturbances

Forest structure recovery around West Africa's last great rainforest

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In West Africa, secondary forest recovery remains poorly understood despite their crucial role in restoring biodiversity and biomass. In Taï National Park, we analyzed post-agricultural regeneration using 143 plots spanning old-growth (disturbed and undisturbed) and secondary forests. Four structural attributes aboveground biomass, Lorey's height, quadratic mean diameter, and structural homogeneity were modeled within a Bayesian framework. Recovery rates differed markedly: homogeneity and diameter recovered in about 30 years, height in about 40 years, whereas biomass required over a century. Overall, forest structure in disturbed old-growth forests reached only 32% of their asymptotic biomass potential, while other attributes reached 74–77% of their potential. herbivory presence reduced structural development, and anthropogenic disturbances further limited recovery. Remnant trees and landscape connectivity strongly promoted regeneration, particularly for biomass accumulation. Former cocoa plantations exhibited the fastest recovery, whereas abandoned mining sites showed extremely limited regeneration due to severe soil degradation. These results highlight the heterogeneity of recovery trajectories in the park and emphasize the importance of preserving remnant trees and maintaining connectivity to support effective passive regeneration. In contrast, active restoration is recommended for highly degraded areas.

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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 9 – Oral 8: Recovery and restoration of tropical forests following anthropogenic disturbances

Scale layers in the tropics: does resilience affect forest recovery?

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Tropical forests' understories host key processes supporting ecosystem functioning but are highly vulnerable to anthropogenic disturbances, from monocultures to selective timber, deadwood extraction, and hunting. Such interferences may disrupt ecosystem functionality depending on properties of the forest and its overstory. We integrated data across multiple understory processes to examine resilience mechanisms at different scales and their role in ecosystem recovery in naturally regenerating tropical forests. We propose that both early-successional stages, driven by high light and resource availability, and mature forests, with richer species pools, enhance efficiency and resilience of processes after disturbance. Mid-successional forests may recover more slowly, reflecting their transitional and more fragile state. We also expect defaunation to have variable effects on ecosystem functions. We applied generalised models to predict recovery rates from small scale disturbance, by the interaction between regeneration time from large scale disturbance and mammal exclusion. Preliminary results confirmed the dual scenario: some processes recovered rapidly in early succession, likely facilitated by the high abundance of pioneer species, while the structural complexity of mature forests also promoted high recovery. We believe that disentangling recovery trajectories of ecosystem processes is essential for understanding forest recovery dynamics and for effective restoration.

Merian Awards Candidate

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 9 – Oral 9: Recovery and restoration of tropical forests following anthropogenic disturbances

Influence of species' drought sensitivity on regeneration dynamics in secondary tropical forests

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Secondary forests recovering from human disturbance now make up the majority of forests in the tropics and play a key role in biodiversity conservation and carbon sequestration. Thus, understanding the regeneration dynamics of tropical tree species in secondary forests is critical. Hotter, drier environments of younger secondary forests may favor seedlings of more drought resistant species, while more drought sensitivity species may perform better in the cooler, more humid understory of older forests. To test this, we analyzed how species drought sensitivity impacts seedling performance during secondary succession in tropical moist forest in a chronosequence of ten 1-ha plots in secondary forests aged ~9 to ~129 years in central Panama. Seedlings were censused annually in 400 1-m2 subplots within each 1-ha plot. As a proxy for drought sensitivity, each tree species was assigned a moisture affinity value based on its distribution across a rainfall gradient in central Panama. Using mixed effects models, we modeled seedling performance as a function of forest age, species moisture affinity, and their interaction to determine whether species drought sensitivity predicts changes in seedling abundance, growth, and survival over the course of secondary succession. Our results reveal the role of tree species drought sensitivity in driving regeneration dynamics following human disturbance and enhance understanding of tropical forest resilience.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 9 – Oral 10: Recovery and restoration of tropical forests following anthropogenic disturbances

Tree islands enhance natural regeneration of native woody species in oil palm landscapes over time

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The large-scale conversion of tropical rainforest into oil palm plantations is a major driver of biodiversity loss in Southeast Asia, particularly threatening native forest-associated woody species. Integrating tree islands into monocultural oil palm plantations has emerged as a promising strategy to enhance native biodiversity. However, the effectiveness of such interventions in promoting natural regeneration and native woody species recovery over longer time periods remains unclear. Using a large-scale biodiversity enrichment experiment of 52 tree islands embedded in a conventional oil palm plantation in Sumatra since 2013, we analyzed temporal trends (2018-2024) in diversity and abundance of naturally recruiting woody species. Four complete censuses of all naturally recruiting individuals were conducted, and over 12,000 individuals representing 82 species from 34 families recorded. Most species (90%) and individuals (90%) were native. Species richness and abundance increased by ~42% and ~69%, respectively, from 2018 to 2024, accompanied by a trend towards greater community evenness and continued recruitment of locally rare species. Importantly, forest-associated richness increased steadily from 33% (2018) to 50% (2024). This study provides evidence that tree islands enhance natural regeneration and accelerate the recovery of native woody diversity over longer time periods, offering a strategic approach to sustaining tropical forest biodiversity within oil palm landscapes.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 9 – Oral 11: Recovery and restoration of tropical forests following anthropogenic disturbances

Tree species, diversity, soil and weeds shape tree survival in a tropical restoration experiment

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Tree-based restoration can support biodiversity and provisioning of ecosystem services, but early tree survival often limits success. We tested whether tree diversity and spacing affect early survival on degraded land. The study took place in north-eastern Madagascar, a global biodiversity hotspot, in the SAVA-Biodiversity Enrichment Experiment (SAVA-BEE). The design combines tree diversity (1, 3 and 6 species) and spacing (2 × 2 m, 4 × 4 m and 8 × 8 m) in an orthogonal setup. We examined survival at 4, 7, 12 and 24 months, integrating information on tree species identity, functional traits, diversity and spacing with soil properties and competition by the invasive grass *Imperata cylindrica*. Tree species identity was the strongest predictor; species with larger leaves and lower specific leaf area survived best. The positive effect of six-species mixtures was pronounced at months 4 and 7, with an odds ratio of 1.6 for survival compared with monocultures. The positive effect of higher soil nitrogen weakened over time, while clay content gained importance at month 12. Negative effects of *I. cylindrica* emerged from month 12 onwards. These findings highlight the dynamic nature of factors influencing young trees on degraded land. Careful species selection, site preparation, monitoring and maintenance are essential for successful restoration, while richer mixtures can aid survival during the critical establishment phase.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 9 – Oral 12: Recovery and restoration of tropical forests following anthropogenic disturbances

Diversity effects increase across trophic levels during forest growth

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Plant diversity affects ecosystem functioning via bottom-up effects propagating across trophic interactions. However, little is known about how these mechanisms change over time. This is particularly relevant during forest growth, where biomass and deadwood accumulation, canopy closure, and increased structural complexity transform habitat conditions, filtering species and reorganizing interactions. Using a decade of data from the world's largest forest biodiversity experiment ('BEF-China'), we tested how tree diversity effects propagate through multitrophic interactions over time to regulate a higher-order ecosystem function (parasitism). We provided artificial nesting aids to solitary bee and wasp communities from 2014 to 2023, tracking abundance, diversity, and interactions of 75 host and 116 natural enemy species from 65,000 brood cells. We found that parasitism in growing forests was jointly driven by tree diversity and stand age via multitrophic diversity, mediated by stand biomass accumulation. Forest growth amplified diversity effects across the trophic cascade, culminating in a stronger dependence of parasitism on diverse enemy communities. Tree diversity thus yielded increasing ecological benefits across multitrophic communities over time, highlighting the advantages of species-rich communities for ecosystem recovery. These temporal dynamics show that the full ecological value of biodiversity – and the costs of its loss – may only unfold over years or decades.

Merian Awards Candidate

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 9 – Oral 13: Recovery and restoration of tropical forests following anthropogenic disturbances

Forest restoration monitoring at the site and landscape level in Ethiopia

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Forest degradation and deforestation are major global challenges intensified by climate change and population pressure. Forest Landscape Restoration (FLR) offers a pathway to reverse their negative impact on natural systems while enhancing human livelihoods. However, limited local knowledge and technical capacity, particularly in site-matching, site maintenance, and economic valuation of restoration options remain major barriers. Conflicting stakeholder priorities on ecosystem services also create trade-offs and governance challenges. This study, conducted in Ethiopia under the Forest and Land Use and Ecosystem Service Restoration in Africa (FLESRA) project, integrated biophysical, socioeconomic, and governance analyses to identify conditions influencing restoration success. Data were collected from 1,316 plots across seven forest stand types in Oromia and South-Central regions, complemented by key informant and farmer inputs. Our findings showed that while combining active and passive restoration approaches enhances plant diversity, soil fertility and climate strongly influenced restoration performace among restoration strategies. Cost-benefit analyses of these strategies showed that value addition options like carbon credits increased viability of longer rotation plantation and woodlots. Our results identify the locally suitable restoration strategies and generally supplement decision-making tools to guide effective and sustainable FLR efforts in Ethiopia and similar landscapes.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 9 – Oral 14: Recovery and restoration of tropical forests following anthropogenic disturbances

Restoration ecology of tropical bracken-dominated areas: What do we know after 15 years?

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Fire is one of the main threats to biodiversity in tropical montane forests. After fire or land abandonment, deforested areas are frequently dominated by the bracken fern (*Pteridium spp.*), and forest succession is arrested. To understand the role of bracken in forest succession, since 2010 we established field experiments and observational plots in a tropical montane forest–bracken landscape in Bolivia. We found lower species richness, diversity, and abundance in the seed rain, soil seed bank, and in naturally recruiting seedlings in bracken areas compared to the forest interior, indicating seed limitation. This limitation was associated with differences in the species composition of seed-dispersing birds and bats between bracken areas and forest edges. The installation of bird perches increased seed rain and seedling recruitment, thereby reducing both seed and establishment limitations. The removal of bracken fronds and litter led to a reduction in seedling diversity, density, survival, and growth compared to intact bracken conditions. We observed facilitation by bracken fronds and competitive effects of bracken litter on the recruitment of small-seeded species. Allelopathic effects of bracken on native tree species were weak. Shade-tolerant, bird-dispersed small tree species showed higher establishment, survival, and growth in bracken areas. We suggest planting these species and installing perches to promote forest recovery in bracken-dominated areas across the tropics.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 9 – Oral 15: Recovery and restoration of tropical forests following anthropogenic disturbances

Vegetation dynamics and impact on the distribution of edible caterpillar host species in Ngomedzap

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Ngomedzap is located in the central region of Cameroon. This area is covered by dense, humid forest rich in biodiversity, including many woody species that host edible caterpillars widely consumed as traditional dishes by local populations and which form part of their dietary habits. These caterpillars, which contribute significantly to local food security, are tending to disappear or become scarce due to deforestation and forest degradation. The aim of this article is therefore to show how the degradation or destruction of vegetation cover negatively affects the population of edible caterpillars in order to consider restoration measures in the Ngomedzap communal forest.

The study was based on diachronic analyses of satellite images, floristic surveys and socio-economic surveys. The results show that mature forests declined by 52.69% between 2000 and 2024, while degraded forests increased by 38.40% and cocoa-based agroforests expanded by 60.75%. This vegetation cover dynamic contributed to biodiversity loss. Thus, 123 species were identified in mature forests, 118 species in secondary forests and 40 species in cocoa agroforests. As a result, 71% of the population reports observing a decline in edible caterpillar species, which has a negative impact on their diet and constitutes a factor of food insecurity. The domestication and reforestation of edible caterpillar host species is urgently needed to restore the forest and preserve local dietary habits.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 9 – Poster 1: Recovery and restoration of tropical forests following anthropogenic disturbances

Successional dynamics of structure and function in restored riparian forests

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Restoring degraded lands is critical for re-establishing ecosystem structure and function, particularly in tropical forests converted for pasture and agriculture. This study presents the structural and functional dynamics of riparian forests restored by direct seeding along a 15-year chronosequence in the Xingu River Basin, a key Amazon-Cerrado transition zone. We conducted forest inventories in 66 permanent plots during two expeditions (2017 and 2022) across sites ranging from 1 to 15 years old. We investigated changes in structural attributes and functional traits, classifying species by seed dispersal and pollination syndromes. Structurally, most attributes increased significantly over time, though the density of young trees (DBH < 10 cm) did not, suggesting the onset of self-thinning. Functionally, we observed a significant increase in the density and richness of animal-dispersed species with site age. Among pollination syndromes, the density of bat-pollinated species showed a weak but significant positive trend over time. Our findings demonstrate that direct seeding effectively initiates the recovery of both structural complexity and key ecological functions, such as animal-mediated dispersal and pollination, in highly degraded landscapes. We demonstrate the link between structural and functional recovery, underscoring the need to track multiple indicators to evaluate the return of diverse ecosystem services.

Funding: CNPq scholarship1400/74/2023-6

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 9 – Poster 2: Recovery and restoration of tropical forests following anthropogenic disturbances

The potential role of dung beetles as secondary seed dispersers in Buenaventura, Ecuador

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Tropical forest regeneration after disturbance is largely dependent on seed dispersal by animals. While primary seed dispersers determine future plant communities of recovering forests, secondary seed dispersers such as dung beetles further shape regeneration patterns through their burial activity. We studied how forest recovery under active and passive restoration influences dung beetle diversity and what environmental and trait-related factors determine seed burial. The study was conducted in 21 plots in a montane cloud forest in Ecuador, with seven plots each representing passive restoration, active restoration and old-growth forest. Dung beetles were sampled with dung-baited pitfall traps and seed burial was measured using seed-mimicking beads of varying textures and sizes, which were placed in dung. As predicted, abundance and burial activity increased with recovery time. Actively restored forests showed a more pronounced trajectory towards old-growth stage than passively recovering forests, regarding abundance and community similarity. Successful seed burial was found to be strongly dependent on seed traits, with pubescent and medium sized beads buried most frequently across all study plots. Environmental conditions strongly determine the diversity and composition of dung beetle communities and therewith enhance their seed burial activities, which are likely to increase forest regeneration.

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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 9 – Poster 3: Recovery and restoration of tropical forests following anthropogenic disturbances

Cavity-nesting Hymenoptera prefer standing over laying deadwood for nest construction in forests

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Cavity-nesting Hymenoptera play key roles as pollinators and predators in forest ecosystems, yet their nesting site selection in forests remains poorly understood. We investigated how tree diversity, deadwood position, and ant exclusion influence nesting activity of solitary bees and wasps in 64 experimental forest plots spanning a gradient of 1-16 tree species. Each plot received three deadwood blocks with pre-drilled cavities – one laying on the ground, one standing with ant exclusion, and one standing without ant exclusion – offering cavities of varying diameters. After a full year of exposure in the field, 29 host species from 1104 individuals, and 12 natural enemy species from 123 individuals emerged from the deadwood. Bees and wasps strongly preferred standing over laying deadwood for nest construction, while ant exclusion had no effect. Tree richness promoted deadwood availability and the diversity of cavity-nesting communities. This highlights the potential of tree diversity to increase laying and standing deadwood and subsequently to enhance the diversity of cavity-nesting arthropods and their natural enemies in forests.

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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

Thematic Sessions

Session 10: Advancements in wildlife malaria research in tropical ecosystems

Convener: Kasun Bodawatta

Vector-transmitted haemosporidian blood parasites (agents of malaria) infect vertebrates globally and have important consequences for host health and fitness. Vertebrate hosts and malaria parasites have a long co-evolutionary history, with parasite specializations within haemosporidian genera and parasite lineages ranging from generalists to specialists on a diverse array of hosts. The distributions and prevalences of specific haemosporidians are dictated by a series of biotic and abiotic factors, making these associations vulnerable to habitat degradation and changing climates. Consequently, novel host-parasite associations and mismatches in specificity could arise, with potential consequences for host communities. Understanding the dynamics of interactions and factors affecting associations between hosts, parasites, and their dipteran vectors are imperative, particularly in the tropics, where human influence threatens a diversity of ecosystems. This symposium will highlight a diversity of recent studies on vertebrate-haemosporidian-vector associations in tropical ecosystem across the globe.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 10 – Oral 1: Advancements in wildlife malaria research in tropical ecosystems

The Wildlife Malaria Network: relevance to tropical ecology

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The Wildlife Malaria Network, or WIMANET, is an EU-funded research co-ordination network providing opportunities for global collaboration and networking around a common research agenda. Aims of the network are to unite the efforts of research groups around the world to combine knowledge and expertise around five research objectives and four capacity-building objectives, focusing on genomics and transcriptomics (WG1); species and morphology (WG2); vectors of wildlife malaria (WG3); integrating impacts of anthropogenic activities and wildlife malaria on host haematology (WG4); multi-host-parasite community-level interactions (WG5); and dissemination and capacity building (WG6). We aim to encourage the development of a common research agenda by providing opportunities for training, collaboration and knowledge exchange, targeting researchers across disciplines to foster an interdisciplinary approach, increasing the proportion of underrepresented groups involved in haemosporidian research, and targeting stakeholders, policymakers and the general public to endorse knowledge transfer.

In this talk, I will outline the ongoing and proposed work of each working group, highlighting opportunities to contribute to, and benefit from, funding provided through WIMANET, and the relevance of the network for wildlife malaria researchers in the tropics.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 10 – Oral 2: Advancements in wildlife malaria research in tropical ecosystems

Forgotten parasites? *Polychromophilus* in bats from French Guiana considering current knowledge

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Vector-borne haemosporidian parasites of bats remain poorly studied despite their potential ecological and evolutionary significance. Among them, *Polychromophilus spp*. are recognized agents of bat malaria but have received little attention in Neotropics. In this study, we screened bat flies and blood samples from the bat *Carollia perspicillata* captured in French Guiana and detected infections with *Polychromophilus spp*. using molecular tools (PCR-based identification and sequencing). Positive findings confirm the circulation of this parasite in local bat populations, adding to the limited reports from South America. To place these results in a broader context, we reviewed the available literature on *Polychromophilus sp*., synthesizing current knowledge on its taxonomy, host range, geographic distribution, and diagnostic approaches. Our findings highlight the need to integrate morphological and molecular methods for accurate parasite identification and call attention to the neglected diversity of bat haemosposridians in the Neotropics.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 10 – Oral 3: Advancements in wildlife malaria research in tropical ecosystems

Exploring avian malaria diversity and host–parasite interactions in the tropics

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Avian malaria parasites (haemosporidians) are widespread pathogens that can have a significant impact on birds; however, tropical regions—where host and parasite diversity are at their peak—remain poorly studied. Within the EU COST Wildlife Malaria Network (WIMANET), we examined haemosporidian diversity and host–parasite associations in tropical bird communities. In Peru, we detected 70 lineages, including 25 previously undescribed lineages, and 81 novel host–parasite associations. Strikingly, we also documented the first record of the invasive *Plasmodium relictum* lineage SGS1 from mainland South America, which infected multiple host species. In Myanmar, 27% of detected lineages were new to science, and nearly two-thirds of associations were unreported. Prevalence and lineage diversity were slightly higher in human-modified habitats, suggesting that disturbance may shape parasite dynamics. Overall, our results reveal extraordinary and largely hidden diversity in tropical avian malaria systems. By uncovering undescribed lineages, novel host–parasite interactions, and invasive pathogens, this study contributes to a global framework for understanding wildlife malaria. In line with WIMANET's mission, these findings underscore the pressing need for international collaboration to advance biodiversity conservation, enhance disease surveillance, and improve predictions of host–parasite interactions in a rapidly changing world.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 10 – Oral 4: Advancements in wildlife malaria research in tropical ecosystems

Overlooking the tropics: A systematic review of amphibian blood parasite research

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The impact of blood parasites on wildlife remains largely overlooked, especially in tropical environments. Amphibians, one of the most biodiverse yet threatened vertebrate groups, are particularly understudied. To address this gap, we conducted a systematic review of natural blood parasite infections in amphibians, comparing studies performed in tropical versus temperate regions. We carried out searches conducted in Scopus and Web of Science, using keywords related to blood parasites and amphibians. After filtering, 283 studies were included, of which less than 45% were focused on tropical regions (Neotropical, Afrotropical, Australasian, Indomalayan). Although this result does not look disproportionate at first glance, it does if we consider that tropical areas harbor roughly three-quarters of the world's amphibian biodiversity. Therefore, the results suggest parasites of tropical amphibians remain largely understudied and highlight a strong bias toward studies targeting common species in temperate areas. Overall, our study emphasizes an urgent need for a standardized and geographically inclusive research to better understand host-parasite dynamics in this threatened vertebrate group.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 10 – Poster 1: Advancements in wildlife malaria research in tropical ecosystems

Parasite–host dynamics of *Hepatocystis* in African fruit bats under changing ecological conditions

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Hepatocystis parasites are the closest relatives of mammalian *Plasmodium* and infect diverse mammals across Africa, Asia, and Australia. African epauletted fruit bats are common hosts, and we investigated infections in *E. labiatus*, a highly social species that has increasingly adopted peri-domestic roosting following habitat loss. To assess how seasonality, anthropogenic disturbance, and reproductive stress shape infection dynamics, we repeatedly sampled colonies in northern Uganda over four years. Prevalence exceeded 80%, with infections showing a seasonal pattern and reproductively active individuals exhibiting higher prevalence. Mean parasitemia remained low (<0.5%) across colonies, but bats in disturbed colonies had significantly higher values, with maxima reaching 5% compared to 1.4% in an undisturbed colony. To complement these findings, we monitored six naturally infected bats in captivity for three months. Parasitemia peaked during the initial weeks, coinciding with adaptation stress, before stabilizing at lower levels once bats acclimated. These results indicate that reproductive activity, anthropogenic disturbance, and acute stress impact *Hepatocystis* infection dynamics, underscoring the importance of evaluating parasite–host dynamics under changing ecological conditions, with implications for bat health, including possible co-infections with viruses with implications for both wildlife conservation and public health.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

Thematic Sessions

Session 11: Pathways towards positive land futures for biodiversity in tropical ecosystems

Conveners: Claudia Capitani, Robert Marchant

The escalating global biodiversity crisis demands a paradigm shift towards proactive, solutions-oriented conservation, specifically through envisioning and achieving positive, sustainable land use futures for tropical ecosystems. In response to conservation community calls to explore nature positive futures and engage indigenous people and local communities, this session will illustrate the transformative potential of participatory scenario planning to develop forward-looking and systemic responses, bridging scientific rigor with local knowledge. Our focus is on building "plausible positive futures for nature" through interdisciplinary exchange and empowering local voices in land-use decisions. We will emphasise the development, use and application of the 'KESHO' tool, an integrated approach applied across Africa and beyond, which uniquely combines community participation with quantitative modeling using insights from the distant past, earth observation time series, and climate change projections for co-producing spatially explicit scenarios and potential impacts on ecosystems, people and species. Participants will gain an understanding of the KESHO framework and the relevance of stakeholder-led approaches in shaping sustainable futures by improving land use planning, biodiversity conservation and climate resilience.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 11 – Oral 1: Pathways towards positive land futures for biodiversity in tropical ecosystems

Optimizing tropical forest landscapes: a two-stage framework for spatial land-use planning

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Creating multifunctional landscapes that balance human needs while enhancing ecosystem services delivery is crucial for the sustainable use of land resources, especially in tropical regions. Although both the composition and configuration of landscapes determine their multifunctionality, most studies address these dimensions in isolation, limiting their capacity to capture the complex interactions that shape ecological processes and influence service provision. To address this gap, we developed an innovative two-stage optimization framework integrating multiple non-spatial and spatial criteria to inform land-use allocation in tropical forest landscapes. Our approach applied a robust optimization model (Knoke et al. 2020) to determine the optimal landscape composition based on a set of socioeconomic and ecological indicators previously developed for the study region. We then integrated these results into CoMOLA (Strauch et al., 2019), a metaheuristic approach for spatial allocation problems. Here, we introduced explicit spatial objectives (i.e., pasture suitability and landscape connectivity) by incorporating topographic, climatic, soil, and accessibility variables, as well as species-specific data. The resulting framework provides decision-makers with a powerful tool to anticipate land-use impacts and to develop targeted, evidence-based conservation strategies. Thus, supporting the design of multifunctional landscapes that balance conservation goals with sustainable use.

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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 11 – Oral 2: Pathways towards positive land futures for biodiversity in tropical ecosystems

Participatory scenarios & spatial modelling of future mangrove ecosystem services in Lamu, Kenya

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Land use and land cover change (LULCC) disrupts ecosystem structure and function, leading to the loss of ecosystem services and threatening ecological integrity and human well-being. Anticipating future trajectories is particularly urgent in coastal regions, where mangrove ecosystems face mounting climatic and anthropogenic pressures. Here, we combine participatory scenario development with spatial modelling and ecosystem service valuation to explore plausible futures in Lamu County, Kenya. Using the Kesho toolkit, a diverse group of stakeholders co-produced four contrasting development scenarios to 2063, which were translated into spatially explicit LULCC maps. A benefit transfer method was applied in two ways to estimate the value of mangrove ecosystem services. Based on land-cover change alone, all scenarios show a slight decline in the value of ecosystem services. However, when scenario-specific changes in unit values were incorporated, the annual value diverged sharply, rising to USD 10.5 billion under the New Dawn scenario and falling to USD 7.6 billion under the Growth Trap. This paper presents the results of the first participatory scenario assessment in Lamu County, providing policy-relevant insights into how drivers of change may shape ecosystems and the services they provide. Kesho offers an adaptable tool for application in other mangrove-rich regions globally, supporting efforts to align local decision-making with continental and global sustainability agendas.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 11 – Oral 3: Pathways towards positive land futures for biodiversity in tropical ecosystems

Balancing nature and people: using participatory scenarios to navigate resilient tropical mountains

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Tropical mountain systems are biodiversity hotspots that sustain people through vital ecosystem services, yet they face escalating pressures from population growth, deforestation, land degradation, and climate change. Addressing these interconnected challenges requires approaches that link ecosystems and human well-being. Our study applies KESHO – a participatory land use scenario approach – to envision future pathways for land use, biodiversity, and community resilience in Nan province, northern Thailand. Using land as a lens allows us to integrate the people's choices on what land is used for and understand how this responds to external drivers. Based on social memory, local participants co-constructed a historical change timeline extending back some 50 years to identify key drivers behind land use change. Participants then co-developed plausible land use futures, revealing both desirable and undesirable land use potential in the short term (2030/2037) and long term (2065). The scenarios revealed trade-offs between agricultural expansion and ecosystem health but also opportunities to balance biodiversity conservation with local well-being. Our findings show how participatory scenario planning can integrate science and local knowledge to strengthen nature–people linkages, foster learning and ownership, and provide actionable insights for policy and practice, ultimately guiding co-produced pathways toward resilient tropical mountain systems.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 11 – Oral 4: Pathways towards positive land futures for biodiversity in tropical ecosystems

Community perceptions of ecosystem services of the Luki Biosphere Reserve, DRC

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The conservation of protected areas and the sustainable management of natural ecosystems are major challenges on a global scale, particularly in tropical regions rich in biodiversity such as the Democratic Republic of Congo. This work synthesizes the existing knowledge and presents empirical evidence on local community perceptions of the ecosystem services offered by the Luki Biosphere Reserve. It combines a systematic review of local and regional literature with a socio-economic survey of 361 households in 18 villages (selected through random sampling), 18 semi-structured interviews with key stakeholders, 8 focus groups, and direct field observations. Descriptive analyses, Chi-square tests and multiple correspondence analyses were performed on the respondent's data using SPSS v.23.0 software. Results indicated that provisioning services are perceived as priorities, followed by cultural services and regulating services. Supporting services, however, are less explicitly recognized. More than 72% of respondents perceive a decrease in certain services over time, mainly due to overexploitation and deforestation. These perceptions vary significantly by age (P-value = 0.032<0.05), length of residence (P-value = 0.010 <0.05), education level (P-value = 0.000 <0.05) and ethnicity (P-value = 0.000 <0.05), but not by gender (P-value = 0.394 >0.05). Traditional knowledge emerges as an important asset for adaptive management, yet governance mechanisms are perceived as insufficiently inclusive. Therefore, the participatory management approaches, integrating local knowledge into management plans and promoting environmental education, are essential for the sustainable future of the reserve.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 11 – Oral 5: Pathways towards positive land futures for biodiversity in tropical ecosystems

Potential causes and solutions for human-wildlife conflicts at the Bale Mountains National Park

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The Bale Mountains National Park (BMNP) in Ethiopia is a biodiversity hotspot, yet faces escalating human-wildlife conflicts (HWCs) that threaten both local livelihoods and conservation efforts. It needs to be verified if the degradation of the Harenna Forest (HF) – driven by subsistence farming – causes these HWCs. This study investigates the relationship between forest condition, resource use, and HWCs, aiming to identify root causes and propose sustainable mitigation strategies.

In 2024 and 2025, socio-economic interviews and focus group discussions were conducted in 15 communities inside and around the BMNP. Results revealed that diseases instead of wildlife account for the majority of livestock losses, while rainfall fluctuations and pests cause more crop damage than wildlife. However, wildlife attacks remain a significant concern, with villagers attributing them to proximity to the park, habitat overlap, and resource scarcity. Conversely, human disturbance was revealed by vegetation structure mapping inside HF in 2024 and confirmed by remote sensing analysis using the BFAST approach, which indicates a negative trend in forest coverage within the BMNP.

To mitigate HWCs, we propose introducing Holistic Management, a regenerative grazing framework that restores degraded rangelands outside HF by mimicking natural herd movements. This approach would alleviate pressure on the HF, particularly benefiting lowland pastoralists who heavily rely on its resources.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 11 – Oral 6: Pathways towards positive land futures for biodiversity in tropical ecosystems

Tree microhabitat diversity and its indicator potential in tropical forests of India

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Tropical forests are 'biodiversity cradles' facing conservation and management challenges. Tree microhabitats are proven as structure-based indicators of biodiversity in temperate forests. Their indicator potential is not assessed in tropical regions, limiting the utilization of this tool. To address this, an inventory was conducted for tree microhabitats, and their indicator potential was assessed for avifauna in the Western Ghats, India. Cooccurrences of tree microhabitats were statistically assessed to understand the distribution pattern. Tree microhabitats belonging to nine categories and 33 sub-categories were documented in evergreen and deciduous habitats. Injuries and exposed wood, epiphytic and epixylic structures, crown deadwood, excrescences growth forms, and Crematogaster ant nests were significant indicators of cavity trees and cavities, and increased heterogeneity in habitat. Crown deadwood, growth forms such as buttress, seams and flutes, epiphytic and epixylic structures, fungal fruiting bodies, injuries and exposed wood, and Crematogaster ant nests were significant indicators of avifauna diversity. Deadwood on living trees, snags, buttress, flutes, and epiphytes were potential indicators of avifauna diversity and their habitat resources in tropical forests, and thus the integrity of the ecosystem. Retention of these structures and integrating them as habitat monitoring parameters can improve conservation efforts and biodiversity in novel ecosystems.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 11 – Oral 7: Pathways towards positive land futures for biodiversity in tropical ecosystems

Towards nature-positive development: A decision support tool for tropical green corridors.

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The growing needs for socio-economic development of tropical countries in parallel with escalating biodiversity and climate crises requires solutions-oriented plans, particularly in vital tropical ecosystems like the Congo Basin. The Democratic Republic of Congo has launched the ambitious Kivu-Kinshasa Green Development Corridor (KKGDC) initiative to reconcile economic development with environmental protection. The KKGDC covers about 540,000 km2, of which primary forest and peatlands are about 30%. It hosts almost 30 millions inhabitants scattered across 129 villages and 6 cities. Its implementation is focused on developing critical energy, transport, and digital infrastructure, clustered around anchor projects in mining and agribusiness to catalyze regional investment. In this context, its sustainability depends on the meaningful inclusion of local communities. By using the KKGDC as case study, this oral talk illustrates a framework to prioritise and guide sustainable infrastructure and agricultural value chain development within development corridors. We propose a tool for a multi-layered analysis to enhance site prioritization for sustainable agricultural intensification and infrastructure projects that align with both community needs and conservation goals. The tool allows scenarios development and users customisation of drivers. We advocate for a mixed approach fostering a truly "nature-positive" future.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 11 – Poster 1: Pathways towards positive land futures for biodiversity in tropical ecosystems

Evaluating socio-ecological drivers of grazing, land cover and woody structure in miombo woodlands

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Climate change increases livelihood vulnerability among agro-pastoralists in tropical regions. Rainfall variability, population growth, and land-use conflicts have intensified environmental degradation and pressured socio-ecological systems. In western Tanzania, Sukuma agro-pastoralists increasingly use miombo woodlands for grazing, shifting pressure from grasslands. However, their ecological knowledge is rooted in grasslands, making adaptation to woodlands uncertain. This study assessed the resilience of Sukuma agropastoralism in Issa Valley, examining migration patterns, adaptation strategies, and effects on miombo ecosystem integrity. Participatory rural appraisal, vegetation surveys, and remote sensing captured household practices, woody plant structure, and land-cover change. Results show migration is driven by land scarcity and avoidance of restricted-mobility areas. Vegetation surveys revealed that moderate grazing maintained higher tree diversity and regeneration, while heavy grazing reduced recruitment and tree density by over 80%. Species richness declined in heavily grazed sites, while lightly grazed areas showed strong regeneration. Remote sensing identified localized degradation near dense herding zones but stable productivity at the landscape scale. Findings suggest ecological stress is less a product of pastoralism than of conditions limiting herd distribution. Recognizing pastoralist knowledge and mobility may help sustain miombo woodlands and guide management

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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

Thematic Sessions

Session 12: Habitability – interrogation land in transition from an interdisciplinary perspective

Conveners: Martina Padmanabhan, Gerhard Rainer

For ecologists, habitat is a fundamental term referring to the biotic and abiotic factors in a designated area, which favor and supports the life of a specific species. It thus focuses on the interrelationship between a species and its surroundings and thus moves beyond a sole focus on flora, fauna or the environment. Applying the term to *homo sapiens*, the debate evolves around living conditions for humans, in recent decades with a focus on the impact of climate-change and consequences like migration and displacement. However, the assessment of habitability is prone to the historical influences of colonialism as Fleetwood (2023) shows, when distinguishing the inhabitable from the habitable, differentiating habitability conditions for different human groups and the malleability of these limits for better and worse. Based on work highlighting postcolonial, intersectional and locally differentiated assessments of (in)habitability, we aim to explore the fruitful tensions of habitat as a concept situated between and across the natural and the social sciences.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 12 -Oral 1: Habitability – interrogation land in transition from an interdisciplinary perspective

Who inhabits the land? A feminist political ecology perspective on plantation labor in Cameroon

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Living conditions for human beings are shaped by flora and fauna, but also climate and geological forces. While plants and animals entertain multiple relations with their environment, humans claim the realm of the political as shaping their relations with the environment as a defining feature. Political ecology understands the manipulation and coproduction between humans and more-than-human beings as an analytical perspective, that brings the intended and unintended consequences of the dependence and interrelationship to the fore. We aim to present a Feminist Political Ecology analysis, to reveal the power relations in the ordering of human-nature relations, integrated in gendered and intersectional hierarchies in plantations of banana, palm and rubber in Fako, Cameroon. We analyzed 50 interviews, focus group discussions and participatory observation in spring 2025 of the embodied practices of laborers with MAXQDS for inductive coding. The findings reveal the plantation as shaping labor hierarchies, bearing the legacy of racialized and gendered colonial subjects. The feminization of the workforce under the conditions of the current Anglophone crisis reflects a locked-in phenomenon rather than emancipatory effects as suggested in the debate on feminization of agriculture. We argue that the plantation as an overarching institution bears the character of perpetuating its coloniality, assigning agency unevenly along gendered lines.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 12 -Oral 2: Habitability – interrogation land in transition from an interdisciplinary perspective

Habitability from a more-than-human perspective

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While the need for a fundamental transformation of our society's relationship with nature has become increasingly apparent in recent decades, the question of what such a transformation might look like is becoming increasingly pressing. Until now, the most common proposal has been to commodify and price nature in order to protect it—and, as such, to assign it an (exclusively) economic value. However, it has been shown on many occasions that this approach usually leads to a dead end. Anthropocentric views must be overcome and new human-environment relationships based on solidarity and care must be envisioned, both conceptually and in the form of real projects. In industrial agriculture, which is characterized by high pesticide and herbicide use and practices generally geared toward ever-higher productivity, the need for such a change is particularly evident (e.g., loss of biodiversity, water pollution, decline in fertility). In recent years, however, new practices have emerged in agriculture, albeit in a small niche segment, which are based on a fundamentally different approach of living in, through and with our co-natural world. Using the empirical example of the natural wine movement, this paper explores the question of how such a more-than-human perspective on agriculture is being implemented in practice and what problems and challenges are associated with it.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 12 -Oral 3: Habitability – interrogation land in transition from an interdisciplinary perspective

Colonized habitats, colonized habitability: Man-eaters in African history

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Beyond the obvious constraints that colonialism imposed on the habitability of land – such as land appropriation, plantation economies, infrastructural interventions, and the establishment of conservation areas – colonial rule had unintended and often poorly understood ecological consequences. Colonization profoundly altered the distribution and behavior of animal species, including those dangerous to humans. This paper traces the colonial-era scandals surrounding so-called man-eaters – the human-animal predators that haunted colonial imaginaries – and revisits the testimonies of colonized populations, whose explanations and experiences were frequently dismissed or disbelieved by colonial authorities.

Precolonial African societies had developed diverse modes of coexistence with potentially dangerous species, ranging from spatial segregation (for instance, with large felines) to close interaction and even ritualized feeding relationships (as between fishers and crocodiles). Colonization disrupted these finely tuned human–animal spatial arrangements, often with lethal consequences for both human mobility and the habitability of the land. By interrogating the entanglements of ecological, social, and epistemic transformation, the paper contributes to a broader discussion of how colonialism redefined the very conditions of habitability – an issue that remains central to interdisciplinary debates on habitat across the natural sciences and the humanities.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 12 -Oral 4: Habitability – interrogation land in transition from an interdisciplinary perspective

Media as corporate watchdogs for corporate social irresponsibility of the world's largest MNCs

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It is broadly acknowledged that the world's largest corporations have a critical role to play in addressing today's most pressing social and environmental challenges. Media coverage serves as one of the mechanisms holding these companies accountable for their impact on both the social and the natural environment. Although the media have no means to sanction organizations when they act irresponsibly, media coverage of such incidents can trigger sanctions from other, direct stakeholders such as customers, shareholders or board members following the incident. In this paper, we explore the effectiveness of this mechanism. We investigate the antecedents that lead to exposure of severe incidents of Corporate Social Irresponsibility (CSI) in influential media outlets. We develop and test a framework using a database of the world's 400 largest firms' severe CSI incidents reported in the media between 2012 and 2022.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Thematic Sessions

Session 13: Tropical freshwater biodiversity: from monitoring to conservation

Conveners: Alexandra Zieritz, Thomas von Rintelen

Tropical freshwaters experience some of the highest rates of biodiversity loss globally owing to an array of human threats, including pollution, deforestation, land-use change, dams, non-native invasive species and climate change. These threats are commonly closely associated with the rapid rates of development and urbanisation in many tropical countries, whilst efforts towards conserving tropical freshwaters are lagging behind most other ecosystems. Our understanding of tropical freshwater systems and their biodiversity is still rudimentary, but novel technological approaches, including environmental DNA and remote sensing, have the potential to rapidly fill these gaps in data and knowledge. This session will focus on recent advances in our understanding of tropical freshwater ecosystems and their biodiversity. Contributions will include those aiming to unravel the distribution and evolutionary history of tropical freshwater biodiversity, the underlying drivers and mechanisms of this distribution, ecosystem functions, services and threats, as well as those implementing and testing conservation approaches and interventions on the ground.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 13 – Oral 1: Tropical freshwater biodiversity: from monitoring to conservation

Riverine Pachychilid snails of Sulawesi: Patterns of diversity and distribution

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Sulawesi, Indonesia, hosts an extraordinary assemblage of freshwater mollusks, with pachychilid snails representing one of its most remarkable endemic radiations. While previous studies have primarily elucidated the adaptive diversification of pachychilids in Sulawesi's ancient lakes, the diversity and evolutionary dynamics of their riverine counterparts remain poorly explored. This study addresses this knowledge gap by examining the phylogenetic diversity and distribution of endemic pachychilid snails across multiple riverine systems throughout the island. Using concatenated mitochondrial 16S and COI gene sequences (n = 565), a comprehensive phylogenetic reconstruction revealed 13 major clades representing distinct riverine lineages. The results demonstrate substantial cryptic diversity and geographic structuring, reflecting limited dispersal and localized speciation within drainage systems. These findings highlight the evolutionary significance of Sulawesi's riverine habitats and contribute to a more complete understanding of pachychilid diversification beyond lacustrine environments.

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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 13 – Oral 2: Tropical freshwater biodiversity: from monitoring to conservation

Taxonomic and functional traits of freshwater biodiversity in Amazonian wetlands

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In an era of rapid environmental change, understanding the drivers of biodiversity is crucial for maintaining ecosystem stability and resilience. Tropical freshwater ecosystems, particularly wetlands, remain poorly studied despite their key role in sustaining biodiversity. These habitats are highly susceptible to land-use and seasonal variations, yet their taxonomic and functional dynamics remain largely unknown. Here, we compared fish and macroinvertebrate assemblages within oxbows of French Guiana across land-use, geographical, seasonal, and abiotic gradients. We identified 89 families of invertebrates and over 82 species of fishes, with clear influences of land use and seasonality on assemblage composition. Co-occurrence network analyses revealed greater structural complexity among invertebrates. Land-use conversion from forest to agricultural or urban areas reduced both fish and invertebrate taxonomic and functional richness, leading to increased community homogenization, while seasonal variation promoted species turnover. This study, by integrating the traditional taxonomic lens with a functional perspective, provides new insights into the processes driving biodiversity within tropical freshwater systems and underscores the importance of multiscale, trait-based conservation frameworks.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 13 – Oral 3: Tropical freshwater biodiversity: from monitoring to conservation

Drainage history and lake-level change shaped freshwater gastropod evolution in African Great Lakes

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The African Great Lakes (AGL) are key centers of tropical freshwater biodiversity, yet the evolutionary history of many invertebrate groups in these systems is still poorly known. Most research has focused on vertebrates such as cichlids, leaving macroinvertebrates largely overlooked. In this study, we examine the freshwater snail genus *Gabbiella* (Bithyniidae) to understand its evolutionary relationships, geographic structure, and colonisation history across six African Great Lakes, connected rivers, and crater lakes in western Uganda. We used mitochondrial and nuclear DNA markers to build a time-calibrated phylogeny and to trace ancestral areas and dispersal routes. Our results suggest that *Gabbiella* began diversifying in the Miocene, with later radiations during the Pliocene and Pleistocene. The most recent common ancestor of *G. humerosa* subspecies likely originated in the Kivu–Tanganyika region, followed by dispersal into the Nile system. These diversification phases coincide with major geological and hydrological events, including rifting and lake-level changes, which likely shaped the distribution of freshwater fauna in the region. Overall, the study shows that historical connectivity and environmental change have played a major role in shaping freshwater biodiversity in tropical Africa. Recognising these deep-time patterns helps to place modern biodiversity monitoring and conservation efforts in an evolutionary and landscape context.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 13 – Oral 4: Tropical freshwater biodiversity: from monitoring to conservation

Ecosystem change indicators: Macroinvertebrate evidence from Lake Mweru Basin

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Lake Mweru (Zambia/DR Congo) and its tributaries are vital ecosystems, supporting the inhabiting organisms. However, these interconnected systems, classified among vulnerable freshwater ecoregions, have not been recently studied for biodiversity and ecological status. A study conducted in 2008 reported several threatened species, including endemic mollusc species, in the lake. The lake has experienced a decline in level due to sedimentation and drought. Therefore, the existing knowledge gap regarding the current ecological status, coupled with ongoing threats such as overexploitation and pollution, motivated the current study. We aimed at[1] evaluating the ecological status of the lake and its tributaries using macroinvertebrates, and[2] assessing the conservation status of the previously reported endangered endemic mollusc species. The first phase of data collection (dry season) has been completed (October 2025). Macroinvertebrates were sampled along the longitudinal gradient (upstream, middle, and river mouth) of the Luapula, Mwatishi, Kalungwishi, and Katete Rivers, using standard methods. Environmental variables were recorded using standard methods. The lake and the tributaries face similar significant threats. Endemic and endangered mollusc species still thrive in Lake Mweru. The findings presented are crucial in developing evidence-based conservation strategies for endangered species and ensuring the sustainable management of Lake Mweru Basin.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 13 – Oral 5: Tropical freshwater biodiversity: from monitoring to conservation

From species to stewardship; the Bangweulu Wetlands' story

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Bangweulu Wetlands, one of Zambia's largest and most important wetlands lies in north-eastern Zambia. Spanning an area of 6645 km2, the wetland is nourished by seventeen rivers and drained by one, Luapula River. It produces 15,000 metric tonnes of fish and provides other ecosystem services to over 50,000 people. However, the wetland is threatened by impacts of climate change, increasing population, habitat modification, and pollution. Spanning over 6 chiefdoms, where local communities have rights to manage and harvest natural resources. The study assessed water quality, macroinvertebrate communities; and governance structures for the management of the wetland. Sampling was conducted in October, 2025 in pre-selected river sections adjacent to human settlements. Macroinvertebrates, environmental variables and community engagement were collected using standard methods. Results showed elevated levels of nitrates, ammonium, and phosphates, indicating pollution likely from human activities. Macroinvertebrate surveys showed high biodiversity in sites distant from human settlements, whereas diversity and abundance declined near communities reflecting water quality deterioration due to pollution. Additionally, an evaluation of governance structures uncovered inadequacies in management, hindering effective conservation efforts. The findings underscore the urgent need for improved governance and sustainable management practices to safeguard the wetland's ecological integrity.

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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 13 – Oral 6: Tropical freshwater biodiversity: from monitoring to conservation

Iron dynamics in mangrove-influenced coastal waters of Iriomote Island

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Iron (Fe) is a vital micronutrient for marine primary production, yet its concentration in seawater is extremely low and can limit phytoplankton growth. Mangrove forests are potential sources of dissolved iron to coastal waters, but their quantitative contribution, particularly in tropical regions, remains poorly understood. This study investigated spatial and temporal variations of dissolved Fe in mangrove-influenced waters on Iriomote Island, Okinawa, a pristine tropical island with over 90% forest cover. Water samples were collected along salinity gradients from the Maira and Shiira creeks and from two offshore non-mangrove sites as controls. Dissolved Fe concentrations were determined by ICP-AES. In addition, 12-hour time-series samplings were conducted to capture tidal variability. Results showed clear tidal fluctuations in Fe concentration, indicating that tidal exchange strongly modulates short-term Fe dynamics. Spatially, Fe concentrations decreased from riverine to coastal waters, while localized enrichment was occasionally observed near mangrove areas. Offshore waters exhibited much lower Fe levels, indicating a distinct mangrove-derived Fe signal. These findings highlight the important role of mangrove ecosystems as suppliers of bioavailable iron to tropical coastal environments.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 13 – Oral 7: Tropical freshwater biodiversity: from monitoring to conservation

eDNA enhances conventional biodiversity assessments: Evidence from a tropical rapid survey

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Environmental DNA (eDNA) from water has emerged as a powerful tool for detecting vertebrate biodiversity, offering a scalable, non-invasive complement to traditional surveys. However, its effectiveness depends on consistent field, laboratory, and bioinformatic protocols, as well as robust molecular reference libraries.

As part of Conservation International's Rapid Assessment Program (RAP), we conducted an eDNA survey across 24 freshwater sites in Equatorial Guinea, spanning two regions on Bioko Island and one on the mainland. At each site, up to three 30 L water replicates were filtered, and five vertebrate-targeting primers were used for DNA amplification and sequencing. In parallel, 415 tissue samples from major vertebrate groups were barcoded (COI) and 165 mitochondrial genomes sequenced to enhance regional reference databases.

The eDNA analysis detected 208 vertebrate species (81 mammals, 36 birds, 43 amphibians, 14 reptiles, 34 fishes), including 25 threatened or near-threatened taxa such as the African forest elephant, Bioko black colobus, and African grey parrot. Species richness was higher on the mainland, while Bioko sites showed more mammalian eDNA.

Comparisons with traditional RAP data revealed 87 shared species but 121 unique detections from eDNA, particularly among amphibians and mammals. These results demonstrate that eDNA significantly expands biodiversity coverage and community insights, reinforcing its value for rapid, integrative conservation assessments in tropical ecosystems.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 13 – Oral 8: Tropical freshwater biodiversity: from monitoring to conservation

Life beneath the palms: mussels and invertebrate communities in tropical streams

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Conversion of tropical forests to oil palm plantations profoundly alters river ecosystems by modifying channel structure and riparian vegetation, increasing sedimentation, temperature, and nutrient and pollutant inputs. Although these changes are known to reduce tropical freshwater biodiversity, their effects on one of the most imperilled faunal groups—freshwater mussels (Bivalvia: Unionida)—remain poorly understood. This gap is critical given the key ecological roles mussels play in water filtration, nutrient cycling, and habitat structuring, which may help buffer the impacts of land-use change on aquatic ecosystems. In the Serting River catchment, Peninsular Malaysia, we used environmental DNA and traditional sampling techniques to examine environmental drivers of mussel distributions in oil palm streams and assessed their links to invertebrate community structure. Despite the seemingly uniform landscape, substantial variation in environmental conditions was observed among streams, reflected in mussel distributions and invertebrate assemblages. Mussels were associated with cooler clearer waters, and distinct invertebrate communities that were dominated by mayflies. These findings underscore the importance of riparian buffers and other shading measures to mitigate thermal stress and sedimentation, supporting freshwater mussels and biodiversity more broadly in tropical agricultural landscapes.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 13 – Oral 9: Tropical freshwater biodiversity: from monitoring to conservation

Disentangling the drivers of stream health in oil palm landscapes: catchment vs riparian land-cover

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Globally, biodiversity loss is greatest in freshwaters, where multiple stressors act synergistically on species-rich ecosystems. The situation is particularly severe in Indonesia and Malaysia – regions characterised by an extraordinary concentration of endemic species but subject to the large-scale replacement of tropical rainforest with Oil Palm Plantations (OPPs). Existing research suggests increased sedimentation, temperature, and input of pollutants impact freshwater biodiversity within OPPs. Whilst riparian buffers can help mitigate impacts, they are highly variable and often lacking, and the relative importance of riparian and catchment land-use in driving OPP stream health is unknown. To fill this research gap, we sampled 43 sites at multiple spatial scales across Peninsular Malaysia. Each site spanned a 30m section of stream and underwent a comprehensive assessment: data was collected on water quality, river morphology, riparian land-cover, upstream catchment land-cover, and benthic invertebrate community. Preliminary findings suggest riparian land-cover drives specific habitat features (e.g. in-stream wood, macrophyte cover), while water chemistry and hydrology may be driven by catchment-scale effects. Our findings may contribute to the field of evidence informing sustainable certification schemes, such as the Round Table on Sustainable Palm Oil (RSPO), and provide evidence for more effective management of freshwater ecosystems in OPPs.

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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 13 – Oral 10: Tropical freshwater biodiversity: from monitoring to conservation

Ten years of freshwater mussel research in Sundaland: weaving knowledge systems for conservation

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Freshwater mussels (Bivalvia: Unionida) are one of the most threatened groups of animals, especially in the tropics. Until recently, our scientific knowledge on the freshwater mussel fauna of the biodiversity hotspot Sundaland has been based largely on specimens collected by colonial naturalists. Starting in 2015, we conducted a series of expeditions across the Malay Peninsula, Java, Sumatra and parts of Borneo. Visiting over 500 sites, we interviewed local communities and physically surveyed mussels to collate data on the presence and habitat requirements of species, and trends in environmental conditions and population sizes. Integration of DNA barcoding, molecular phylogenetics and morphological analyses of voucher specimens led to considerable changes in our understanding of this fauna, including the description of one new genus and five new species, all endemic to the region. Most species are now threatened, suffering rapid declines in population numbers and sizes due to human activities, including deforestation, land-use change to agricultural monocultures, urbanisation, industrialisation, dams, mining and aquaculture. Conservation actions are urgently needed, most notably implementation of best practices (e.g. riparian buffers and water treatment) to mitigate human impacts, systematic conservation planning and public outreach. These actions should involve local communities, who are crucial knowledge holders and safeguards of Sundaland's unique freshwater habitats.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 13 – Poster 1: Tropical freshwater biodiversity: from monitoring to conservation

Species diversity and distribution of the endemic atyid freshwater shrimps of Sulawesi, Indonesia

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Within the Indoaustralian Archipelago, Sulawesi stands out for its exceptional diversity of atyid species, with 63 species in five genera recorded, mostly in the genus *Caridina*. Most of these species are endemic to the island (n=44) and most of these are found in the island's ancient lakes, which have historically been the primary focus of research on Sulawesi's *Caridina*. The diversity and distribution of species in the island's rivers has not been well studied to date, though.

Based on sampling across the entire range of Sulawesi's endemic atyids, we have addressed[1] the phylogenetic relationships and[2] the species diversity and distribution of endemic *Caridina*, by reconstructing a molecular phylogeny using sequences from two mitochondrial gene fragments, as well as mapping the distributions of described and putative species.

Our results show that (I) the endemic atyids of Sulawesi belong to five distinct clades, with the majority of endemic species falling into two major *Caridina* clades, which exhibit a distinct geographic distribution in the west and the east, respectively; (III) the diversity of riverine species is greatly underestimated, with several previously overlooked narrow-range endemics; (IV) our data do not support the supposed widespread distribution of some described species. Sulawesi atyids are in clear need of an integrative taxonomic revision, and further exploration of the island, especially in karst regions, is likely to reveal more endemic species.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

Thematic Sessions

Session 15: Uncovering the mechanisms driving population declines in tropical forest understory birds

Conveners: Gladys Nyakeru Kung'u, Luc Lens, Beate Apfelbeck

Tropical understory birds are among the most vulnerable species within forest ecosystems, with many undergoing poorly understood population declines, even in forests that appear to be largely undisturbed. Therefore, it is crucial to identify the underlying mechanisms responsible for these losses. This session highlights novel research examining the behavioural and physiological processes linking environmental change to the decline of understorey birds. Topics will include how habitat fragmentation, degradation and climate change trigger cascading impacts on understory birds through changes in prey, parasite and predator communities or alterations in vegetation structure and microclimate on habitat use, dispersal, physiological stress, altered metabolic rates and energy budgets, and reproductive failure. Contributors will also discuss how such mechanistic knowledge can inform more effective forest management actions. The ultimate aim of this session is to bridge the gap between science and conservation planning for tropical understory birds by linking empirical evidence and practical applications from different tropical regions.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 15 – Oral 1: Uncovering the mechanisms driving population declines in tropical forest understory birds

Habitat fragmentation shapes dispersal and social structure in a cooperative breeder

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Cooperative breeding species are characterised by individuals delaying dispersal and independent breeding to help raise offspring that are not their own. Fragmentation of tropical forests may alter the fitness pay-offs of delayed dispersal, thereby affecting the expression of cooperative breeding and ultimately influencing population dynamics. We studied natal dispersal and group composition in the cooperatively breeding placid greenbul (*Phyllastrephus placidus*) inhabiting the highly fragmented cloud forests of the Taita Hills, south-eastern Kenya. Almost 90% of fledglings settled within their natal subpopulation. Males born in fragmented forests dispersed about one year earlier than those from continuous forests but generally remained within their natal patch, whereas females dispersed earlier and over greater distances. Despite these differences, overall group sizes were similar across habitats, likely because recruitment of one-year-olds declined with increasing group size, suggesting social constraints on group expansion. Age structure and sex ratio differed markedly between continuous and fragmented forests, while helping propensity and effort were unaffected by fragment size or quality. Together, these findings indicate that habitat fragmentation shapes dispersal strategies, recruitment, and social composition in complex, interacting ways, highlighting the role of social dynamics in mediating demographic responses to habitat change in tropical forest birds.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 15 – Oral 2: Uncovering the mechanisms driving population declines in tropical forest understory birds

Thermoregulatory limits of tropical forest birds in fragmented landscapes

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Climate warming and forest fragmentation threaten tropical biodiversity by altering microclimates and pushing species toward their thermal limits. We investigated the thermoregulatory capacities of five forest-dependent bird species from the Taita Hills (Kenya), a biodiversity hotspot experiencing severe habitat loss. Using respirometry, we measured resting metabolic rate across temperatures to determine the thermoneutral zone (TNZ) width, evaporative water loss and heat loss as proxies of cooling capacity, and heat tolerance limits (HTLs). Our results revealed consistent interspecific differences associated with body size. Larger species had broader TNZs and higher HTLs than smaller ones, while evaporative cooling efficiency was uniformly weak, flat or negative in small birds and only modestly increasing in larger ones. This mismatch between heat tolerance and evaporative efficiency suggests that montane tropical birds rely mainly on morphological and behavioural buffering rather than efficient evaporative cooling. Despite small sample sizes, our results indicate that tropical montane forest birds, especially small-bodied specialists, have narrow thermal margins and may be highly vulnerable to warming, extreme heat, and microclimatic shifts intensified by forest fragmentation. Conserving or restoring large, intact forest fragments will be critical to buffer microclimates, reduce heat stress, and support the persistence of these vulnerable communities under climate change.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 15 – Oral 3: Uncovering the mechanisms driving population declines in tropical forest understory birds

Forest degradation and warming constrain behaviour and fitness in an understory insectivorous bird

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Ongoing forest loss, degradation and accelerating climate change are driving biodiversity declines across the tropics, yet the mechanisms linking these pressures to species performance remain unclear. Through habitat surveys, arthropod sampling, radio telemetry, diet analysis and nest monitoring, we examined how forest degradation and weather influence habitat structure, food resources, behaviour and reproductive success of a forest understory bird, the placid greenbul (*Phyllastrphus cabanisi placidus*) in the cloud forests of the Taita Hills, Kenya. Degraded forests had simplified vegetation structure and fewer arthropods. Adult greenbuls exhibited larger home ranges, travelled farther, preferred higher canopy cover and reduced activity during peak heat in degraded forests. Nestlings in degraded forests were in poorer condition, especially in dry periods, and high temperatures further reduced condition across habitats. Heat also lowered provisioning rates, suggesting that thermal stress and reduced feeding jointly limited nestling growth. Overall, our results indicate that habitat degradation increases energetic demands and reduces reproductive performance in greenbuls, with warming amplifying these effects, potentially turning degraded forests into ecological traps. Conserving canopy integrity is therefore crucial to maintain tropical forest resilience under rising climatic and anthropogenic pressures.

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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 15 – Oral 4: Uncovering the mechanisms driving population declines in tropical forest understory birds

Taita Apalis: how saving one species can stimulate landscape restoration and improved livelihoods

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Taita Apalis *Apalis fuscigularis* population has declined to c200 individuals globally, with viable populations in only two forest remnants. The conservation challenges facing this species have been uncovered by long-term population and nesting studies across the Taita Hills' cloud forests. Key drivers of this population decline and range contraction include historical fragmentation and loss of critical habitat, high nest predation rates and micro-climatic changes. In this presentation, we show how insights from the long-term study have shaped current and planned conservation actions across this landscape comprising small native forest remnants immersed in a vast agricultural mosaic. Conservation actions already implemented include mapping of strategic and priority sites for habitat expansion and connectivity enhancement, forest restoration within some priority sites through eradication of invasive tree species, acquisition of land in priority sites and supporting local communities with income-generating activities. Ongoing or planned activities include further expansion of *Apalis* habitat by eradication of invasives in Iyale and Vuria fragments, enhancement of habitat connectivity between Vuria, Iyale, and Ngangao fragments, maintenance work in recently restored sites, and scaling up on-farm woodlots along the designated corridors. This work will engage the local community to ensure they are sensitised, trained and inspired, whilst also improving their livelihoods.

2026 VOL. 28:202601
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ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 15 – Oral 5: Uncovering the mechanisms driving population declines in tropical forest understory birds

Finding *Dorylus*: Unpacking the dependence of rainforest birds on driver ants in central Africa

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Though their ecological importance in Afrotropical rainforests is enormous, driver ants (*Dorylus sp*.) are among the most poorly understood keystone species on Earth. *Dorylus* colonies are common (25-80 per 100ha) and contain up to 20 million individuals. *Dorylus* raids create a massive front of fleeing arthropods that presents a bounty for primates, pangolins, and specialized ant-following birds. Three drive ant species coexist on our study plots, prompting us to explore differences in their diets, tolerance to disturbance, and impact on the ecosystem. In parallel, we've been working to understand the vulnerabilities of specialized *Dorylus*-following birds. Since 2014, we've captured about 6000 birds in primary and secondary rainforest on mainland Equatorial Guinea—the site of a new national park. Capture rates are twice as high in primary forest—with ant-following birds showing a particularly steep drop off—presumably due to the higher *Dorylus* abundance. At least five ant-following bird species regularly check driver ant nests. Ten bird species responded to heterospecific ant-follower vocalizations—suggesting a complex and interdependent relationship. Finally, we found that the home ranges of specialized ant-followers are ~70ha—at least seven times larger than those of less specialized insectivores. Afrotropical ant-following birds are not hunted, have large home ranges and are dependent on *Dorylus* ants, making both groups honest sentinels for rainforest degradation.

2026 VOL. 28:202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 15 – Oral 6: Uncovering the mechanisms driving population declines in tropical forest understory birds

Mind the gap! Bird recaptures across roads and powerlines in central African rainforest

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Despite assumptions that birds readily cross open spaces, tropical forest species often avoid canopy gaps and cleared corridors. This limits movement between habitat fragments, with consequences for dispersal, gene flow, and persistence. As roads and powerlines expand across forested landscapes, their potential to act as barriers warrants closer examination. We tested whether roads or powerlines reduce bird recapture probability across mist-net lanes using Bayesian mixed models. Net lanes were placed on either side of continuous forest (controls), roads, or powerlines (~70 m wide). Recapture probability was significantly lower across roads (0.8% ± 1.5%) compared to forest controls (5% ± 2.5%) across all trophic guilds. Powerlines did not significantly affect overall recapture probability (3.9% ± 3%), but guild-level responses revealed variation. Ant-followers dropped from 5.8% ± 1.6 in forest to 2.1% ± 1.2 in powerline treatments, while mixed-species flock participants declined from 5.4% ± 1.5 to 2.3% ± 1.3. Our findings show that even narrow roads and powerline corridors can reduce functional connectivity for forest birds. Recognizing such small-scale movement barriers is essential for conservation planning. Strategies like maintaining vegetated corridors or minimizing infrastructure in sensitive areas may help preserve connectivity and reduce extinction risk.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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Session 15 – Oral 7: Uncovering the mechanisms driving population declines in tropical forest understory birds

Can tropical birds withstand climate change? Testing the microclimate refugia hypothesis in Amazonia

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Tropical understory bird populations are declining even within intact forests, likely driven by climate-related changes in temperature and precipitation. One hypothesized buffer against these changes is the presence of microclimate refugia, which are areas within the forest understory that remain cooler and moister due to topographic variation. In the Amazon, igarapé habitats along small streams may serve as such refugia compared to the surrounding plateaus. We tested the microclimate refugia hypothesis in the central Amazon rainforest by comparing individual-level body condition, breeding activity, and age structure of understory birds sampled during the 2023 and 2024 dry seasons in igarapé and plateau habitats. Despite cooler and moister conditions in igarapés, we found no significant differences in body mass, breeding activity, or age structure between habitats. Birds captured on plateaus exhibited elevated core body temperatures and ketone levels, potentially indicating reduced food availability and thermal stress. Our findings suggest that differences in microclimate conditions may contribute to physiological stress in understory birds, potentially influencing demographic processes over time. While cooler, moister igarapé habitats may offer some relief, they alone may be insufficient to offset the impacts of climate change and prevent ongoing population declines in understory birds.

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Session 15 – Poster 1: Uncovering the mechanisms driving population declines in tropical forest understory birds

Impact of habitat degradation on dispersal decisions in a cooperative breeding tropical forest bird

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Tropical birds, with a slower pace of life and complex social structures, are at risk of decline due to rapid environmental change driven by human activities. The effects of habitat degradation, and fragmentation have correlated with changes in natal dispersal behaviour of subordinates within cooperative breeding groups. Whilst natal dispersal behaviour underpins sociality and group formation, it is unclear how habitat degradation is affecting the dispersal behaviour in cooperative breeding tropical forest bird species. We aim to experimentally determine how tropical forest degradation affects natal dispersal in a cooperatively breeding species, the Placid Greenbul, focusing on both direct and indirect effects of habitat quality. Additionally, using a long-term dataset, we look to determine whether the decision to disperse is made by the subordinate, or by the dominant adults within the social group. Using corticosterone implants to experimentally induce poor habitat quality, and radio tags to locate individuals, data will be collected on social behaviour and GPS coordinates. This data will be analysed in a pathway analysis to determine the decision-making process behind dispersal. Through conducting this work, we hope to unravel the impacts of degraded habitat quality on dispersal timing and understand the decision-making process that drives dispersal behaviour of a tropical forest cooperative breeding bird, providing valuable insight into group cohesion and maintenance.

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2026 VOL. 28:202601
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Session 15 – Poster 2: Uncovering the mechanisms driving population declines in tropical forest understory birds

Predation as a driver of cooperative behavior in placid greenbuls under global change

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Predation is a key force shaping sociality, but its role in driving cooperative group formation remains unclear. Global change is expected to disrupt trophic interactions, potentially destabilizing such systems. We used placid greenbul (*Phyllastrephus placidus*), a cooperative breeder from Kenya's Taita Hills, to explore how predation, climate, and habitat shape sociality. We tested whether (i) habitat and climate influence group formation and (ii) habitat, climate, and sociality influence predation risk, to assess if global change may alter the costs and benefits of sociality.

We combined 10 years of nest monitoring with focal observations and playback to assess group formation and predation risk. LiDAR quantified habitat structure, and distributed lag models identified climatic time frames influencing predation. Generalized models related ecological, social, and spatial factors to group size and predation rate.

Predation risk was best predicted by precipitation over 25 days before nest fate. Precipitation correlated negatively with both predation risk and group size, while temperature correlated negatively with group size only. Nest predation related to group size, but only when perceived risk was experimentally increased.

Our results show that predation risk is modulated by both climate and cooperative behavior in placid greenbuls. Additionally, as climate shifts, the balance of social costs and benefits may change, affecting established cooperative strategies.

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ECOTROPICA
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Thematic Sessions

Session 16: Climate change impacts on tropical forests across spatial and temporal scales

Conveners: Achim Bräuning, Aster Gebrekirstos

Climate change impacts tropical trees and forests across a range of spatial and temporal scales. Spatially, these effects manifest at the level of plant organs, individual trees, forest stands and entire ecosystems. Temporally, they span from short-term modulations of physiological activity, such as, photosynthetic activity or stomatal conductance, to mid-term changes in tree growth, carbon allocation and phenology, and long-term shifts, including species turnover and evolutionary adaptation. For each of the mentioned temporal and spatial scales, specific methodologies exist, including empirical data acquisition methods and modelling techniques. However, integrating findings across these scales remains a key challenge, particularly when attempting to upscale from organs to individuals, or from individuals to ecosystems. This session welcomes contributions addressing climate change impacts on tropical trees and forests across any of these spatial and temporal dimensions. We particularly encourage studies employing physiological, phenological, dendroecological, remote sensing, or modelling approaches. Of special interest are studies that include multiple spatiotermporal scales, trying to assess climate change effects of tropical trees and forest ecosystems, including tropical humid forests, dry forests, savannas, and agroforestry systems.

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Session 16 – Oral 1: Climate change impacts on tropical forests across spatial and temporal scales

Changes in ecosystem biodiversity and functioning from coastal drylands to Amazonian rainforests

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Tropical rainforests are global hotspots of biodiversity, yet we still lack a clear understanding of the drivers that determine diversity patterns and ecosystem functioning under changing climatic conditions. We conducted a large-scale survey to assess how multiple dimensions of plant and soil biodiversity, together with soil attributes and functioning, vary along a longitudinal precipitation gradient within and beyond the Marañon Valley, a biogeographic corridor linking the Pacific dryland forests, the Andean highland forests, and the Amazon lowland rainforest in northern Peru. Our results show that rainfall patterns explain sharp transitions in plant biodiversity, accompanied by consistent shifts in key biotic and abiotic soil properties. In this conference, we will show how species richness and composition change markedly along the gradient, contrasting dryland and rainforest communities, and we will also present data on soil microbial diversity and soil process rates, highlighting strong links between vegetation, soil communities, and ecosystem functions across this important climatic gradient.

2026 VOL. 28:202601
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ECOTROPICA
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Session 16 – Oral 2: Climate change impacts on tropical forests across spatial and temporal scales

The boiling river: a window into the future of the Amazon

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At Peru's Boiling River ("Shanay-Timpishka" in the indigenous Asháninka language), water temperatures reach a scorching >95oC. These hot waters warm the surrounding area, creating the hottest forest on Earth and making a unique "natural warming experiment" that provides powerful insights into how the Amazon Rainforest – and its constituent plant, animal, and microbe species – are affected by futuristically high soil and air temperatures. Our research at the Boiling River has already shown that 1) plant species are incapable of fully acclimating their leaf morphology and/or physiology to offset hotter air temperatures, and consequently 2) species diversity decreases markedly at hotter temperatures (~10% decrease in tree species diversity per 1oC warming). In addition, 3) the plants that persist in the hotter forests are a non-random subset of just the most-thermophilic species. Taken together, these results suggest that rising temperatures due to global warming will decrease alpha, beta, and eventually gamma diversity across the Amazon. Current research projects at the Boiling River are investigating the physiological responses of tree species to changes in temperature and the effects of high temperatures on plant-animal and plant-microbe interactions. Research at the Boiling River is increasing our understanding of species' temperature responses and will allow us to better predict the fate of tropical forests.

2026 VOL. 28:202601
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ECOTROPICA
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Session 16 – Oral 3: Climate change impacts on tropical forests across spatial and temporal scales

What will happen to Bamboo dominance in Amazonian rain forests as climate changes?

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Bamboo can be found to dominate rain forest canopy in several places in Amazonia. However, apparently only in southwestern Amazonia bamboo attains to dominate really substantial areas. In the border zone of Peru, Brazil and Bolivia, two species of *Guadua* bamboo dominate a summed area of at least 160,000 km2. One of the dominating bamboo species, G. *weberbaueri*, is found over a very large area in Amazonia from Bolivia to northern Brazil and Colombia. Accordingly, there has to be something special in southwestern Amazonia that enables *G. weberbaueri* to grow over forest canopy. If this special condition is related to climate, it is conceivable that climate change will rapidly turn current high canopy rain forests to bamboo-dominated thickets because the bamboo species that is capable to do this does not need to disperse. It only needs to sit and wait for a change in climate.

We investigated this scenario by first examining with a GIS-analysis which climatic and soil characteristics can best explain the current geographical distribution of bamboo-dominated forests. It turned out that the best explanatory variables are precipitation of the driest quarter of the year and soil base cation (Ca, K, Mg) concentration. We projected the modelled environmental niche of bamboo dominance to different future climate scenarios. Bamboo-dominance may indeed become more widespread in the future but there are several caveats in this conclusion.

2026 VOL. 28:202601
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ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 16 – Oral 4: Climate change impacts on tropical forests across spatial and temporal scales

Rainfall manipulation experiment in the Amazon shows how climate change impacts animal diversity

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Tropical forest species are adapted to specific temperature and humidity ranges that shape their behavior and habitat use, but increasingly frequent extreme weather events are exposing even pristine Amazonian forests to novel climatic conditions. Understanding how species respond to these rapid changes requires either long-term monitoring or targeted experimental approaches. We conducted the IRRIGA rainfall manipulation experiment in the Central Amazon, where we replicated typical dry-season rainfall patterns in 1-ha sections of forest during an extreme dry season. The additional 3mm of daily 'rain' altered the microclimate temperature and relative humidity compared to control sites so much that remote sensing shows increased productivity NIRv at experimental sites. Camera traps documented 25 mammal and 17 bird species, and audio data are currently being analyzed. Mistnet captures accounted for 620 birds, representing 67 species across 26 families. These data show birds with greater breeding activity, based on brood patches, in experimental compared to control sites. Preliminary results indicate a bottom-up effect in which the additional dry season precipitation increases productivity that leads to greater species activity and more breeding individuals in the experimental plots, revealing a potential pathway in which climate change is negatively affecting biodiversity in the Amazon.

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2026 VOL. 28:202601
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ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 16 – Oral 5: Climate change impacts on tropical forests across spatial and temporal scales

Leaf traits and spectroscopy reveal acclimation of individual trees to 40 years of climate change

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Climate change is altering the functionality of tropical forests, However, we lack a complete understanding of how individual tropical trees have been responding in recent decades. In our study, we leveraged historical and contemporary herbarium specimens collected from the same individual trees in the Peruvian Amazon, tested for changes in their functional traits over 40 years, and related these changes to local changes in climate. We also employed reflectance spectroscopy to train models for rapid trait estimation, which we used to predict traits on herbarium specimens collected from across the Amazon. We hypothesized that trees have acclimated their traits in response to increasing temperature and intensifying drought and that this acclimation would help to maintain stable leaf temperatures through time. We found significant decreases in leaf size and shape metrics and in stomatal traits within individuals through time. However, modelled leaf temperatures increased faster than would be expected based on changes in air temperature. This rapid warming of leaves was likely due to dry season intensification and rising [CO2]. We also found that reflectance spectra can be used to predict functional trait measurements on preserved leaves, corroborating previous studies. We highlight the potential of reflectance spectroscopy to predict traits from historical plant collections, enabling global-scale studies of trait changes across space and through time.

2026 VOL. 28:202601
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ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 16 – Oral 6: Climate change impacts on tropical forests across spatial and temporal scales

Photosynthesis parameters along elevation and humidity gradients in the tropical Andes

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Photosynthetic capacity of tree leaves was measured in the South Ecuadorian mountain rain forest (MRF) along an elevation gradient from 1000 m to 3000 m a.s.l. and in the corresponding mountain dry forest at 600 m a.s.l. about 150 km southwards. The parameters suitable for comparison are the maximum carboxylation efficiency of RubisCO (Vcmax) and the maximal electron transport rate (Jmax). Measurements were performed with the LI-COR 6800 gas exchange system using the protocols for light and CO2 response, respectively, as described in the manual. When averaged across altitude levels of the MRF, no pronounced trend was observed in either parameter. In the dry forest, however, both parameters were significantly higher during the rainy season. Leaves of pioneer trees showed higher Vcmax and Jmax then those of late successional species. In spite of the constant humidity and temperature during the measurements, both parameters showed frequent moderate fluctuations during the day. The equation for calculating Vcmax from the A-Ci curve also allows to determine Jmax (von Caemmerer et al. 2009). However, Jmax, measured directly in the light response curves was significantly lower by a factor between 2 and 3 than the rates calculated from the FvCB-Model. The reasons for this discrepancy will be discussed.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 16 – Oral 7: Climate change impacts on tropical forests across spatial and temporal scales

Predicting future growth of three neotropical tree species using the INTRAGRO approach

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Growth predictions of trees under climate change scenarios are crucial for sustainable forest management and conservation. The application of machine learning models offers a better tool for forecasting tree growth by integrating complex environmental variables. This study evaluates the predictive potential of INTRAGRO, a machine learning-based model, for three ecologically and economically significant Neotropical broadleaved species. We used long-term growth data recorded by dendrometers and climate projections to assess the model's performance in simulating growth responses under varying climate scenarios.

We found that INTRAGRO effectively captures intra-annual growth patterns, demonstrating its potential on three neotropical broadleaved tree species. Applying INTRAGRO, it was possible to model monthly tree growth, explaining more than 80% of the growth variance. Our result underscores the advantages of the INTRAGRO model in growth modelling in sub-annual temporal resolution, particularly in tropical trees with a lack of detectable growth rings.

With its robust results, INTRAGRO can support data-driven decision-making in forestry, biodiversity conservation, and carbon sequestration strategies by refining growth predictions.

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DOI: 10.30427/ecotrop202601
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Session 16 – Oral 8: Climate change impacts on tropical forests across spatial and temporal scales

Constrained thermal limits of tropical insects

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Insects constitute the largest share of global biodiversity, with nearly three quarters of species found in tropical regions. As ectotherms with narrow distributional ranges, tropical insects are particularly vulnerable to climate change. Despite this, their response to heat remains poorly understood, mainly due to non-standardized and taxonomically skewed data. We experimentally assessed thermal tolerance limits of insect communities sampled along large Afrotropical and Neotropical elevational gradients and related it to protein stabilities. Insect thermal limits did not scale linearly with environmental temperature but instead plateaued in tropical lowlands. High-elevation species exhibited thermal plasticity that may buffer them against warming, while lowland taxa had restricted plastic capacities. Heat tolerance varied significantly among insect orders and families, corresponding to differences in protein stability—indicating that changes in protein architecture may shape thermal limits. Future climate projections suggest that a large proportion of temperatures expected in Amazonian lowlands until 2100 could induce lethal heat stress in half of the insect community studied. This set of strong indicators suggests that insects in the most biodiverse ecosystems on Earth have a constrained ability to adapt to climate change.

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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 16 – Oral 9: Climate change impacts on tropical forests across spatial and temporal scales

Seasonal variation of seed dispersal syndromes in a seasonally dry tropical forest

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Seed dispersal is a crucial process in the plant life cycle driven by biotic and abiotic vectors that vary across space and time. We investigated the temporal variation in seed dispersal syndromes across the rainy and dry seasons in a dry forest of Ecuador. Due to seasonality marked mainly by precipitation, we expected a shift from wind-dispersed seeds in the dry season to more animal-dispersed seeds in the rainy season. We collected fruits and seeds from 214 seed traps distributed across twelve 1-ha plots. After 16 months, we recorded 63 plant species associated with zoochoric species (animal-dispersed) with ~40,000 seeds, followed by anemochoric species (wind-dispersed) with ~15,000 seeds and autochoric species (gravity/explosion) with ~7,000 seeds. Both anemochoric and zoochoric seed abundance peaked in the early dry season. The rest of the dry season was dominated by anemochoric seeds until the onset of the rainy season. Although seed rain abundance decreased for all seed dispersal syndromes in the rainy season, zoochoric seeds were the only affected with increasing precipitation. Our data provide information on the seasonal dynamics of seed-dispersal syndromes within the plant communities in this poorly studied, but highly diverse tropical ecosystem. In coming analyses, we seek to project future seed rain abundances based on modeled future climate data to better understand seed rain dynamics under changing climate.

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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 16 – Oral 10: Climate change impacts on tropical forests across spatial and temporal scales

Adaptive physiological responses of Persian oak to drought in the Zagros Mountains, Iran

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Drought-tolerant tree species in semi-arid regions play a critical role in regulating water resources and contributing to the global carbon cycle. The Zagros Mountains in western Iran host West Asia's largest oak forest, dominated by Persian oak, which grows under the influence of the summer subtropical high-pressure belt and plays an essential role in maintaining ecosystem balance. Understanding how native tree species physiologically adapt to harsh climatic conditions in subtropical transition zones is crucial for predicting forest responses to climate change. To evaluate adaptive responses along humidity gradients, we analyzed physiological and wood-anatomical traits of Persian oak across humidity gradients in a region where seasonal drought and heat stress strongly limit tree growth. Sub-annual ring-width parameters, stable carbon isotope ratio, and vessel size parameters were measured from increment cores. Results revealed that during drought periods, trees exhibited reduced radial growth, but higher $\delta^{13}C$, indicating enhanced water-use efficiency under moisture-limited conditions. Vessel size decreased significantly during droughts, suggesting structural adjustments of the xylem to enhance hydraulic safety. These findings demonstrate that Persian oak employs coordinated physiological and anatomical strategies to tolerate environmental stress, highlighting its resilience in subtropical dry forests.

Funding: Deutsche Forschungsgemeinschaft (DFG), grant number: AR1642/1–1.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 16 – Oral 11: Climate change impacts on tropical forests across spatial and temporal scales

Living labs and dendrochronology—tracking climate change impacts on tropical agroforests

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Understanding how tropical trees respond to climate variability across spatial and temporal scales is essential for climate-resilient land management. In Ethiopia, the Living Lab initiative — a community-driven, open innovation platform — links farmers, scientists, and policymakers to co-design adaptive agroforestry management solutions. Spanning diverse ecological zones from the humid Gedeo highlands in southeast Ethiopia to the semi-arid Tigray drylands in northwestern Ethiopia, these Living Labs integrate dendrochronology and real-time tree growth monitoring to capture fine-scale tree–climate interactions.

Electronic dendrometers installed on key indigenous and multipurpose tree and shrub species (e.g., *Cordia africana*, *Albizia gummifera*, *Coffea arabica*) record stem diameter changes every 30 minutes, revealing water stress, growth rhythms, and recovery after extreme events. We will present preliminary results showing how these measurements provide empirical evidence of how trees mediate and reflect climatic variability, informing species selection, restoration design, and ecosystem service valuation. By coupling long-term growth records with real-time stress monitoring, Ethiopia's Living Labs bridge temporal and spatial scales of climate response, strengthening both scientific understanding and community-led adaptation in tropical agroforestry landscapes.

Funding: UK Department for Environment, Food and Rural Affairs (DEFRA) and the Global Centre on Biodiversity for Climate (GCBC).

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 16 – Poster 1: Climate change impacts on tropical forests across spatial and temporal scales

Alien plant richness & β-diversity along a PNG rainforest elevational gradient

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Aim: Assess how alien plant diversity responds to temperature and precipitation along a long tropical elevational gradient.

Location: Secondary tropical rainforest, Papua New Guinea.

Methods: We surveyed alien plants in 1,133 transects (100×5 m) along a 30 m-wide, ~150 km corridor through primary forest for a gas pipeline, spanning 22–2,775 m a.s.l. We analysed richness, beta diversity, and composition versus elevation, mean annual temperature, and mean annual precipitation using polynomial regressions and multivariate statistics.

Results: Species richness showed unimodal responses along elevation, temperature, and precipitation, peaking near ~1,000 m a.s.l., ~22 °C, and weakly near ~4,500 mm. Beta diversity increased with environmental distance on all gradients, strongest for elevation and temperature. Turnover dominated across all gradients the most strongly with precipitation. Species composition was primarily driven by temperature, followed by precipitation; together, they accounted for 26% of total constrained variation. Many alien species had broad elevational ranges (mean 1,654 m; n=80), yet only a subset (24/80) spanned the full gradient. We recorded >20,000 individuals, 94 species in 31 families, dominated by Asteraceae and mostly of American origin.

Main conclusion: Temperature more strongly shaped alien plant composition, richness, and beta diversity than precipitation, and broad ranges indicate the capacity to establish across diverse environments.

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DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Thematic Sessions

Session 17: Human legacies in tropical forests: the role of land use history

Conveners: Majoi Nascimento, Nina Witteveen

Tropical forests, known for their incredible biodiversity, are highly threatened by agricultural expansion, deforestation, and climate change. Although many secondary forests regenerate naturally, the resilience and recovery of tropical forests varies widely and are influenced by land use history and human legacies. This session sheds light on the role of human land use on tropical forests across timescales and successional stages and calls for inclusive conservation. Human legacies refer to the short-term and long-term influence that human societies – both past and present – have on the functioning, composition and structure of tropical forests. People have inhabited tropical forests for millennia and their practices have shaped modern tropical forests. Numerous modern forests still bear the marks of past land use from agroforestry, shifting cultivation, soil modifications, domestication, and fire management. Indigenous and traditional practices often enhanced biodiversity, and influenced carbon dynamics. These dynamics are subjective by the frequency, extent, and intensity of the forest's past land use and by the time of the most recent disturbance. Land use history – on various timescales – is an important driver of the successional trajectories of tropical forests, as it determines the starting conditions for recovery. Previous high frequency and intensity land uses, such as cattle grazing, can deplete the seed bank and favor resprouting, leading to a slower or halted succession and reduced tree species richness. Previous low frequency and intensity land uses, on another hand, may result in faster recovery, and possible forest enrichment with useful species that can be dispersed through human use (e.g., fruit trees). Insight into past land use can be used to make management decisions on natural regeneration or active restoration. This session invites an international audience to reflect on the ways humans interact with tropical forests by providing a historical and modern perspective on land use, forest management and conservation practices, and the role of Indigenous and local communities.

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DOI: 10.30427/ecotrop202601
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Session 17 – Oral 1: Human legacies in tropical forests: the role of land use history

Multitaxa responses to land-use change in a human-modified landscape in central Panama

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Tropical landscapes are rapidly shifting from continuous tracts of undisturbed forest to complex landscape mosaics of primary forest fragments, regenerating forest and agricultural land, and the long-term conservation of tropical forest biodiversity is increasingly dependent on these diverse landscapes to support viable populations of forest species. We monitored tree, bird and mammal communities in an agricultural landscape in central Panama, sampling spanned included key components of these landscapes including remanant forest patches, regenerating forest, plantations, and pastures with living fences. Specifically we investigate 1) how species composition compares with that of neighbouring continuous forest within protected areas, 2) if diverse taxa respond to habitat type and landscape context (e.g. fragmentation, connectivity) in similar ways, and 3) whether species characteristics or life-history traits can explain species abundance across the landscape. Across all taxa, diversity remained high at the landscape scale, and overlap to primary forest was highest in remnant forests and lowest in pastures. Birds and mammals appeared more strongly imapcted by fragmentation and landscape context than tree communities. We found functional shifts in all taxa across gradients of increasing human disturbance, highlighting the vulnerability of some functional groups (e.g. large-bodied, frugivorous birds and mammals).

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DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 17 – Oral 2: Human legacies in tropical forests: the role of land use history

Kano: Plants, place & people

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For centuries, Kano City's districts were named after the indigenous plants that defined their landscape. However, these species are now under threat from urbanization, fuel use, and agriculture. Using field observations and remote sensing, this study analyzed the species distribution and population dynamics of this urban flora. The study utilized multi-temporal satellite data, consisting of Landsat imagery from 1975, 1995, and 2015, along with ancillary ground truth data for land use/land cover (LU/LC) classification. The results show a steady decline and the extinction of several key species in these districts. The study also found a significant shift in land use, with residential, commercial, industrial, public, and semi-public areas expanding steadily. Concurrently, parks, recreational areas, and agricultural land were converted to other uses. This led to a 23.18% increase in residential settlements between 1975 and 2015, while vegetation coverage decreased by 41.95% over the same period. The reduction in the vegetation is attributed to the growing demand for land for both residential and agricultural purposes. This highlights the critical need for conservation and climate action to protect Kano's urban biodiversity. In response, efforts to reintroduce some of these species have begun in collaboration with strategic stakeholders.

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DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 17 – Oral 3: Human legacies in tropical forests: the role of land use history

Centuries of compounding human influence on Amazonian forests

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Recent evidence suggests that the ecological footprints of pre-Columbian Indigenous peoples in Amazonia persist in modern forests. Ecological impacts resulting from European colonization c. 1550 CE and the Amazonian Rubber Boom c. 1850-1920 CE are largely unexplored but could be important additive influences on forest structure and tree species composition. Using environmental niche models, we show the highest probabilities of pre-Columbian and colonial occupation sites, and hence human-induced ecological influences, occurred in forests along rivers. In many areas, the predicted pre-Columbian and colonial distributions overlap spatially with the potential for superimposed ecological influences. Environmental gradients are known to structure Amazonian vegetation composition, but they are also strong predictors of past human influence, both spatially and temporally. Our comparisons of model outputs with relative abundances of Amazonian tree species suggest that pre-Columbian and colonial-period ecological legacies are associated with modern forest composition.

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DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 17 – Oral 4: Human legacies in tropical forests: the role of land use history

The fire history of the Dahomey Gap

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The Dahomey Gap is today a c. 200 km wide dry grassland corridor in western Africa, bordered to the east and west by moist tropical forest, and to the north by the Sahara. Fossil pollen data suggest that the current configuration of the Dahomey Gap emerged around c. 4500-3400 years ago when forest was replaced by grasslands. The reason for this replacement of forest with grassland has been attributed to both climatic (drying) and human (increasing population) factors. The role of fire in this opening up of the landscape, however, remains unexplored. Here we present the fire history of the Ewe-Adakplame forest patch within the Dahomey Gap (Benin). The fire history data are generated from a 2 m long sediment core recovered from a swampy area on the edge of the forest patch. Large charcoal fragments (>160 microns) were extracted from the sediment core at 2 cm intervals (n=101), and identified and quantified. The charcoal fragments were interpreted to represent fire in the landscape around the study site (10-100s m). Charcoal was found in 98 sub-samples and abundances ranged from 0 to 193 fragments per sub-sample. These data provide clear evidence that fire has been a long term (>1000 year) component of the Dahomey Gap, and likely played a significant role in maintaining the grassland, i.e. preventing forest expansion. Correlation with archaeological data and observation of modern land use practices suggests humans likely played a role in driving fire activity at this location.

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DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 17 – Oral 5: Human legacies in tropical forests: the role of land use history

Amazonian population collapse and ecological legacies: a paleoecological view

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Recently, historical ecologists have argued that most Andean and Amazonian forests bear the legacy effects, i.e. lasting structural or compositional changes, of Pre-Columbian land use. It is assumed that forest regrowth occurred in the wake of a c. 90-95% reduction in Indigenous populations 1550–1650 CE following European arrival, meaning that these legacy effects have persisted for 370–470 years. We present paleoecological data that point to an earlier period of land abandonment, about 1000–1300 CE, but very little evidence of major land use change 1550–1650 CE. While at a local scale soil amendment, and alteration of drainage are likely to cause persistent and measurable differences in forest cover, the 'softer' exploitation of landscape, ie. hunting, burning, crop cultivation, which presumable covered much larger areas, does not leave lasting legacies. More recent land use, however, such as during the rubber boom of c. 1850-1920 or as Indigenous and enslaved populations fled European rule, did alter forests with lasting consequences.

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DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 17 – Poster 1: Human legacies in tropical forests: the role of land use history

Perception of ecosystem services and disservices in a traditional coastal community

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A realistic perspective of society-nature relationships, especially in territories of traditional communities, can be obtained through an integrated approach that considers both ecosystem services (ES) and disservices (EDS). This study investigated the perception of a traditional community regarding ES and EDS in estuarine ecosystems (mangrove, estuary, estuarine beach, and restinga) within a coastal Environmental Protection Area, Brazil. Using semi-structured forms and generalized linear models, the results showed that the community perceives far more services (349 citations) than disservices (42 citations). The perception of ES is positively influenced by the level of schooling and by professional activities linked to nature. Provisioning services were the most cited (49%), followed by cultural services (23.1%). The mangrove was the ecosystem with the highest number of recognized ES (33%), followed by the estuary (27%). The data indicate that the community recognizes eight times more benefits than harms, with an emphasis on provisioning services linked to daily use, especially in the mangrove and estuary. This appreciation reflects the daily contact with the ecosystems, even with socioeconomic limitations. People were more aware of the EDS resulting from human activities than of those inherent to the ecological system. Understanding these perceptions is fundamental for effective conservation strategies and for strengthening community management in protected areas.

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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Thematic Sessions

Session 18: How to make forest restoration work: exploring innovative approaches and success factors

Conveners: Claudia Raedig, Nehren Udo

In the context of land degradation and global climate change, the restoration of tropical forests holds great potential for biodiversity conservation, climate change mitigation and adaptation, disaster risk reduction and the provision of important ecosystem services. However, many restoration projects fail for various reasons and the best strategies to promote forest landscape restoration on the ground are still unclear. The aim of this session is to bring together actors from science and practice to present and discuss their approaches to successful restoration of tropical forests with the involvement of local stakeholders. The focus is on approaches that show how different actors such as local communities, academics and business can be involved in forest restoration to raise awareness of the importance of restored ecosystems, empower local people, finance reforestation and create jobs. In order to compare the different success factors, innovation and unique characteristics of the approaches are essential: What led to local actors becoming active agents of change?

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DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 18 – Oral 1: How to make forest restoration work: exploring innovative approaches and success factors

From ruin to renewal: The fate of Rio's Atlantic forest ecosystems and climate

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The Atlantic Forest in the state of Rio de Janeiro represents a vital remnant of one of the world's richest and most threatened tropical forests. Most of the original forest area has been lost through deforestation and conversion to pasture and agricultural land, as well as urban expansion. This deforestation and forest degradation has serious implications for biodiversity conservation, endangering many threatened species and disrupting sensitive ecological networks. The fragmentation reduces habitat connectivity and genetic exchange, increasing species vulnerability. Moreover, forest loss in this area alters local microclimates, reduces carbon sequestration capacity, and impairs regulation of water cycles, exacerbating regional climate variability and risks such as droughts and floods. The degradation also diminishes ecosystem services that support human livelihoods, including clean water provision and soil stability. This presentation summarizes current knowledge on the ecological and climatic consequences of Atlantic Forest degradation in Rio de Janeiro, and provides an overview of ongoing forest landscape restoration initiatives. Given the critical stage of forest loss and its socio-ecological consequences, urgent, coordinated efforts involving public policy, scientific research, and community engagement are essential to restore ecosystem integrity, conserve biodiversity, and improve climate resilience in the region.

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DOI: 10.30427/ecotrop202601
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Session 18 – Oral 2: How to make forest restoration work: exploring innovative approaches and success factors

The restoration chain at REGUA: Linking forest recovery, biodiversity and community engagement

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The Atlantic Forest, one of the most biodiverse biomes on Earth, is also among the most fragmented and threatened in the world. Within this context lies the Guapiaçu Ecological Reserve (REGUA), located in Cachoeiras de Macacu, Rio de Janeiro, southeastern Brazil. REGUA's mission is to conserve and protect the remaining Atlantic Forest within the Guapiaçu watershed. REGUA plays a crucial role in biodiversity conservation, the provision of ecosystem services, and climate change mitigation. It also stands out for its comprehensive forest restoration programme, which strengthens the entire "restoration chain" — from seed collection and propagation in its nursery to planting, maintenance, and long-term monitoring of restored areas. These efforts aim to revitalise ecological corridors that reconnect isolated forest fragments, ensuring biodiversity protection and water security. Aligned with its restoration goals, REGUA advances its mission by promoting scientific research and providing a well-established setting for the reintroduction of locally extinct species, such as the lowland tapir. Its broad environmental education and awareness programmes foster local understanding, capacity-building, and stewardship. While REGUA is widely recognised for its success in forest restoration, deeper community engagement remains essential to strengthen a sense of belonging and ensure the long-term sustainability of the restored landscapes.

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DOI: 10.30427/ecotrop202601
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Session 18 – Oral 3: How to make forest restoration work: exploring innovative approaches and success factors

The REPLÂNTICA project – capacity building in forest restoration

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The REPLÂNTICA project is presented as a case study for successful capacity building in forest restoration. It is an initiative of TH Köln and the Brazilian NGO REGUA, which mainstreams ecological restoration of forest ecosystems of Brazil's Atlantic Forest. Since 2024 the project develops and implements training courses tailored for six local and cross-sectoral key target groups, providing practical and scientifically based knowledge on forest restoration. Turning restored forests into a classroom we are teaching the techniques, assessment, management and financing of forest restorations, and all courses inform the fundamental relationships between restoration and biodiversity, climate change adaptation, and ecosystem services. The training courses have been developed based on needs assessments and together with local academic and practicing experts. Tailoring considers mainly the educational, social and professional background and needs of the respective target groups, with a special focus on empowerment of rural women. Innovative matchmaking-workshops link the course participants with private actors willing to support restoration activities.

Our REPLÂNTICA Participatory Network for Ecological Restoration supports participants in actively contributing to ecological restoration and strengthens their ownership. An online knowledge-base for participants and trainers provides key strategic project insights and serves as a project documentation to be repeated elsewhere.

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DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 18 – Oral 4: How to make forest restoration work: exploring innovative approaches and success factors

Priority areas for forest connectivity: integrating landowner perspectives

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The Mata Atlântica, global biodiversity hotspot with high species endemicity, faces severe threats due to widespread deforestation and fragmentation. Landscape connectivity plays a crucial role in ecosystem functioning, biodiversity conservation and the provision of ecosystem services, all currently at risk. Human actions are a main driver of land cover changes and landscape patterns, and integrating human dimensions with ecological metrics is critical to reversing fragmentation. Landowner surveys (n=20) were conducted to assess knowledge, attitudes and barriers on forest conservation, restoration and applicable legislation, including environmental quotas (CRA). Results show economic barriers, particularly dependence on agricultural livelihoods, often outweigh environmental awareness in land-use decisions. Land cover mapping via supervised classification of satellite imagery provided insights regarding changes in forest cover and landscape metrics. Suitability analysis aims to balance agricultural productivity with conservation and restoration goals. Finally, these results were brought together in a corridor design, integrating the physical characteristics of existing forests, available mechanisms of forest protection, and social variables derived from surveys. Promoting biodiversity offsetting by expanding CRA trade mechanisms may incentivize restoration in key areas to boost connectivity, ensuring the restoration of ecosystem functions.

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DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 18 – Oral 5: How to make forest restoration work: exploring innovative approaches and success factors

Corporate sustainability initiatives through participatory networks for ecological restoration

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The Guapi-Macacu Watershed in Rio de Janeiro, Brazil, is both ecologically vital and increasingly threatened by land use change, industrial expansion, and urbanization. At its headwaters, the Reserva Ecológica de Guapiaçu (REGUA) plays a key role in forest restoration and biodiversity conservation. This study examines how companies operating in this watershed engage with ecosystem services (ES) and biodiversity, and how such engagement can be integrated into corporate strategies. The research is guided by the European Sustainability Reporting Standard ESRS E4 on Biodiversity and Ecosystems, connecting local realities in Brazil to global regulatory trends. A six-week field study combined multiple methods: company interviews and surveys (n=9), semi-structured interviews with corporate sustainability experts in Brazil and Germany, stakeholder mapping, snowball sampling, and an expert interview with REGUA's management. Results show limited corporate familiarity with ecosystem services, though water regulation and climate mitigation are widely recognized as critical for operations. Companies expressed interest in PES and partnerships, but cited financial and regulatory barriers. The stakeholder analysis identified REGUA and selected companies as strategic partners, with potential blockers among regulatory actors. These partnerships can be further identified and mapped through the Participatory Network for Ecological Restoration (RPRE) created under the REPLÂNTICA Project.

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Session 18 – Oral 6: How to make forest restoration work: exploring innovative approaches and success factors

Engaging communities in restoration: a participatory species catalogue for sustainable forests

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Restoring forests that are both ecologically functional and socially meaningful requires innovative and participatory approaches. While planting native trees with known ecological roles is widely practiced, attracting animal species – especially those locally extinct – remains a significant challenge. Within the REPLÂNTICA project's capacity-building activities, community participants expressed a desire to see their return into the restored forest areas. This feedback inspired the creation of a participatory species catalogue that collects "wanted" species suggestions directly from local communities. To develop the catalogue, we utilized AI to generate an initial selection of endemic species and to design a user-friendly, accessible format. The catalogue integrates three key data sets for each species: restoration-relevant information (for tree species), ecological functions and ecological niche characteristics, and ecosystem services provided. By blending scientific knowledge with insights from local actors, the catalogue seeks to enhance local engagement and understanding of the vital links between biodiversity, ecosystem functions and services. In the project's final year, we will conduct surveys to evaluate catalogue usage and stakeholder perceptions of its utility. We invite collaboration with researchers and practitioners interested in applying this participatory species catalogue to other regions to foster inclusive, knowledge-based forest restoration efforts.

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DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 18 – Oral 7: How to make forest restoration work: exploring innovative approaches and success factors

Social seed for scaling restoration: Women's empowerment, and ecological efficiency

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Scaling tropical restoration with native species needs more than seed production and finance; it needs social infrastructure to produce and govern diverse seed lots at landscape scale. In Brazil, community seed networks with Indigenous participation align restoration demand with local supply. We propose that knowledge exchange—peer learning, exchange visits, co-created protocols—builds this infrastructure and yields the social seed: seed produced with community participation that combines intrinsic quality (diversity, provenance, germination) with social and ecological practices (sustainable harvest, traceability, fair pricing, gender-inclusive governance, community stewardship of ecosystem services). These processes[1] strengthen governance through shared rules, standard quality control and transparent pricing;[2] empower women via paid technical roles and representation; and[3] deliver measurable ecosystem services monitored locally. Evidence from Brazilian networks, especially the Xingu Seed Network, shows that Indigenous leadership and women's participation, structured by knowledge exchange, provide reliable seed supply for restoration with social legitimacy and ecological effectiveness. We also outline policy and market implications that reframe procurement as ecosystem-service contracting, where social seed carries verified co-benefits: biological quality and diversity plus the social and ecological practices that sustain them

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 18 – Oral 8: How to make forest restoration work: exploring innovative approaches and success factors

Conservation practitioners could know about and use pioneer plants more in ecological restoration

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Globally, terrestrial habitat restoration predominantly focusses on active tree planting. However, this approach poses challenges which curtail restoration success. The use of pioneer trees has been recommended to accelerate ecological restoration and reduce its costs, but remains rare in restoration projects. We conducted a questionnaire-based survey with conservation practitioners on two degraded oceanic islands (Mauritius and Rodrigues) to assess the human dimensions influencing the integration of native pioneer plants in restoration projects. We computed an awareness index to gauge practitioners' knowledge on pioneer plant species, assessed their perceptions about those species, and described how they use them. We show that conservation practitioners' awareness about pioneer plant species is generally low. Although most of them perceive pioneer species as beneficial for restoration, only a minority use them strategically. Most practitioners consider pioneer plants like any other species, or control them, as is the case for *Harungana madagascariensis*, based on hypothesis or suppositions rather than evidence. Such practice however, contributes to set back and slow down restoration progress, increase restoration costs, weaken resilience to alien plant invasion, and even directly contributes to further degrade biodiversity. Our study therefore illustrates the need for evidence-based restoration to supplant enduring supposition-based restoration.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 18 – Oral 9: How to make forest restoration work: exploring innovative approaches and success factors

Conservation of endemic palms of Hawaii

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The isolated Hawaiian archipelago hosts approximately 24 species of endemic palms in the genus *Pritchardia*, representing an evolutionary marvel that was once ecologically dominant and remains culturally vital. This talk presents current applied research focused on the conservation of these threatened palms. Research efforts include clarifying taxonomic boundaries and hybridization potential, assessing in situ threats such as the invasive coconut rhinoceros beetles, maintaining living collections in botanical gardens, and preserving genetic diversity through pollen banking and strategic crosses. We are initiating creative conservation pathways, including community-based initiatives such as palm give-aways to return even the most endangered of these species to the care of Hawaiian people. The talk concludes with future research directions and opportunities for collaboration.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 18 – Oral 10: How to make forest restoration work: exploring innovative approaches and success factors

Restoring more than trees: Lessons from restoration practices in the Great Green Wall project areas

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This study examines the politics and performance of forest landscape restoration in the drought-prone and highly degraded mountain ecosystems of Tigray, northern Ethiopia. The area has recently been affected by massive violent conflict. Under these conditions, we are particularly interested in how competing visions of ecological recovery and development intersect, and how this is translated into alternative project approaches. Through a comparative analysis of three major initiatives, EthioTrees, WeForest, and REDD+, the research explores how contrasting governance arrangements and institutional logics shape restoration outcomes. EthioTrees operates as a community-based carbon forestry project. WeForest represents an international NGO-led model that combines reforestation with agroforestry and livelihood support. REDD+ is a state-led, internationally financed initiative focused on emissions reduction. Drawing on qualitative fieldwork and interviews with farmers, restoration workers, NGO staff, and government officials, the study finds that secure land tenure, participatory governance, and locally embedded approaches underpin restoration success. In contrast, technocratic, target-driven approaches emphasizing tree counts and carbon metrics risk reinforcing power imbalances and undermining sustainability. The findings call for a shift from narrow afforestation targets toward more inclusive, socially grounded restoration strategies that address both ecological repair and local livelihoods.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 18 – Oral 11: How to make forest restoration work: exploring innovative approaches and success factors

Vegetated gullies foster landscape restoration: the case of Enqulal catchment, Ethiopia

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Gully erosion, which accelerates the rate of land degradation, is a widespread phenomenon in Ethiopia. Vegetated gullies, however, may foster landscape restoration if protected from animal and human disturbance. In this study, gully erosion processes have been studied under different vegetation conditions in the Enkuala Catchment, Ethiopia. Gully cross-sectional morphometric parameters were measured at two different times in two years period. Hence, gully morphometric changes were analyzed considering three vegetation classes. The result revealed that the average gully density in the area is 35 m2 ha-1 while average area covered by gully is 161 m2 ha-1 (1.6% of the area). The total gully volume has increased from 86580 m3 to 94334 m3 during the two year period. Vegetated gully segments were found to have larger morphometric parameters. However, gully volumetric changes were nine and two times higher in open gullies than in vegetated and partially vegetated gullies, respectively. The equivalent average annual sediment yield in open gullies was 35 Mg ha-1 y-1, which is two order of magnitude greater than the sediment export from overland erosion. Vegetated gullies were also found to have hosted diverse shrub and tree species which serve as an ecological corridor and stepping stone, further enhancing the ecological connectivity in the area. Therefore, gullies can be considered as an entry point for fostering restoration in degraded landscapes.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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Session 18 – Poster 1: How to make forest restoration work: exploring innovative approaches and success factors

Opportunities for maximizing biodiversity conservation in tropical mountain forest restoration

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Tree planting, in the scope of Forest Landscape Restoration FLR, has been widely implemented to reverse landscapes degradation and biodiversity erosion. To achieve ambitious global goals of FLR, we need to connect global targets with local implementation. A step forward is understanding the relationships between landowners' land-use decisions, the purposes of tree planting and restoration outcomes. Here we examine these relationships at 99 forest restoration plots in the northwestern Andean foothills of Ecuador, a hotspot for biodiversity. We evaluate plant diversity locally at each restoration plot and similarity in species composition across plots located in farms with different land uses. We found that restoration plots within silvopastures and agroforestry systems hold higher species diversity than river protection plots. Agroforestry systems sustain a higher diversity of life forms, besides trees (e.g. palms, shrubs and herbs), however they also exhibit the highest proportion of introduced species. Similarity in species composition across restoration plots was rather low (c. 25%), but increased up to 40% when compared within each land use. The relatively low similarity suggests low biotic homogenization across restored sites and land uses. Further efforts could focus on increasing the propagation of rare and threatened plants as well as plant life forms underrepresented in current restoration to maximize the positive effects on biodiversity.

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DOI: 10.30427/ecotrop202601
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Session 18 – Poster 2: How to make forest restoration work: exploring innovative approaches and success factors

Promising experience of the farmer managed natural regeneration landscape restoration approach

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The problem of land degradation in Ethiopia is critical. The Ethiopian government has made a commitment to restore 22 million ha by 2030 as part of the Bonn Challenge. Currently, the government is implementing its flagship initiative "The Green Legacy Initiative", which has gained recognition by the FAO recently. Aligned with those government initiatives, World Vision Ethiopia (WVE) has introduced the Farmer Managed Natural Regeneration (FMNR) landscape restoration approach, which focuses on the management of naturally regenerating sprouts and seedlings. WVE has planned to restore 4.6 million ha of land by spreading the FMNR practices throughout Ethiopia until 2033. The FMNR approach is fast, low cost and not sophisticated, and brings synergistic improvements on the landscape restoration and livelihood of communities. FMNR is spreading fast through responsible government authorities and other NGOs. The practical experiences from WVE demonstration learning sites at Chilga and Habru, which cover 4,497 ha, show that vegetation has been restored, biodiversity recovered, and livelihood of communities improved. The practical lesson so far implicates the immense potential of the FMNR approach to restore landscapes where access is limited, resources are scarce and environmental conditions do not favor survival of planted seedlings.

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DOI: 10.30427/ecotrop202601
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Session 18 – Poster 3: How to make forest restoration work: exploring innovative approaches and success factors

Tropical forest restoration: trait species selection for ecological and social outcomes

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Direct seeding is a scalable pathway for tropical forest restoration, yet species choice often remains opportunistic. We synthesize evidence from 36 studies (963 trials; 168 native tree species) in the Atlantic Forest and link early performance (germination, emergence, establishment, survival) to functional traits to guide species mixes for direct seeding and to support seed-harvest planning by community seed networks. Unsupervised clustering identified distinct performance profiles; associations with seed mass, biological N fixation, wood density, regeneration strategy, shade tolerance, and dispersal syndrome accounted for much of the variation. High-performing clusters were enriched in large-seeded pioneers and N-fixing legumes, whereas median performers contributed complementary functions that enhance stand stability and fauna. Trait-informed direct seeding can increase ecological efficiency (greater establishment per unit effort) and reduce costs relative to seedling planting, while generating predictable demand for native seeds. Demand for trait-oriented groups with similar performance enables planning and investment in community seed production. We provide priority species lists and associated trait profiles to support substitutions when supply is constrained, offering a practical, evidence-based pathway to scaling restoration in tropical dry zones.

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Session 18 – Poster 4: How to make forest restoration work: exploring innovative approaches and success factors

Stakeholder and training needs analysis for tailored capacity building modules on forest restoration

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The Replântica Project, a collaborative initiative between TH Köln and the Guapiaçu Ecological Reserve (REGUA), aims to build local capacity for ecological restoration in Brazil's Atlantic Forest. To design targeted training modules, a stakeholder mapping and needs assessment were conducted between 2024 and 2025 in the Guapiaçu Basin, Rio de Janeiro. A total of 51 stakeholders were identified through on-site interviews with landowners, local environmental government representatives, and REGUA's staff. Each mapped stakeholder was evaluated regarding its potential to contribute to the restoration training modules provided by Replântica.

To complement and define the main topics of interest and needs in the study area for capacity building, a survey with 64 participants assessed knowledge gaps and training priorities among the six target groups of Replântica: landowners; local government representatives; NGOs; students; women from rural areas; and local citizens. The results revealed consistent deficits in knowledge about financial mechanisms for restoration (e.g., Payments for Ecosystem Services and carbon credits) and strong interest in practical restoration skills such as seed collection, agroforestry, and fire prevention. While the needs assessment analysis revealed which training topics most interest Replântica's target groups, the stakeholder mapping points out to experts who can assist in the development of Replântica training content.

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DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Thematic Sessions

Session 19: Free topics

Convener: Dieter Anhuf

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DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 19 – Oral 1: Free topics

Impacts of slash-and-burn agriculture on soil microbial-mediated ecosystem processes in Caatinga Tro

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Tropical forests, including the Caatinga dry forests, are vital for ecosystem services but are increasingly converted into human-modified landscapes through slash-and-burn agriculture. This practice alters soil properties and microbial communities that drive biogeochemical transformations. We investigated how slash-and-burn affects soil nitrogen (N) and carbon (C) dynamics and the role of microbial structure and activity in these processes. Control and slash-and-burn plots were monitored over a year, from pre-cutting to initial regeneration, assessing gas fluxes (CO_2, CH_4, N_2O), inorganic N (NH_4^+, NO_3^-), microbial activity (qCO_2), and functional genes (bacteria, archaea, AOB, cbbL). Impacts on C and N transformations emerged months after burning, not immediately. NH_4^+ increased six months after burning, correlating with microbial biomass and gene abundance, while lower bacterial and archaeal abundance shortly after fire coincided with reduced NO_3^-. CO_2 and N_2O fluxes remained stable, whereas CH_4 decreased three months after burning, linked to lower cbbL abundance, related to C fixation. These findings reveal that microbial responses to slash-and-burn are delayed and seasonally modulated, highlighting the importance of microbial–process linkages for managing soil fertility and ecosystem resilience in tropical dry forests that support rural livelihoods.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 19 – Oral 2: Free topics

Mapping human-wildlife conflict hotspots to better protect an endangered flying fox and fruit crops

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Human-wildlife conflicts (HWC) are increasing worldwide, adding pressure on threatened biodiversity and contributing to the ongoing extinction crisis. In Mauritius, the Mascarene endemic and endangered flying fox (Pteropus niger) includes commercial fruits like lychee (Litchi chinensis Sonn.) and mango (Mangifera indica L.) in its diet, resulting in conflict with growers. In response, the Mauritian government weakened the biodiversity conservation law to enable several campaigns of mass culling of flying foxes, increasing the species' extinction risk while fruit production dropped. Since the spatial distribution of orchards on the island remains largely undocumented, we mapped lychee and mango orchards to identify conflict-prone areas and guide non-lethal management strategies. Satellite images were examined using grid overlays to identify potential orchards based on tree spacing and canopy characteristics, followed by ground truthing to confirm fruit species. We identified 630 orchards (~33,000 trees), the majority of which were lychee-only (N = 533). Lychee orchards were concentrated in the island's north (43%) and south (26%), mango orchards in the north (46%) and west (27%), and mixed orchards mainly in the north (52%). Heatmaps of conflict hotspots can guide the optimized deployment of effective non-lethal methods like netting. We fulfill a key step towards finer-grained evidence-based HWC management in Mauritius that may serve as a model for similar conflicts elsewhere.

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DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 19 – Oral 3: Free topics

The functional traits driving woody encroachment in tropical savannas

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Rapidly increasing indigenous tree densities are transforming savannas globally, altering ecosystem structure and function. Rising atmospheric CO_2 is a key driver of encroachment, by fertilising tree growth and shifting the tree-grass competitive balance. However, as only certain tree species encroach, we hypothesised that key traits, including CO_2-responsiveness, are associated with the ability to encroach.

We ran a two-year experiment on twelve African leguminous tree species (six encroachers, six non-encroachers), growing them under ambient and elevated CO_2, with varied water and grass competition, and measured traits linked to photosynthesis, growth, and nitrogen dynamics.

We found a suite of traits distinguishing encroachers. Unlike non-encroachers, they upregulated photosynthesis under elevated CO_2 and had lower leaf δ15N, indicating greater use of N2-fixation products. Encroachers also showed greater plasticity in growth and biomass allocation. When freed from grass competition, they increased growth more strongly and, under competition, prioritised leaf area; non-encroachers showed limited flexibility.

These findings indicate encroachers use an opportunistic strategy, with traits enabling rapid establishment when conditions allow. This flexibility may also confer tolerance to adverse periods, allowing persistence until conditions improve. The results provide a mechanistic explanation for why certain tree species drive savanna encroachment under a changing climate.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 19 – Oral 4: Free topics

Trait-driven patterns of tree-related microhabitats along land-cover gradients in Kumasi, Ghana

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Urban trees play a vital role in sustaining biodiversity and ecosystem functions in rapidly expanding tropical cities, yet their structural and functional trait composition and associated microhabitats (tree-related microhabitats, TreMs) remain understudied, particularly in Sub-Saharan African cities. This study investigates how urban land-cover gradients and environmental pressures shape tree species composition, functional traits, and TreM diversity in Greater Kumasi, Ghana.

Between August and December 2022, we surveyed 644 trees across 236 plots representing 93 species and 31 families. Our analyses revealed a dominance of non-native species and a marked scarcity of large-diameter trees, which are crucial for supporting a rich diversity of TreMs, including ecologically important structures such as epiphyte habitats. Functional differences among tree groups—such as palms versus trees and deciduous versus evergreen species—were linked to significant variation in TreM abundance and richness.

By applying a trait-based approach, this study highlights how urban environmental gradients influence both biodiversity patterns and the structural complexity that underpins ecosystem functioning. Our findings advocate for urban forest management strategies that protect mature native trees, and control invasive species to enhance biodiversity and ecosystem resilience under ongoing climate and land-use change.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 19 – Oral 5: Free topics

How common is cauliflory? Insights from a regional florula of western Amazonia

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In tropical ecology textbooks, cauliflory is quoted as a very common phenomenon of many species of woody trees. However, quantitative information is largely lacking. To find out how common cauliflory is in Amazonian rainforests, I examined a regional florula from Peru. I scored cauliflory as present or absent on the genus level, and calculated the percentage of genera and families, respectively, that include at least one cauliflorous species. Also, I counted the number and the percentage of genera per family with cauliflorous species. Overall, cauliflory is present in 9% of genera and 28% of families. Some large families (Fabaceae, Annonaceae) have more genera with cauliflorous species, but the proportion of genera with cauliflorous species is generally higher in small families (e.g., Monimiaceae, Theophrastaceae). In conclusion, the predication that cauliflory is very common in tropical rainforests is not supported for a regional florula from Amazonia. Similar analyses are needed for florulas from other tropical rainforest regions. This could help to answer questions that are of more general interest from an eco-evolutionary point of view like:[1] How generalized or specialized are plant-animal interactions of cauliflorous plants?[2] Is selection pressure from pollinators responsible for the evolution of cauliflory or do seed dispersers also matter?[3] Are cauliflorous plants that grow over several forest strata connectors between strata-specific interaction networks?

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DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 19 – Oral 6: Free topics

Competition in arboreal ant communities is higher in lowland than in mid-elevation rainforests

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Interspecific competition is a common phenomenon in nature but challenging to quantify. Tropical ants are common on trees and their canopies, where they often forage and build nests from lowland up to highland. We hypothesized that ant competition is mediated by temperature and therefore expected it to increase in the warmer lowland rainforests compared with mid-elevations. We also expected that temperature should lead to higher competition in forest canopies compared with smaller understorey trees due to warmer microclimate.

To test our hypotheses, we measured resource competition by placing baits (food resource) and bamboo cavities (nesting resource) in the natural rainforest of Mt. Wilhelm, Papua New Guinea, distributed across forest plots at low-elevation (200 m), and mid-elevation (900 m) where temperature is 4 °C colder. Furthermore, we translocated the cavities after exposing them to ants from mid to low elevation.

While the translocation experiment was challenging to interpret due to too low occupancy and nest survival, the occupancy of both baits and cavities was higher in low than mid-elevation, and in canopies. However, this effect was not due to a simple decrease in ant activity, since their species richness was higher in the mid elevation, where territorial dominant ants were rare. Our study helps to explain the large differences in ant community structure observed between the elevations through evidence for a higher competition for resources in the hot lowlands.

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DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 19 – Oral 7: Free topics

On the evolutionary assembly of the tree flora in the Cerrado biodiversity hotspot

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The Cerrado of South America houses the most diverse tree flora of any savanna region worldwide, yet only 10% of its territory is protected. Determining conservation priorities in such biodiverse regions, however, is no easy task. Recent studies have documented the diversity and dominance of Cerrado tree species at large spatial scales, showing that almost half are rare or microendemic. Here, we explore the evolutionary assembly of the Cerrado tree flora to advance our understanding of the origins of ecological dominance in this biodiversity hotspot. We compiled a comprehensive dataset describing the abundance, distribution, taxonomy and phylogenetic relationships of 220 angiosperm lineages. We find no phylogenetic signal for species richness, range size, and ecological dominance in the Cerrado tree flora. These results hold when analysed for each Cerrado ecoregion separately. Although two-thirds of the lineages in our analyses have low abundance and incidence, they cover large spatial extents (2,320 km on average). We also show that rare tree lineages in the Cerrado stem from relatively shorter branch lengths in the phylogeny, which results in a higher contribution of dominant lineages to the phylogenetic diversity of Cerrado savannas. Efforts aiming to protect the full spectrum of evolutionary diversity in the Cerrado biodiversity hotspot must go beyond traditional metrics, accounting for the intricate patterns of lineage dominance, rarity, and phylogenetic structure.

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DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 19 – Oral 8: Free topics

Dispersal, diversification, and distribution in tropical Asia: biogeography of Dissochaeteae

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Southeast Asia hosts one of the world's most diverse floras, yet the processes shaping this richness remain poorly understood. Despite being among the largest and most diverse tropical angiosperm families, Melastomataceae is understudied in this biogeographically complex region. The family includes several Southeast Asian lineages differing in origin, age, habitat, and dispersal ecology. These contrasts provide a powerful framework to explore the region's geological and biogeographic history.

The tribe Dissochaeteae comprises about 70 species of lianas and shrubs found in primary and secondary forests from Thailand to New Guinea, with diversity peaking in Borneo. We present a densely sampled phylogenomic framework for the tribe using high-throughput sequencing to reveal diversification and dispersal patterns across Southeast Asia. Our results show that Dissochaeteae followed predominant eastward dispersal trends, including multiple expansions from Sunda to Sahul and several diversification bursts since the Miocene. However, climatic niche analyses indicate that suitable climate is not the main driver of diversity, contrasting with patterns seen in other Southeast Asian clades. Ongoing comparative studies across Melastomataceae lineages aim to further illuminate the evolutionary processes underlying the region's extraordinary plant diversity.

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DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 19 – Oral 9: Free topics

Local and landscape drivers of small mammal diversity in a forest-cashew mosaic in West Africa

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Forest conversion into agriculture is a major driver of biodiversity loss in the tropics. In Guinea-Bissau, the quick expansion of cashew (*Anacardium occidentale*) has led to extensive forest loss, yet its effects on native fauna remain poorly understood. We investigated how the expansion of cashew orchards influences small mammal diversity in Cantanhez National Park, West Africa. Small mammals were live-trapped across 24 sites (12 forest and 12 cashew orchards) over 5,760 trap-nights, identified morphologically and molecularly, and their diversity was related to local (canopy openness, understory obstruction, tree structure, palm and vine density) and landscape variables (forest and cashew cover, edge density). We captured 105 individuals from 7 species (5 rodents, 2 shrews). Species richness increased with understory obstruction, species abundance declined with higher cashew cover, and species composition varied with forest cover, canopy openness, and tree height. The most abundant species, *Praomys rostratus* (n = 72), was largely restricted to forests. Cashew expansion is driving the decline of the forest-dependent P. rostratus and promoting a shift towards generalist and open-area species. These results highlight that cashews sustain only a subset of generalist taxa and cannot replace native forests. Conservation efforts should prioritize preserving forest fragments and regulating cashew expansion to guarantee the persistence of forest-dependent biodiversity in the tropics.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 19 – Oral 10: Free topics

Long-term community dynamics of vascular epiphytes in a tropical lowland forest in Panama

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Understanding the mechanisms that shape plant communities is a key focus of community ecology. Yet in tropical rainforests, research has predominantly focussed on trees, leaving canopy community dynamics less explored. Owing to the challenging accessibility of the forest canopy, long-term studies on epiphytes encompassing large forest areas and numerous species remain scarce. We address this gap by examining the long-term dynamics of vascular epiphytes in San Lorenzo National Park, Panama, the only long-term research plot worldwide dedicated to epiphytes research. The first two censuses, conducted over a 10-year period, showed increases in both total epiphyte abundance and mean biodiversity per tree. To determine whether these trends persisted, the third census was conducted 15 years later over 0.56 ha using a canopy crane and tree climbing. Contrary to previous observations, the third census revealed a drastic decline in epiphyte abundance. Temporal beta-diversity indices indicated a net loss in diversity, challenging the hypothesis of a continuous upward trend. The death of large host trees that provided substrates for many epiphytes indicates that tree mortality had the strongest influence on the epiphyte community. These results also highlight the importance of large old trees for local vascular epiphyte communities and their long-term development.

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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 19 – Oral 11: Free topics

Ferns lined up: 150 km of landscape heterogeneity in Amazonian rainforests

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Amazonian rainforests have long been famous for their extremely species-rich plant communities, and understanding is increasing also about their spatial heterogeneity. General species turnover patterns have already been well documented for many plant groups, but more detailed assessments of the niche requirements and distributions of individual plant species are relatively rare. However, these are especially informative when compared among closely related species: they can shed light both on the ecological drivers of local community assembly and on niche evolution and other long-term processes that may have triggered biotic diversification. I will explore the distributions of some species-rich fern genera in western Amazonian rainforests along six intensively inventoried transect lines that together measured more than 150 km in length. The data show clearly how species distributions are structured in a hierarchical fashion by different factors at different scales: drainage-related variation is obvious at the local scale while patchiness related to soil chemistry and geological formations become apparent at landscape and broader scales. These results support niche-related species sorting as an important process that defines species co-occurrence and turnover patterns within Amazonian rainforests, and provide information on which evolutionary inferences can be based.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 19 – Oral 12: Free topics

Contrasting responses of soil bioturbation by social insects to tropical forest degradation in Borneo

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Soils are critically important components in tropical forest ecosystems, driving nutrient cycling, carbon storage, and vegetation resilience. Bioturbating social insects are key to soil health, as their mounds enhance aeration, infiltration, and fertility, yet these groups are under threat from anthropogenic disturbance. We quantified the density of bioturbated structures by *Dicuspiditermes*, *Macrotermes*, other termites, and ants across a typical gradient of anthropogenic habitat modification in Malaysian Borneo: primary forest, once-logged, twice-logged, and oil palm plantations (n=15 plots, 25×25 m per habitat). Structure density declined with disturbance, highest in primary and once-logged forests and lowest in twice-logged and plantations. *Dicuspiditermes* dominated primary forests but declined sharply with logging and conversion to oil palm, while ants showed moderate declines in twice logged forests. *Macrotermes* remained relatively stable. Both *Macrotermes* and ants significantly increased bioturbation compared to other termites with *Macrotermes* showing the highest volumes in logged and plantation sites while ants contributed moderately but consistently across habitats. These results indicate that key soil engineers particularly *Dicuspiditermes* are sensitive to repeated logging and conversion, threatening soil health. Protecting and reintroducing sensitive bioturbators could sustain belowground ecosystem functions and enhance soil fertility in degraded tropical landscapes.

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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 19 – Oral 13: Free topics

Assessing present and future trends in Macromoth diversity in a subtropical montane environment

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Since 2009, we have been conducting a national long-term ecological monitoring program on Hallasan Mountain (max 1950m a.s.l.) in Jeju Island, Korea's largest island located in the subtropical climate zone. This monitoring focuses on altitudinal transects, with the primary goal of observing biotic changes in response to recent climate change. We have carried out monthly surveys from May to October, focusing on moths. The study sites range in elevation from 278 meters to 1,699 meters. Lower elevations are heavily influenced by human activity (e.g. coppicing), while higher elevations are relatively undisturbed. We have recorded a total of 848 species and 34,450 individual moths. Species richness and abundance show a unimodal pattern, peaking at mid-elevations. Using the collected species data, we applied an ensemble stacked species distribution model based on the WorldClim to predict future changes in species distributions under different climate change scenarios. To assess these changes, we selected 24 moth species and evaluated the influence of environmental variables. The results revealed that species richness tends to decline at lower elevations, while distribution ranges expand at higher elevations. Under more severe climate change scenarios, species richness at higher elevations is projected to decline significantly. Among the 24 species, those inhabiting high elevations are expected to experience substantial population declines due to climate change.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 19 – Oral 14: Free topics

Vertebrate scavenging in a subtropical biodiversity experiment

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Biodiversity generally enhances ecosystem functioning, but the strength of this relationship varies across sites and scales. One explanation is that biodiversity-driven complementarity among plants operates mainly at local scales. Because higher-trophic animals have large ranges and high mobility, biodiversity may have limited effects on their functions, particularly in BEF experiments with small plots. Yet, such effects have rarely been tested. Here, we investigated how tree species richness influences vertebrate scavenging by monitoring the removal of over 5,000 mouse carcasses across 96 plots in 2023-2024, and across 300 plots in 2025 along a tree diversity gradient in subtropical BEF-China. Carrion removal was low in spring 2023 and autumn 2025 (~10%) but much higher in summer 2024 (~30%). Removal rates increased with tree species richness, shallower slopes, and denser canopies, though these relationships varied among years. Our findings underscore the roles of topography and forest structure in vertebrate scavenging and suggest that localized biodiversity effects can persist even for ecosystem functions involving high-trophic-level animals.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 19 – Oral 15: Free topics

The value of student theses in ecology

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Each year, students in ecology produce theses filled with unique data and new findings. Yet, even though universities are meant to lead the way in open science, more than 90% of institutions across Central Europe have no consistent system for sharing student theses publicly. Since only a small number of student theses ever make it into scientific journals, most remain unnoticed and unused. In this talk, I will explore the potential of student research in ecology and the barriers that prevent its visibility and reuse. Drawing on a regional survey of universities and interviews with academic staff, I will discuss some of the problems arising from the inaccessibility of student theses, common misconceptions about their scientific value, and how this lack of access ultimately limits our way of doing science. In the end, I will provide examples of good practice and propose practical recommendations for universities, supervisors, and students to make ecological knowledge more accessible, transparent, and impactful.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 19 – Oral 16: Free topics

Global giants: Biogeographic patterns across the world's biggest plant genera

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Fewer than 1% of plant genera contain more than 500 species, yet these so-called big genera account for over 25% of all flowering plant diversity. Why are some genera so diverse, and how have they spread so widely?

To explore these questions, we analysed global species distribution data from taxonomic checklists to map the species diversity of big genera across botanical countries, climate zones, and floristic realms. While big genera contribute disproportionately to species diversity in continental and polar climates, they are also major contributor to tropical plant diversity. Tropical regions such as the Andes, Malesia, and Madagascar show marked concentrations of big genera, many of which are predominantly epiphytic or montane lineages. Over 90% of big genera occur in multiple floristic realms, and a third are nearly global. Hierarchical clustering identified five major biogeographic groupings, each centred on a distinct floristic realm.

We propose that the extraordinary diversity of these genera stems from a combination of pre-adaptations, ecological opportunity, long-distance dispersal, and key evolutionary innovations i.e. from being the right plant at the right place at the right time. Together, these factors have repeatedly triggered radiations across different plant lineages and offer a unique insight into the processes that drive large-scale plant diversifications.

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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 19 – Oral 17: Free topics

Accuracy of global biomass and canopy height products in East African forest fragments

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Tropical forests in East Africa are under high land-use pressure, resulting in deforestation and forest degradation. The remaining forest fragments are important carbon stores and harbour many endemic species. Forest structure assessments are crucial for monitoring forest degradation and recovery following conservation measures. As fieldwork is time consuming and costly, we evaluated the accuracy of above ground biomass (AGB) and canopy height products for selected forests. Data were collected in 108 systematically distributed plots (r = 15m) in Taita Hills cloud forest and Kaya Kambe coastal forest (Kenya), and Tara Gedam dry Afromontane forest (Ethiopia). Tree diameter and height were measured, and plot-level AGB and maximum canopy height derived. These were compared to ESA CCI BIOMASS (100m) (Santoro & Cartus 2023), African Aboveground Biomass 2017 (100m) (Rodriguez Veiga & Balzter 2021), Global Canopy Height (10m) (Lang et al. 2023), and Global Canopy Height (1m) (Tolan et al. 2024) by extracting raster values at each plot. Preliminary results show that both biomass products significantly underestimate AGB across all forests, especially at higher biomass levels. Canopy height datasets aligned more closely with field data, with the 10m product outperforming the 1m dataset. These findings highlight the need for better calibration of biomass products and demonstrate the potential of canopy height datasets to strengthen forest assessment and monitoring in remote forest areas in East Africa.

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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 19 – Oral 18: Free topics

Climate risk and conservation of narrow-niche sub alpine and alpine flora in the western Himalaya

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Climate-induced changes in Himalayan ecosystems pose a significant threat to high-altitude, narrow-niche flora. This study examines the vulnerability of three keystone species: *Aconitum heterophyllum*, *Meconopsis aculeata*, and *Rhododendron campanulatum* in the subalpine and alpine ecosystems of Himachal Pradesh. It integrates field-based phytosociological surveys with species distribution modelling, along with bioclimatic and topographic variables under Shared Socioeconomic Pathways (SSPs 126, 245, and 585) to project future habitat suitability. *Aconitum heterophyllum* density peaked at 3306m in Abies forests, favouring moist, shaded, northwest-facing slopes. Its narrow climatic range (7–8°C, precipitation seasonality of 40–100 mm), with habitat loss projected to exceed 50% under future scenarios. *Meconopsis aculeata* was most abundant at 4176m in alpine herb communities, restricted to steep, well-drained slopes with low precipitation variability and high isothermality (>35%). *Rhododendron campanulatum* peaked at 3851m, favouring stable diurnal temperatures (~10°C) and north-facing slopes. Key environmental drivers include elevation, soil cover, temperature, and precipitation variability. The study suggests that conservation strategies should focus on elevational habitat corridors and protection of ecological refugia.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 19 – Oral 19: Free topics

Remote sensing of canopy height and aboveground biomass in tropical mangrove restoration areas

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Protecting and restoring mangrove ecosystems is a critical priority, which the activities have expanded in the last decades after the incorporation of blue carbon ecosystems in the global carbon budget. In this study, Synthetic Aperture Radar (SAR) polarimetric and interferometric features along with spectral bands and indices were extracted from C-band SAR Sentinel-1, L-band SAR SAOCOM-1 and optical multispectral Sentinel-2 to estimate the forest structure of mangrove restoration areas in a tropical region. A 15-m spatial resolution reference dataset of canopy height and aboveground biomass was generated with regression models between field observations and UAV-LiDAR metrics. Using a random forest algorithm and spatial cross-validation, we found that models combining all three data sources significantly outperformed single- or dual-source models. SAOCOM-1 interferometric coherences and Copernicus DEM elevation had the highest importance, followed by Sentinel-2 and SAR polarimetric variables. To assess the transferability potential of the final model, the model performance was assessed in another study area where only field data is available that were not used for training the models. The assessment showed that canopy heights and aboveground biomass of under restoration mangroves could be better estimated than non-restored mangroves in the untrained study area. Our study provides an essential reference for monitoring the progress of mangrove restoration programs.

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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 19 – Oral 20: Free topics

Losing an island's only cave-roosting bat would impoverish cavernicolous invertebrate communities

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Cave ecosystems are nutrient-limited habitats where bat guano often provides a major allochthonous input supporting invertebrate communities. On oceanic islands like Mauritius, such habitats face growing human pressures, with urbanisation encroaching on caves and chemical pesticide overuse potentially reducing insect prey availability to bats, indirectly affecting colony size and guano input. The endemic Endangered Mauritius free-tailed bat (*Mormopterus acetabulosus*) – the island's only cave-roosting bat, may play a key role in sustaining cavernicolous biodiversity (e.g. endemic silverfish *Lepidospora mascareniensis*), yet faces elevated extinction risk. We assessed invertebrate diversity, abundance and community at two scales: 1) between caves with and without bat colonies, and 2) within caves along transects from the cave entrance through guano zones to post-guano zones. We found higher invertebrate diversity and abundance in bat-occupied caves, with diversity peaking near entrances (likely reflecting environmental heterogeneity) and abundance peaking within guano zones, declining before and beyond guano deposits. These patterns indicate that the loss of *M. acetabulosus* roosting colonies could trigger cascading declines of guano-dependent invertebrate taxa. Our findings can support targeted conservation measures, including legal protection of caves, strategic management or avoidance of bat guano harvest, and reduced use of chemical pesticides within the bats' foraging range.

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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 19 – Oral 21: Free topics

Integrating local ecological knowledge to assess seagrass responses to sedimentation

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Madagascar is a data-poor tropical bioregion increasingly exposed to severe tropical storms. Yet, the ecological effects of cyclone-driven disturbance, such as sedimentation, on estuarine ecosystems remain unstudied. Under a multi-disciplinary assessment framework, we integrated local ecological knowledge (LEK) to examine seagrass bed responses to sediment deposition. Semi-structured interviews were conducted in four estuaries using convenience sampling to document regional baseline information on estuarine seagrass beds. Data were structured to capture seagrass ecology, disturbances related to sedimentation, and short- to long-term ecosystem responses. Respondents described distinct species–sediment associations along estuarine gradients: fine-leaved, thin-rhizomed species dominate muddy-sand zones near freshwater inflows, while robust, broad-leaved species occur in coarser seaward sediments. Seasonal flooding and wind-driven resuspension were identified as stressors causing burial on short timescales. Thin-leaved species often act as early colonizers after short-term disturbance. For moderate to long-term change, seascape successional patterns were linked to sediment texture shifts related to sedimentation in some areas. Regional variations in perception of seagrass stressors emphasized the need for site-specific management approaches. LEK, as process-based, demonstrates potential to overcome temporal and baseline data gaps, serve to guide adaptive management strategies.

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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 19 – Oral 22: Free topics

Biodiversity conservation in northeast India: Implications for sustainable wildlife management

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Northeast India, part of the Indo-Burma and Eastern Himalayan biodiversity hotspots, is among the most biodiverse regions globally. However, human activities and economic pressures have impacted the region's ecology, affecting both wildlife and communities. This study explored current conservation measures promoting sustainable wildlife management. It used qualitative methods such as open-ended surveys, interviews, and focus group discussions. Data were collected from local communities and stakeholders involved in conservation measures. Findings showed that conservation efforts are largely species-specific and focus on human-elephant conflict mitigation. Programs included awareness campaigns, habitat restoration, alternative livelihoods, and incentive-based initiatives. Capacity building and skills training supported community-led conservation. Efforts were mostly community-centered and involved multiple stakeholders. One effort was the Greater Adjutant Stork conservation campaign, which integrated biodiversity communication combined with local culture and traditions. Another was the human-elephant conflict program, emphasizing habitat restoration and awareness. The study concludes that communication, livelihoods, incentives, and skills development are key to sustainable wildlife conservation.

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2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
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INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 19 – Poster 1: Free topics

Global giants: Biogeographic patterns across the world's biggest plant genera

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Fewer than 1% of plant genera contain more than 500 species, yet these so-called big genera account for over 25% of all flowering plant diversity. Why are some genera so diverse, and how have they spread so widely?

To explore these questions, we analysed global species distribution data from taxonomic checklists to map the species diversity of big genera across botanical countries, climate zones, and floristic realms. While big genera contribute disproportionately to species diversity in continental and polar climates, they are also major contributor to tropical plant diversity. Tropical regions such as the Andes, Malesia, and Madagascar show marked concentrations of big genera, many of which are predominantly epiphytic or montane lineages. Over 90% of big genera occur in multiple floristic realms, and a third are nearly global. Hierarchical clustering identified five major biogeographic groupings, each centred on a distinct floristic realm.

We propose that the extraordinary diversity of these genera stems from a combination of pre-adaptations, ecological opportunity, long-distance dispersal, and key evolutionary innovations i.e. from being the right plant at the right place at the right time. Together, these factors have repeatedly triggered radiations across different plant lineages and offer a unique insight into the processes that drive large-scale plant diversifications.

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ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

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Session 19 – Poster 2: Free topics

Tropical mesocarnivores as heavy metal sentinels

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The Bornean state of Sabah has lost ~40% of its forests to oil palm. Despite this, generalist mesocarnivores such as civets and leopard cats persist in plantations, potentially increasing exposure to inorganic pollutants such as heavy metals from agrochemicals. We assessed acute and chronic non-essential heavy metal burdens in wild mesocarnivores from the Lower Kinabatangan Wildlife Sanctuary, where remnant forest lots are surrounded by plantations, using ICP-OES. Sunda leopard cats show elevated As (acute: 9.86 ± 1.56; chronic: 2.86 ± 2.65 mg/kg) and Pb (0.32 ± 0.31; 1.93 ± 3.15 mg/kg). Common palm civets exhibit elevated As (0.95 ± 0.70; 1.11 ± 0.60 mg/kg), Pb (0.74 ± 0.33; 0.80 ± 0.53 mg/kg), and Al (43.43 ± 23.92; 24.56 ± 13.43 mg/kg). Malay civets show high Al (38.94 ± 25.02; 53.16 ± 46.83 mg/kg), As (0.95 ± 0.33; 1.10 ± 0.19 mg/kg), Cd (0.41 ± 0.79; 0.12 ± 0.07 mg/kg), Hg (2.69 ± 5.64; 7.88 ± 12.82 mg/kg) and Pb (0.98 ± 0.63; 0.55 ± 0.29 mg/kg). Results suggest metal bioaccumulation is a constant pressure, with As and Pb particularly elevated in plantation-persistent mesocarnivores. All elevated non-essential metals exceeded thresholds of concern for each study species, raising urgent questions about the future for mesocarnivore persistence in oil palm systems and the invisible impacts of extensive agriculture on tropical communities.

Merian Awards Candidate

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 19 – Poster 3: Free topics

Understanding the drivers of tree spatial patterns in African savannas

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In dry savannas, theory suggests that scale-dependent feedbacks drive the formation of regular vegetation patterns. Such patterns are often associated with extreme conditions, including those intensified by climate change. However, in savanna tree stands, spatial patterns may also arise from intrinsic processes unrelated to climatic forcing.

In this study, we conduct a meta-analysis of 314 studies to[1] identify the range of spatial patterns observed in tropical African trees,[2] determine the main mechanisms underlying these patterns, and[3] disentangle self-organized tree patterns driven by scale-dependent feedbacks from those imposed by landscape heterogeneity.

We find that empirical studies most commonly report clustered, random, or regular tree spatial patterns, with occasional evidence of power-law distributions. These pattern types occur across a broad range of annual precipitation values, though dominant drivers differ between arid and mesic regions. Patterns and mechanisms also vary with spatial scale, with environmental heterogeneity emerging primarily at the landscape rather than plot level. Empirical support for self-organization of savanna trees remains scarce and was rarely found to be a dominant driver in this meta-analysis. We highlight the need for targeted, multi-scale field experiments to clarify the role of tree self-organization in shaping savanna structure and its potential contribution to ecosystem resilience under global change.

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 19 – Poster 4: Free topics

The role of olfaction in frugivore fruit choice: Insights from mouse lemurs in Ranomafana NP

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Primates and fruiting plants are closely linked: primates rely on fruits for food, while plants depend on primates for seed dispersal. This interaction shapes fruit signals, such as odor, and animal sensory adaptations, like olfaction. Fruits often rely on chemical signals to mediate interactions with seed dispersers. Esters have received particular attention because of the positive correlation with sugar content, linking olfactory signal and nutritional reward. Although fruit scent often reflects sugar content and lemurs use smell to select fruit, it remains unclear whether they assess quality by scent alone. This study tests whether frugivorous mouse lemurs assess fruit quality via scent. To investigate this, we conducted choice experiments in the lab with 47 wild lemurs and in the field using two camera traps (350 videos). In the lab, lemurs chose between two ripe fruits, relying solely on smell. We analyzed the figs based on sugar and ester content. In the field, they were presented with fruits with or without added esters to test preference. Lemurs showed significant bias towards fruits with higher ester content, as predicted, but a bias against sugar, possibly because sugar and ester levels were not positively correlated. Analyses excluding non-interacting animals showed a significant preference for the added ester. These results suggest that ester cues guide fruit choice in natural settings, supporting a role of olfactory cues in fruit choice by frugivorous lemurs.

Merian Awards Candidate

2026 VOL. 28:202601
DOI: 10.30427/ecotrop202601
ECOTROPICA
INTERNATIONAL JOURNAL OF TROPICAL ECOLOGY

EUROPEAN CONFERENCE OF TROPICAL ECOLOGY 2026

Session 19 – Poster 5: Free topics

Towards sustainable harvesting of African edible bush-cricket (*Ruspolia differens*) in East Africa

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The global food production system is challenged by multiple factors, including climate change, overgrazing, and overexploitation of populations. Edible insects can be one solution to maintain and improve food security and reduce poverty in regions where insects are valued as traditional parts of the human diet. The African edible bush-cricket *Ruspolia differens* (Orthoptera), is among the most consumed edible insects in East Africa, where it is considered a delicacy and an important source of food and nutrition. Over the past decades, there have been significant improvements in the light-harvesting technology of this species. Here, we propose that sustainability of *R. differens* harvesting can be achieved by a combination of good ecological knowledge and good management. As a first step, we would need a long-term monitoring program of harvesting effort and harvesting yields. As a second step, we would need an improved understanding of the areas where the swarms originate. As a third step towards sustainable harvesting, we would need a harvest management and conservation plan. Since harvested populations are essentially Social-Ecological Systems (SES), the planning process needs to take into account the opinions, motivations and values of local people and the harvesting community.