TROPICAL ORGANISMS AND ECOSYSTEMS IN A CHANGING WORLD

Annual Conference of the Society for Tropical Ecology (Gesellschaft für Tropenökologie e.V. – gtö)

University of Vienna
April 2-5, 2013

IMPRESSUM

Editors
Univ-Prof. Dr. Konrad Fiedler
Ass.-Prof. Dr. Christian H. Schulze
Department of Tropical Ecology and Animal Biodiversity, University of Vienna, Rennweg 14, 1030 Vienna, Austria

Univ.-Prof. Dr. Wolfgang Wanek
Department of Terrestrial Ecosystem Research, University of Vienna, Althanstraße 14, 1090 Vienna, Austria

The respective authors are solely responsible for the contents of their contributions in this book.

Front cover photo
Christian H. Schulze
Back cover photo
Julius Silver
Concept & Layout
roman.tschirf@gmail.com
This book is available at www.gtoe.de. Printed on 100% recycled paper.
ISBN 978-3-200-03022-0

universität wien

BIODIV
Tropical Ecology and Animal Biodiversity

Society for Tropical Ecology
Gesellschaft für Tropenökologie e.V. - gtö

SPONSORING

The Society for Tropical Ecology - gtö thanks the following institutions for their support

NON SOLUS

ELSEVIER

Ecomatik

TABLE OF CONTENTS

WELCOME AND FOREWORD

Dear participants, dear colleagues!

It is a great pleasure to welcome you to the 26th Annual Conference of the Society for Tropical Ecology (gtö) at the University of Vienna, Austria. For the first time a gtö conference is being held outside Germany. In this regard this conference may hopefully be another step in the internationalization of gtö activities. Vienna, the capital city of the Republic of Austria, is home to over 1.7 million inhabitants. The city has a long tradition as a scientific and cultural hotspot, ever since the period of the former Habsburg Empire. Geographically situated between the eastern edge of the Alps and the Pannonian lowlands, Vienna is a place where, right within the centre of Europe, cultural influxes merge between east and west, and between north and south. The University of Vienna, the oldest university in the German-speaking part of Europe, was founded in 1365 and is also amongst the largest universities in Central Europe. Currently over 91,000 students are enrolled in over 180 different curricula, from the Bachelor to the PhD level.

The overarching theme of our conference is *"Tropical organisms and ecosystems in a changing world"*. This title emphasizes two challenges our planet is facing. As widely summarized under the heading "Global Change", life conditions on Earth are being altered at an unprecedented rate, for example with regard to human-driven climate and land-use changes. Tropical realms will experience rapid alterations in temperature and rainfall regimes that likely may affect their biota no less than we already see this occurring at high latitudes or high elevations. Appropriately, two of our sessions specifically address the ecology of tropical high mountains where climate change effects are expected to be severe.

Tropical realms also experience dramatic changes in human population development and their concomitant demands for resources. All these processes put current tropical ecosystems and their functioning at risk. At the centre of such concerns, ecologists should always consider the organisms, since organisms are the actors in ecosystem processes and providers of most ecosystem services. This calls for a revival of organismal biology at the heart of tropical ecology.

We thank all the members of our supporting local organizing team, especially the staff and students of the Department of Tropical Ecology & Animal Biodiversity. Without their assistance, the organization of such a meeting would simply be impossible. Furthermore, we appreciate the sponsorship of our donors and heartily thank all participants for their contributions.

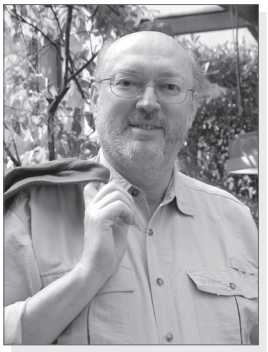
We hope that this year's gtö conference will stimulate scientific debate on climate and land-use change effects on tropical ecosystems, with an emphasis on the role the tropical organisms play in these processes. May this conference also contribute to a more successful science-based conservation of tropical biota and their rich biodiversity.

Apart from these scientific dimensions, we are confident that you will enjoy your stay at Vienna as a city that offers very much to visitors: from cultural highlights to a beautiful surrounding landscape and the charming quality of Austrian cuisine and wine culture.

On behalf of the organizing team,

Konrad Fiedler
Christian H. Schulze
Wolfgang Wanek

Dear participants, dear friends and colleagues,

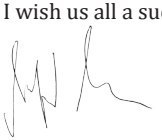


the world is changing fast. Change is normal, change is necessary, there is no doubt about that and as ecologists we are aware of that. But, and there is a big "BUT", the speed, the dimensions and the quality of recent change are worrying. Ecosystems and species are disappearing. Natural and traditional cultural landscapes are altered-into monotonous areas with the production of soy beans, palm oil, corn, shrimps and other "mass products". The increasing monotony of landscapes is accompanied by an increasing monopolization of production and products and both this monotony and monopoles lead to growing poverty and loss of labour opportunities for the local rural population, hitting especially hard those communities who are living in subsistence economies. From a social and ecological point of view, "change" today all too often means deterioration or loss. And change has become a global phenomenon driven by climate change and other factors which are manmade. As scientists we experience these changes, we are studying and monitoring them and we can contribute to elaborating solutions to changes negatively affecting people, ecosystems, ecosystem services and species.Processes of global change have reached levels which pose tremendous challenges for maintaining ecosystem functions. Traditionally, ecological research on climate change had its focus on high altitude and latitude biomes that severely and rapidly suffer from warming. Yet, effects of climate change on tropical ecosystems and organisms can be equally strong. In addition, changes in land-use exert ever increasing pressures especially on tropical biota. Understanding these processes is crucial to allow for predicting and mitigating adverse effects of forthcoming changes on tropical biodiversity and its role in ecosystem functioning. With this conference under the title "Tropical organisms and ecosystems in a changing world" the Society for Tropical Ecology (gtö) wantstherefore to provide an interdisciplinary platform for presentations and discussion, particularly on climate change effects on tropical biota, influence of land-use changes on tropical biota, tropical biodiversity and ecosystem functioning under Global Change and related topics.

The conference aims at maximizing interactions among scientists of all disciplines and backgrounds who are interested in tropical ecology and biodiversity.

We are grateful to our hosts in Vienna, Univ.-Prof. Mag. Dr. Konrad Fiedler, Dr. Christian H. Schulze, Univ.-Prof. Mag. Dr. Wolfgang Wanek and their team for organizing this conference and we thank you all for participating in this important meeting.

I wish us all a successful conference.



Prof. Dr. Manfred Niekisch
President of the Society for Tropical Ecology – gtö

DETAILED SCIENTIFIC PROGRAMM

TUESDAY, APRIL 2

REGISTRATION

Registration can be done
from 15:00 to 18:30
at "Building UZA II", University of Vienna, Althanstrasse 14, 1090 Vienna
See „Map of Conference Venue“ on page 199.

18:30 Welcome Reception

WEDNESDAY, APRIL 3

9:00 Opening Ceremony

10:00 Plenary: Keynote
Dr. Eike Lena Neuschulz
Tropical forest vertebrates in human-dominated landscapes

10:45 Coffee break

11:15 Parallel Sessions

TROPICAL FOREST VERTEBRATES IN HUMAN-DOMINATED LANDSCAPES: WINNERS AND LOSERS, P. 33

Chair: Christian H. Schulze

11:15 Conservation status and management of wildlife in African rainforest: implications for development cooperation
11:30 Conservation planning for Borneo's mammal diversity under forecasts of climate and land-cover change
11:45 Changes of vertebrate species distribution in response to different forms of land use on the Mahafaly Plateau in Southwestern Madagascar
12:00 Does hunting pressure vary with acculturation? Insights from an Amazonian society
12:15 Remnant forest bird species and invaders in the rural landscape of the Bragantina Region, NE-Amazon
12:30 Oil palm development jeopardizes exceptional biodiversity and rural agroforestry systems in Southwest Cameroon

ECOLOGY, CONSERVATION AND MANAGEMENT OF TROPICAL FORESTS, P. 46

Chair: Wolfgang Wanek, Peter Hietz

11:15 Global evaluation of biodiversity and carbon in tropical forest ecosystems
11:30 Modelling the dynamics of tropical rain forests - state of the art and perspectives
11:45 Cimatic controls on primary productivity and the partitioning between canopy and wood production in tropical rainforests
12:00 Grouping of tropical forest trees for modelling
12:15 The structure of tropical rainforests: what can we learn from tree size distributions?
12:30 Wood anatomical variability and adaptation to drought in tropical trees growing in different forest types of Costa Rica

12:45 Lunch break

14:15 Plenary: Keynote
Prof. Dr. Michael Kessler
Understanding tropical mountain biodiversity by linking evolutionary and ecological factors

15:00 Parallel Sessions

SESSION CONTINUED

15:00 Bats and oil palm plantations - first insights from Central America
15:15 Space use in fragmented habitats: responses of a frugivorous bat species to an anthropogenic landscape
15:30 Fragmentation effects on the functional diversity of an amphibian community in the eastern rainforest of Madagascar

SESSION CONTINUED

15:00 The Carbiocial Project: Modelling and implementing carbon-optimized land use strategies for the Southern Amazon
15:15 The current conservation state of Caatinga forests. A Brazilian Literature review
15:30 Ecological resilience in complex agro forest landscape, genes, trees and toy planes!

15:45 Coffee break

16:15 Parallel Sessions

SESSION CONTINUED

16:15 Artificial light at night affects seed dispersal by bats
16:30 Western lowland gorilla populations and logging concessions: is the coexistence possible?

SESSION CONTINUED

16:15 Genetic and ecological threats to important timber species in complex agro-forest landscapes
16:30 Lost in transition: plant diversity of tropical mountain forests versus land-use ecosystems
16:45 Developing tree seed sources concepts for the conservation and management of natural forests in Southern Ecuador
17:00 Direct seeding on burnt areas in Southern Ecuador

17:15 Scientific Poster Session

TROPICAL FOREST VERTEBRATES IN HUMAN-DOMINATED LANDSCAPES: WINNERS AND LOSERS

ECOLOGY, CONSERVATION AND MANAGEMENT OF TROPICAL FORESTS

BIOTIC INTERACTIONS IN A CHANGING WORLD

KILIMANJARO ECOSYSTEMS UNDER GLOBAL CHANGE: LINKING BIODIVERSITY, BIOTIC INTERACTIONS AND BIOGEOCHEMICAL ECOSYSTEM PROCESSES

DIVERSITY AND ECOLOGY OF TROPICAL FUNGI IN THE CONTEXT OF CLIMATE AND LAND USE CHANGE

IMPACTS OF ENVIRONMENTAL CHANGE ON BIODIVERSITY AND ECOSYSTEM FUNCTIONING / SERVICES IN TROPICAL HIGH MOUNTAINS

COMMUNITY ECOLOGY

FREE TOPICS

19:00 Public talk (in German) –
Elisabeth Kalko Memorial Lecture
Prof. Dr. Walter Hödl
„Von den Schwimmenden Wiesen Amazoniens zu den Urwaldbächen der Western Ghats“ – 40 Jahre zoologische Forschung in den Tropen

THURSDAY, APRIL 4

09:00 Plenary: Keynote
Prof. Dr. Vojtech Novotny
How to study extremely complex plant-insect food web in tropical rainforests: progress, failures and opportunities in tropical ecology

09:45 Parallel Sessions

BIOTIC INTERACTIONS IN A CHANGING WORLD, P. 60

Chair: Nina Farwig & Eike Lena Neuschulz

09:45 Interactive effects among ecosystem services and management practices on crop production: pollination in coffee agroforestry systems
10:00 Strong effects of increasing relative invasive abundance and land-use intensity on native plant-pollinator interactions
10:15 An invasive ant species causes collapse of ecosystem services - An altered interaction network in a changing environment
10:30 Birds and bats sustain productivity in agroforests of Central Sulawesi, Indonesia
10:45 Tamarins and secondary forest

KILIMANJARO ECOSYSTEMS UNDER GLOBAL CHANGE: LINKING BIODIVERSITY, BIOTIC INTERACTIONS AND BIOGEOCHEMICAL ECOSYSTEM PROCESSES, P. 70

Chair: Marcell Peters

09:45 Biodiversity and ecosystems processes on Mt. Kilimanjaro under global change: the KiLi project
10:00 East African rainfall and vegetation dynamics in response to a changing El Nino
10:15 Greenhouse gas exchange linked with N cycling along a land-use gradient at Mt. Kilimanjaro, Tanzania
10:30 Distribution models of plant species at Mt Kilimanjaro
10:45 Pollen-rain - vegetation relationship and climate inference for the montane forest of Mt Kilimanjaro during the last Glacial and the Holocene

11:00 Coffee break

11:30 Parallel Sessions

SESSION CONTINUED

11:30 Forest type affects prey foraging of saddleback tamarins Saguinus nigrifrons
11:45 Secondary dispersal by ants enhances seedling recruitment in a fire-degraded tropical montane forest
12:00 Spider-plant relationships in paddy fields of changing Indian landscapes
12:15 The value of land cover change time series for forest management decisions demonstrated by means of bird diversity and carbon storage

SESSION CONTINUED

11:30 Impacts of disturbances on tropical forests in Africa: Modelling the dynamics of rainforests
11:45 Adaptation of tropical mountain plants to altitude: A multi-species transplant experiment at Mount Kilimanjaro, Tanzania
12:00 Plant Soil Feedback in four dominant savannah tree species in East Africa
12:15 Influence of habitat destruction and land use intensification of coffee plantations on ant communities on Mt. Kilimanjaro
12:30 Who reaches the summit? Impacts of land use on elevational distribution patterns of insectivorous bats at Mt. Kilimanjaro, Tanzania

12:45 Lunch break

14:15 Plenary: Keynote
Ass.-Prof. Dr. Priscila Chaverri
Tropical forests as reservoirs of natural enemies against plant pests and diseases

15:00 Parallel Sessions

IMPACTS OF ENVIRONMENTAL CHANGE ON BIODIVERSITY AND ECOSYSTEM FUNCTIONING / SERVICES IN TROPICAL HIGH MOUNTAINS,
P. 82
Chair: Jörg Bendix & Erwin Beck

15:00 Climate and land use change in tropical high mountains - the example of the tropical Andes
15:15 Pollen rain - vegetation relationships in the South Ecuadorian Andes
15:30 Holocene palaeoecology of mountain rainforests in Central Sulawesi (Indonesia)
15:45 Functional diversity in a Bolivian Mountain Forest: Topography and Edge effects

DIVERSITY AND ECOLOGY OF TROPICAL FUNGI IN THE CONTEXT OF CLIMATE AND LAND USE CHANGE,
P. 108
Chair: Meike Piepenbring

15:00 Phenology of fungi in seasonal dry vegetation in Western Panama
15:15 Tropical rust fungi
15:30 Biodiversity of mushrooms in northern Thailand forests, economics of sustainable forestry practices
15:45 Biodiversity and phylogeographic patterns of species of the genus Laccaria

16:00 Coffee break

16:30 Parallel Sessions

THURSDAY

SESSION CONTINUED

16:30 Application of remote sensing technology to detect logging activities in Xe Sap National Protected Area in Lao PDR
16:45 Long term phenological studies in a tropical mountain rain forest in Southern Ecuador
17:00 Which environmental factors influence tropical mountain tree species? A case study in Southern Ecuador (RBSF)
17:15 Assessing the importance of environmental variables for the distribution of 16 tree species in a tropical mountain forest

SESSION CONTINUED

16:30 Arbuscular mycorrhizal fungi in a tropical montane forest soil of Southern Ecuador: extraradical hyphae and fertilization effects
16:45 Communities of arbuscular mycorrhizal fungi in tropical high mountains of South Ecuador
17:00 Endophytic fungi from Peruvian highland and lowland habitats form distinctive and host plant-specific assemblages
17:15 Specificity of the fungi used in carton runway galleries in the Azteca brevis / Tetrathylacium macrophyllum association

17:30 GTÖ assembly
For gtö Members only

20:00 Conference Dinner

FRIDAY, APRIL 5

09:00 Plenary: Keynote
Dr. Jan Beck
Towards the real thing: Biodiversity research and tropical insects

09:45 Parallel Sessions

IMPACTS OF ENVIRONMENTAL CHANGE ON BIODIVERSITY AND ECOSYSTEM FUNCTIONING / SERVICES IN TROPICAL HIGH MOUNTAINS, P. 82
Chair: Jörg Bendix & Erwin Beck

09:45 Wood anatomy and tree height as traits controlling hydraulic efficiency, vulnerability and productivity of tropical trees
10:00 Aluminum toxicity to tropical montane forest trees in Ecuador
10:15 Effects of continued nutrient addition on forest productivity and tree performance in Andean forests
10:30 Links between volcanic and biomass burning SO_2 emissions and SO_4 atmospheric depositions in a tropical mountain forest
10:45 Soil N-cycling responses to elevated nutrient inputs in tropical montane forests

COMMUNITY ECOLOGY, P. 118
Chair: Jan Beck

09:45 Functional diversity and functional redundancy in Madagascan tadpole assemblages reveal patterns of community assembly
10:00 Selective Logging and Climate Extremes: Mutual Determinants of Composition in Tropical Amphibian Assemblages?
10:15 Genetic relatedness, gene flow and competition in co-occurring tropical trees in Borneo, implications for species coexistence
10:30 Process-based modeling of plant species richness in South America
10:45 Genetic diversity and population dynamics in a biodiversity hotspot

11:00 Coffee break

11:30 Parallel Sessions

SESSION CONTINUED

11:30 Nitrogen-cycling response to elevated nutrient inputs in canopy soils of Ecuadorian montane forests
11:45 Effects of nutrient addition on the performance of tree seedlings in a tropical montane forest in southern Ecuador
12:00 Response of soil trace gas fluxes to elevated nutrient inputs in tropical montane forests
12:15 Roots and mycorrhizal fungi as determinants of soil animal communities and litter decomposition in tropical montane rainforests
12:30 Response of soil microorganisms and mesofauna to experimental exclusion of precipitation in tropical montane rainforests
12:45 Enzymatic response of soil microbes to forest disturbance and consequences for soil organic matter dynamics in a mountain rainforest region

SESSION CONTINUED

11:30 Feeding guild composition among caterpillar assemblages on selected shrubs and treelets in the Andes of southern Ecuador
11:45 Trophic diversity of Bornean soil ants as revealed by stable nitrogen and carbon isotopes
12:00 Abundance patterns of arthropod feeding guilds on treelets across different afforestation regimes in the cloud forest zone of Southern Ecuador
12:15 Soil fauna community succession in different tree species plantations on disturbed areas in south Ecuador.
12:30 Unlike fellows - a review of primate - non-primate associations
12:45 Of populations, pools and Peccaries: Ecosystem engineers for Neotropical rainforest frogs

13:00 Lunch break

14:30 Parallel Sessions

SESSION CONTINUED

14:30 From abandoned sites to valuable pasture land: a story of success in Ecuadors highland
14:45 Land use change and spatio-temporal development of an invasive fern cover in a biodiversity hotspot
15:00 Deforestation and fragmentation driving loss of endemic biodiversity in south Ecuadorian forests
15:15 Vegetation modelling in a tropical mountain ecosystem
15:30 Ecological quantification of ecosystem services: A case study in the tropical Andes of South Ecuador

FREE TOPICS, P. 130
Chair: Pia Parolin

14:30 Oil in the Peruvian Amazon: fluvial load, salt licks/oil spills confusion, oil ingestion & illegal logging
14:45 Science and action in protected areas: assessing vulnerability and planning for adaptation in the Sierra Madre Oriental, Mexico
15:00 Agriculture in the tropics: Application of an integrative land-use approach
15:15 Diversity and distribution of rattan (Subfamily Calamoideae) in East and West Sunda: Habitats, seed dispersal and phylogenetic study
15:30 Hiding before using bodyguards: The unique adaptive traits of Macaranga bancana
15:45 The larvicidal efficacy of Malaysian endemic plant extracts on dengue hemorrhagic fever vector, Aedes aegypti
16:00 Determinants of fitness in species with complex life cycles - an island experiment in the Neotropical frog Allobates femoralis
16:15 Floral food-bodies and a bellows-like mechanism in bird-pollinated Axinaea (Melastomataceae)

16:30 Closing ceremony

PLENARY KEYNOTES – ABSTRACTS

Keynote Speaker: Dr. Eike Lena Neuschulz

TROPICAL FOREST VERTEBRATES IN HUMAN-DOMINATED LANDSCAPES

Eike Lena Neuschulz

Biodiversity and Climate Research Centre (BiK-F), Frankfurt, DE, elneuschulz@senckenberg.de

During the last decades, the world has faced significant declines of global forest cover. In particular, tropical and subtropical forests have been threatened by human impacts, such as deforestation and forest fragmentation, resulting in a loss of tropical biodiversity. At the same time, large portions of the still remaining forests have been modified from their primary state to human-modified and secondary forests. Today, many landscapes represent mosaics of differently disturbed forest patches remaining in a matrix of agricultural land use.

These changes have stimulated controversial discussions on how far human-modified landscapes can compensate for the loss of natural habitats. Do modified forests sustain the biodiversity of natural forests? Which groups of species are likely to persist and which groups of species are likely to decline in human-dominated landscapes? How can we manage to increase the permeability of human-dominated landscapes to species specialized on primary forest habitats? And are the ecosystem functions and services that many forest species provide still maintained in modified landscapes?

Numerous case studies have demonstrated conflicting results on the significance of human-modified landscapes to maintain biodiversity and ecosystem functioning. Different species and guilds of species may differ in their responses to human habitat modification. Functional traits, such as body size, dietary and habitat specialization, may be indicative for the ability of species to persist in modified landscapes. Investigating the guild-specific responses of species to habitat-modification in a landscape context is thus key to understand the role of human-dominated landscapes for the conservation of tropical biodiversity.

In this talk, I will critically examine and summarize empirical evidence on the response of vertebrates in human-dominated landscapes. In particular, I will focus on the impacts of land-use change on bird communities in tropical and subtropical forest systems. Studies on the community composition and on feeding and movement behavior of birds in fragmented forest landscapes demonstrate how birds of different functional guilds respond to different types and spatiotemporal scales of forest modification. Based on these findings, I will highlight potential winners and losers of forest bird communities and identify landscape characteristics that are essential to sustain birds and their ecosystem functions and services in human-dominated landscapes.

Keynote Speaker: Prof. Dr. Michael Kessler

UNDERSTANDING TROPICAL MOUNTAIN BIODIVERSITY BY LINKING EVOLUTIONARY AND ECOLOGICAL FACTORS

Michael Kessler

Systematic Botany, University of Zurich, Zurich, CH, michael.kessler@systbot.uzh.ch

Tropical mountains are the global hotspots of terrestrial biodiversity. The causes for this high diversity are still only partly understood. While habitat heterogeneity along ecological gradients (climate, topography, disturbance, soils, etc.) undoubtedly play an important role, for most major groups of plants and animals even within-habitat diversity tends to be higher in tropical mountains than in the lowlands. Explanations for this pattern have focussed on two different aspects and scales. At the local scale, coexistence of species may be limited by niche availablity and interspecific competition whereas at the regional scale, evolutionary aspects such as high speciation or low extinction rates in mountains may be crucial. A review of the evidence for both of types of determinants of patterns of diversity shows that both receive some support at certain spatial and temporal scales but not at others. Based on this, I present a draft of a hierarchical framework to partition patterns of diversity and their determinants in tropical mountains.

Keynote Speaker: Prof. Dr. Vojtech Novotny

HOW TO STUDY EXTREMELY COMPLEX PLANT-INSECT FOOD WEB IN TROPICAL RAINFORESTS: PROGRESS, FAILURES AND OPPORTUNITIES IN TROPICAL ECOLOGY

Vojtech Novotny

Biology Centre, Czech Academy of Science, Ceske Budejovice, CZ, novotny@entu.cas.cz

Plant-insect food webs in tropical forests comprise a majority of all terrestrial species. Such extraordinary complexity is hard to study. Tropical biologists have always been fascinated by tropical biodiversity but only recently have been making some progress in estimating its magnitude. We have now at least approximate idea of the global and local diversity of tropical insects, but still do not know what all these species actually do in the forest, and what ecological mechanisms, if any, permit their coexistence in rainforest ecosystems. On a larger geographic scale, we are also starting to document, and understand, key evolutionary and ecological factors driving tropical altitudinal, and latitudinal, trends in insect species diversity and inter-specific interactions. This lecture provides a broad overview of the state of the art in the field of plant-insect food web studies in tropical forests, focusing on methodological progress and missed opportunities of the last decade, as well as on the most promising directions for future research, using examples from a long-term research of plant-insect interactions in Papua New Guinea.

Keynote Speaker: Ass.-Prof. Dr. Priscila Chaverri

TROPICAL FORESTS AS RESERVOIRS OF NATURAL ENEMIES AGAINST PLANT PESTS AND DISEASES

Priscila Chaverri

University of Maryland, Department of Plant Science and Landscape Architecture, College Park, Maryland, US, pchaverr@umd.edu

Natural old-growth tropical forests provide numerous ecological services such as carbon sequestration, weather regulation, preserving soil integrity, filtering water, and housing biodiversity. Fungi also provide ecosystem services, such as nutrient cycling, maintenance of soil fertility, pest and disease control, and food. Because fungi can parasitize plants, insects and other fungi, they are important in maintaining balance in populations of those organisms. Thus, even though fungi can cause ailments in plants many other fungi provide protection against plant pests and diseases. Tropical plants growing in their native environment are rarely decimated by pathogens. Two accepted hypotheses that aim to explain this phenomenon state that in tropical forests complex structure due to low abundance of numerous tree species reduces opportunities for disease transmission; and high genetic diversity of tree species leads to a large variety of disease resistance genes. Few studies have quantitatively addressed the impact symbiotic fungi, like mycoparasites, entomopathogens, endophytes, play on natural forest health. We tested the hypothesis that natural enemies of plant pests and diseases are more abundant in undisturbed or old-growth tropical forests than in plantations or highly disturbed forests. We conducted studies comparing fungal diversity in different stages of forest succession after clear-cuts. We also compared fungal endophytic communities inhabiting various tropical tree species in the wild and in monoculture plantations. We found that natural enemies of pests and diseases are more abundant in old-growth natural forests. Plant pathogenic fungi are more abundant in plantations and in recently cleared and highly disturbed forests. Wild trees harbor a greater number of endophytic species than trees in plantations. Novel findings from our are that endophytic species with plant pathogenic potential were more common in trees in plantations than in trees in their native habitat; and endophytic *Trichoderma* species, known for their biocontrol properties, dominate in wild trees. These studies support the need for studying and preserving biodiversity in natural habitats and, thus, reinforce the potential loss or change of useful and important biodiversity due to deforestation and climate change.

Keynote Speaker: PD Dr. Jan Beck

TOWARDS THE REAL THING: BIODIVERSITY RESEARCH AND TROPICAL INSECTS

Jan Beck

University of Basel, Basel, CH, jan.beck@unibas.ch

Macroecology and the analysis of large-scale biodiversity patterns have made substantial advances during the last two decades. However, for invertebrates, and particularly those from tropical regions, lack of data still forbids analysing and understanding biodiversity in a similar manner as for vertebrates or plants. I will discuss and exemplify these issues two spatial scales, and I try to point towards solutions.
On a local scale, many studies addressed insect communities in relation to environmental variation. However, due to a lack of standardization of methods and analysis techniques, much of these data cannot be fused to compile databases that would allow more general inference. An example is the contentious issue on the magnitude and pattern beta diversity of rainforest insects. I discuss important recent finding, including our own, and point out the need for systematic cooperation and coordination in sampling programs.
On large spatial scale, that data situation is even worse. Speeding up the process of taxonomic identification is one paramount issue in tropical entomology. However, much data already exists in natural history collections, and these can yield important information if processed appropriately. I exemplify problems and progress in this line of research, and I present our recent efforts to provide detailed distribution and biodiversity data for a Lepidopteran family across the Old World.

PUBLIC TALK (IN GERMAN)

ELISABETH KALKO MEMORIAL LECTURE

FROM THE AMAZONIAN FLOATING MEADOWS TO MOUNTAIN STREAMS IN THE WESTERN GHATS" - 40 YEARS OF ZOOLOGICAL RESEARCH IN THE TROPICS

(Von den Schwimmenden Wiesen Amazoniens zu den Urwaldbächen der Western Ghats" - 40 Jahre zoologische Forschung in den Tropen)

Walter Hödl[1]

[1] *Dep. of Integrative Zoology, Univ. Vienna, Wien, AT, walter.hoedl@univie.ac.at*

The fascinating world of tropical frogs and toads has initiated my metamorphosis from working in an electrophysiological laboratory to becoming an avid herpetologist and behavioral ecologist. Offering insights into the life of a dedicated field biologist I will initially present my work on reproductive biology and communication of frogs from Amazonia, the Atlantic rain forest of Brazil and the highlands of French Guyana. Special attention will be given to both the acoustic strategies used by frogs and toads to attract mates as well as their use of visual signals. Taxon-oriented research widened my interests in a broad range of topics including general life history, reproductive behavior and communication. To make my observations accessible to the public I initiated the production of scientific films on various taxa (frogs, stingless bees, termites, ...). With a large team of dedicated students and colleagues my lab has recently been involved in studies on communication in frogs in Europe (Austria), Asia (Sabah, Brunei, India), and Africa (Tanzania, Uganda). Scientifically very rewarding have been our studies on the bioacoustics and population biology of the dart-poison frog *Allobates femoralis*. Due to its stereotypic acoustic and highly specific reproductive behavior, our "handy fellow" has become our main study species and one of the best studied anurans in its natural habitat.

ORAL PRESENTATIONS – ABSTRACTS

SESSION:

TROPICAL FOREST VERTEBRATES IN HUMAN-DOMINATED LANDSCAPES: WINNERS AND LOSERS

[Short title: Forest vertebrates in human landscapes]

Chair: Ass.-Prof. Dr. Christian H. Schulze
Contact: christian.schulze@univie.ac.at

Today's tropical forests are embedded in a landscape matrix dominated by various types of highly disturbed forests and land-use systems. Only few forest species are able to successfully colonize and reproduce in such human-dominated landscapes. However, for the vast majority of species such landscapes represent either an ecological sink or a prominent barrier for dispersal movements. Hence, for tropical vertebrate communities this matrix acts as a filter preventing the re-colonization of forest fragments for many species, which vanished from such habitat islands due to stochastic processes (e.g. extreme climate events, forest fires) or after overexploitation due to hunting. Focusing on vertebrates, the session will address the following subjects: (1) Which biological traits characterize forest species dealing successfully with tropical human-dominated landscapes? (2) Are human-dominated landscapes only an ecological sink for forest species? (3) Which management measures are promising for increasing the permeability of human-dominated landscapes for forest vertebrates?

CONSERVATION STATUS AND MANAGEMENT OF WILDLIFE IN AFRICAN RAINFOREST: IMPLICATIONS FOR DEVELOPMENT COOPERATION

Matthias Waltert[1], Kadiri Serge Bobo[2], Christos Astaras[3], Denis Kupsch[1], Joshua Linder[4]

[1]*Georg-August-Universität Göttingen, Göttingen, DE, mwalter@gwdg.de*
[2]*University of Dschang, Dschang, CM*
[3]*University of Oxford, Oxford, DE*
[4]*James Madison University, Harrisonburg, US*

The Gulf of Guinea Forests along the West African coast are an important centre of endemism, and the forest along the Cameroon-Nigeria border constitutes the largest continuous block of the whole West African biodiversity hotspot. The Gulf of Guinea forests overall harbour an exceptionally diverse species pool including the so-called Cameroon faunal group of primates (31 taxa, 14 species alone in Korup National Park) including the Elliot's chimpanzee and the Cross River gorilla, the world's rarest great ape taxon. Cameroon's Southwest region has a number of important protected areas (Korup, Mt Cameroon and Bakossi National Parks, Rumpi Hills Forest Reserve and Banyang Mbo Wildlife Sanctuary) and Forest Management Units managed by the Ministry of Forest and Wildlife. The land around these protected areas also consists of largely intact forest landscapes since local small-scale farmers still practice traditional shifting agriculture practices. Over the past two decades, multilateral projects have invested in technical and financial aid for this region. Nevertheless, recent wildlife surveys show that most wildlife indicator species have suffered sever population declines both within and outside protected areas, and suggest that the conservation status of primates and other hunted wildlife has deteriorated considerably within the last decade. Elliot's chimpanzees and forest elephants number in the few hundreds and seem to be largely confined to protected areas. Severl large mammals may now approach extinction in Forest Management Units and even some protected areas. Most of these declines are likely due to poor wildlife law enforcement and less so due to habitat loss. There is limited knowledge on the status of wildlife in the agricultural matrix which confounds current discussions regarding the impact of industrial-scale oil palm plantation development in the region. An in-depth analysis of available reports and current surveys carried out by conservation agencies show a strong need for increased commitment on vertebrate conservation at the level of the donors, the ministry and its regional administration, as well as the conservation NGOs operating in the field. The regulation and management of bushmeat hunting in these areas suffers severely from a lack of wildlife management capacity and commitment. Both could be greatly improved by more strongly formalised cooperations between science and management.

CONSERVATION PLANNING FOR BORNEO'S MAMMAL DIVERSITY UNDER FORECASTS OF CLIMATE AND LAND-COVER CHANGE

Matthew J. Struebig[2,3], Stephanie Kramer-Schadt[1], Erik Meijaard[4], The Borneo Mammal and Modelling Consortium N/A[5], Bob Smith[2], David Gaveau[4], Kristian Metcalfe[2], Andreas Wilting[1]

[1]Leibniz Institute for Zoo and Wildlife Research, Berlin, DE
[2]Durrell Institute of Conservation and Ecology, School of Anthropology and Conservation, University of Kent, Canterbury, UK
[3]School of Biological and Chemical Sciences, Queen Mary University of London, London, UK
[4]People and Nature Consulting International, Jakarta, ID
[5]N/A, N/A,

As a global biodiversity hotspot, Southeast Asia hosts ~13% of all mammal species on only ~1% of the world's land mass. Borneo, the largest island in the region, and shared by Malaysia, Indonesia and Brunei, hosts ~ 300 mammal species, of which ~25% are endemic. Echoing the biodiversity crisis elsewhere in the region, the island faces unprecedented levels of habitat loss. Coupled with climate change forecasts, the future of Borneo's biodiversity is therefore of high conservation concern. How well biodiversity is represented in each country's protected areas under range-shifting forecasts of environmental change is central to conservation planning on the island. Borneo's protected area system comprises traditional parks, wildlife reserves and forest reserves for timber resources. Using hierarchical modelling we evaluated the role of each type of protected area in conserving three mammal groups (81 species of primate, carnivore and bat) across the island under present-day and future (2020, 2050) climate and land-cover changes scenarios: (1) Occurrence records and bioclimatic/environmental variables were compiled and used in a MaxEnt framework, accounting for uneven sampling efforts, to predict current and future species potential distributions; (2) current and future land-cover was then evaluated by a network of experts to define a habitat suitability index; (3) these coverages then formed the basis for MARXAN systematic conservation planning analyses in which population-based area targets were defined for each species. With this approach we show how an integration of species distribution modelling, expert knowledge, and future climate and land-cover scenarios into a systematic conservation assessment can support important decisions concerning the future of tropical biodiversity. Our results highlight that for Borneo mammals, the sustainable management of forests under commercial timber management will be increasingly important under forecasts of environmental change.

CHANGES OF VERTEBRATE SPECIES DISTRIBUTION IN RESPONSE TO DIFFERENT FORMS OF LAND USE ON THE MAHAFALY PLATEAU IN SOUTHWESTERN MADAGASCAR

Susanne Kobbe[1], Joachim Nopper[1], Yedidya R. Ratovonamana[2], Domoina Rakotomalala[3], Enzo Braskamp[1], Balten Lauströer[1], Sylwia Marcek[1], Lalatiana O. Randriamiharisoa[2], Soafara Raonizafinarivo[2], Jörg U. Ganzhorn[1]

[1]University of Hamburg, Hamburg, DE
[2]University of Antananarivo, Antananarivo, MG
[3]WWF, Tuléar, MG

The Mahafaly Plateau in Southwestern Madagascar is one of the most unique and biologically rich drylands on earth with a high degree of endemic plant and animal species. However, its ecosystems are threatened by unsustainable land use practices, which have led to heavy habitat fragmentation and degradation in the area.

Within a BMBF funded project on sustainable land use on the Mahafaly Plateau ("SuLaMa") we aim to assess the relationships between biological diversity and in-situ land management. In order to support alternative land use options and conservation efforts in the region we quantify species and functional diversity in different land use types, which helps toidentify landscape elements and land-use patterns that are associated with high biodiversity and ecosystem functioning.

From 2011 on we have evaluated the response of selected vertebrate animal groups, e.g. birds, reptiles and mammals to different forms of forest related land use types and anthropogenically disturbed habitats. The distribution of the target species was determined by standardized inventories to allow quantitative estimates of species composition and abundances in different forms of natural and agricultural used lands.

First results show that all studied animal groups are affected by habitat alterations, although to different degrees. Species declines show predictable patterns from pristine to degraded forests and to agricultural fields. However, contrary to expectation, leftover structures in pasture and agricultural land, such as hedges or remnant forest structures maintain high biodiversity that decreases significantly only in the most degraded areas. While anthropogenic land use systems cannot harbor all of the endemic species of the region, they could be designed in a way to act as corridors between native forests and buffer zones around protected areas.

DOES HUNTING PRESSURE VARY WITH ACCULTURATION? INSIGHTS FROM AN AMAZONIAN SOCIETY

Ana Luz[1], Justin Brashares[2], Jaime Paneque-Gálvez[1], Maximilien Guèze[1], Joan Pino[3], Manuel J. Macía[5], Martí Orta-Martínez[1], Victoria Reyes-García[1,4]

[1]ICTA / UAB, Barcelona, ES, anazzul@gmail.com
[2]Department of Environmental Science, Policy, and Management, University of California, Berkeley, Berkeley, US
[3]Center for Ecological Research and Forestry Applications (CREAF), Barcelona, ES
[4]ICREA, Barcelona, ES
[5]Departamento de Biología, Unidad de Botánica, Universidad Autónoma de Madrid, Madrid, ES

While subsistence hunting in tropical rainforests contributes to food security, it also constitutes a major challenge to wildlife conservation. In this study, we explore the relation between hunting pressure and wildlife availability and different levels of acculturation among Tsimane' villages, a Bolivian Amazonian indigenous group. Between 2009 and 2010, we conducted a) interviews with hunters from 39 villages to estimate game harvested and b) game transects to estimate wildlife availability. We used GIS to provide a spatial representation of how hunting pressure and game availability vary along a continuum from less to more acculturated villages. Our multivariate analysis suggests that the diminishment of hunting pressure is associated to both changes in the traditional cultural system and wildlife scarcity. The methodology presented here can be a useful tool for the establishment of priority areas of conservation and for the control of the hunting activity itself. Understanding the links between changes in the indigenous traditional cultural system and game harvesting can help design approaches that simultaneously consider indigenous livelihood and wildlife conservation.

Merian Award Applicant

REMNANT FOREST BIRD SPECIES AND INVADERS IN THE RURAL LANDSCAPE OF THE BRAGANTINA REGION, NE-AMAZON

Stefan Hohnwald[1]

[1]*Dept. of Landscape Ecology, Georg August University of Göttingen, Göttingen, DE, shohnwa@gwdg.de*

The Bragantina region in the NE-Amazon is a highly human-dominated landscape since its deforestation of the rainforests about a century ago. Instead of the potential natural vegetation, nowadays, the Bragantina is characterized by a still highly dynamic tessellated rural mosaic of home gardens, fields, oil palm plantations, pastures, secondary forests, and gallery forests. However, little is known about the reaction of the local avifauna to these heavy environmental changes. Thus, the purpose of this study is to summarize bird records from the rural landscape, and especially from the remaining forest islands, giving an overview of which endemic bird species are robust enough to survive within Bragantina and which are in danger to get locally extinct. Data were raised during five years, along field work of agricultural experiments near Igarapé-Açu. Observations have been assigned to the above mentioned land-use units. 236 of the expected 488 bird species could be confirmed of which 87 species vanished already during the last century, and 98 of them are toady designated as scarce. However, just 102 of the known 275 forest species could be re-confirmed during the study period, including such rare endemics like White-tailed Cotinga, Screaming Piha, and Blue-crowned Motmot. However, these results might be artefacts as the remaining forest remnants are hardly penetrable and shy bird species might just have been overlooked. Thus, more intensive studies are necessary to evaluate the conservation status of most forest birds. Robust, widespread neotropical generalists like Guira Cuckoo, Smooth-billed Ani, and Common Ground-Dove invaded the deforested areas and became nowadays dominant. However, many bird species of dry NE-Brazil, like White-throated Seedeater, Picui Groud-Dove or Scaled Dove did incomprehensibly not invade the region until now, although there seems to be similar ecological habitats. Although deforestation rates slow down recently, many parts of the Brazilian Amazon might look like the Bragantina region in the near future. Thus, tropical ecologists should be interested in studying the winners and losers of such highly dynamic land-use shifts to get an idea of how future avifaunae look like, also in other Amazonian regions.

OIL PALM DEVELOPMENT JEOPARDIZES EXCEPTIONAL BIODIVERSITY AND RURAL AGROFORESTRY SYSTEMS IN SOUTHWEST CAMEROON

Denis Kupsch[1], Kadiri Serge Bobo[2], Joshua M. Linder[3], Matthias Waltert[1]

[1]Department of Conservation Biology, Georg-August University Göttingen, Göttingen, DE, dkupsch@gwdg.de
[2]Department of Forestry, University of Dschang, Dschang, CM
[3]Department of Sociology and Anthropology, James Madison University, Harrisonburg (VA), US

Rising global demand for edible oils and biofuels led to a rapidly growing market of palm oil in the last decades. As a consequence, rural agroforestry and natural forest ecosystems are facing a substantial threat caused by land use change. Now that wide areas of Southeast Asia have been converted into plantations, the oil palm development started to emerge rapidly into other tropical forests regions conveying its associated impacts on socio-economy conditions and environment. Recent activities in Cameroon indicate that oil palm production will play a major role in deforestation and livelihood structures of rural communities in the African tropical forest zone.

An American agribusiness company leased a 99-years concession for the establishment of an industrial oil palm plantation of more than 70,000 hectare in the Southwest region of Cameroon and already started to build up nurseries for oil palms. This planned project is located in the heart of the Gulf of Guinea Forests, an important centre of endemism, constituting the largest continuous forest block of the whole West African Forest biodiversity hotspot. This region overall harbours an exceptionally diverse species pool including the so-called Cameroon faunal group of primates (31 taxa, fourteen species alone in Korup National Park) and a traditional agroforestry system primarily based on smallholder farms, embedded in a mature forest matrix.

We describe observed developments, give an insight into the international opposition against the project, question the practices of the plantation promoters and dispute their assertions. This case study illustrates the urgent need for unbiased scientific studies with systematic approaches which are indispensable in the context of environmental and social impact assessmentsto protect vital local communities as well as threatened ecosystems and species in the African forest zone.

Merian Award Applicant

BATS AND OIL PALM PLANTATIONS - FIRST INSIGHTS FROM CENTRAL AMERICA

Anita Freudmann[1], Philipp Mollik[1], Maria Helbig[2], Marco Tschapka[2], Christian H. Schulze[1]

[1]*Department of Tropical Ecology and Animal Biodiversity, University Of Vienna, Vienna, AT*
[2]*Institute of Experimental Ecology, University Of Ulm, Ulm, DE*

Forest conversion and habitat loss play a major role in biodiversity decline. Moreover, the increasing global demand for agricultural crops comes mainly on the expense of tropical forests. Conversion of forests into uniform oil palm plantations dramatically alters habitat structure and, consequently, availability and abundance of resources like roosting sites and food. Nevertheless, oil palm is one of the most important cash crops and therefore plantations are continuously increasing. Cultivation of oil palm is on the rise not only in South East Asia, but also in the Neotropics, and there is urgent need to evaluate impacts on biodiversity in these regions. Bats provide important ecosystem services like pollination, seed dispersal and arthropod predation, therefore effects of habitat conversion on bats in human-dominated landscapes are of broad interest. Using a combination of ground mist netting supplemented by acoustic monitoring, we studied bat assemblages in oil palm plantations, at forest margins and in mature old-growth forest at the border of the Piedras Blancas National Park, Costa Rica. Both techniques are used to provide a first insight into the structure of Neotropical bat assemblages occurring in these monocultures in comparison to those in the interior and at the margin of a Pacific lowland rainforest. Our results report the "best case scenario" of habitat conversion, as the proximity of primary forest and oil palm plantations in the study area still provides options to retreat to the forest, while temporarily using this land-use system. Nevertheless, preliminary data analysis based on mist net captures indicates a significant change in species composition from forest towards oil palm plantations situated at the forest margin. Species richness of bats sampled in mist nets declined towards oil palm plantations, where about 2/3 of the species supported by pristine forest occurred. While some species (*e.g. Artibeus* spp.) are rather abundant in oil palm plantations and seem to use them as flight corridors, several species previously reported as being sensitive to habitat disturbance, *e.g.* members of the Phyllostominae, were not recorded in oil palm plantations at all. For these species, oil palm plantations may act as effective barriers decreasing landscape permeability, thereby preventing the colonization of isolated forest fragments embedded in today's human-dominated landscape.

Merian Award Applicant

SPACE USE IN FRAGMENTED HABITATS: RESPONSES OF A FRUGIVOROUS BAT SPECIES TO AN ANTHROPOGENIC LANDSCAPE

Simon Ripperger[1,2], Elisabeth Kalko[2,3], Frieder Mayer[1], Marco Tschapka[2,3]

[1]Museum für Naturkunde Berlin, Leibniz Institut für Evolutions- und Biodiversitätsforschung, Berlin, DE, simon.ripperger@mfn-berlin.de
[2]University of Ulm, Institute of Experimental Ecology, Ulm, DE, simon.ripperger@mfn-berlin.de
[3]Smithsonian Tropical Research Institute, Balboa, PA

Tropical ecosystems are strongly endangered by human impact. Continuous habitats are converted into mosaic landscapes composed of forest remnants embedded into a matrix of cattle pastures and agricultural lands. Frugivorous bats play key roles in ecosystem functioning and are especially valuable to degraded areas as they hold the potential to functionally connect habitat patches by seed transfer and to foster regeneration of natural vegetation in degraded sites by seed deposition. The responses towards anthropogenic land use are highly species-specific, and hence community structures are changing in disturbed areas. Insights into a species' ability to cope with human habitat alterations might be gained by observations on habitat use during foraging. However, bat movements are especially difficult to observe as a consequence of their nocturnal activity, fast movements in flight and the relatively small body mass that limits the weight of applicable tracking devices. Those obstacles may explain the scarcity of studies evaluating the effects of human land use change on bat movements in tropical ecosystem. In order to shed more light on this subject we applied radiotelemetry to observe the Phyllostomid bat species *Dermanura watsoni*, a species that feeds on fruits of more than 40 plant species from early to late succession. We observed sixteen individuals from four different forest fragments during more than eighty nights. The study took place in the northern Caribbean lowlands of Costa Rica and the observed bats inhabited forest patches (~ 40 to 400 ha) in an agricultural matrix. Whereas day roosts were consistently associated with forest interior or forest edge, foraging behavior revealed heterogeneous reactions of individuals of *Dermanura watsoni* towards the anthropogenic matrix. Nightly movements varied from foraging on remarkably small home ranges within the inhabited forest fragments to commuting flights to neighboring forest patches or disturbed matrix habitats. Our results highlight the conservation value of this small stenodermatine bat species as it might act as an agent for seed dispersal among habitat remnants in mosaic landscapes.

Merian Award Applicant

FRAGMENTATION EFFECTS ON THE FUNCTIONAL DIVERSITY OF AN AMPHIBIAN COMMUNITY IN THE EASTERN RAINFOREST OF MADAGASCAR

Jana C. Riemann[1], Serge H. Ndriantsoa[2], Noromalala R. Raminosoa[2], Mark-Oliver Rödel[3], Julian Glos[1]

[1]Universität Hamburg, Hamburg, DE, Jana.Riemann@uni-hamburg.de
[2]Université d'Antananarivo, Antananarivo, MG
[3]Museum für Naturkunde, Berlin, DE

Madagascar is one of the world's biodiversity hotspots with an outstanding degree of endemism. However, Madagascar's rich and diverse ecosystems are highly threatened by habitat degradation, deforestation, forest fragmentation and land use intensification. Although in general anthropogenic habitat alterations are thought to have negative effects on biodiversity, there is no consistent pattern on species' and communities' reactions and therefore, ecosystem consequences remain poorly known. Usually, not all species react in the same way to disturbances. Differences in species' extinction susceptibilities may result in changes in community structures and food-web interactions, and hence ecosystem functioning. A species' susceptibility to extinction depends on the species' specific traits. Hence, understanding fragmentation effects on functional diversity is crucial for understanding potential ecosystem consequences and future conservation efforts. We aim at understanding patterns of functional diversity in a fragmented landscape and identifying traits that predispose for local extinctions.

Our study site is the Ranomafana National Park (RNP) and its surroundings, a mid-altitude rainforest ecosystem that is exceptional in its amphibian diversity. The surrounding area is, due to slash and burn agriculture, highly fragmented. We determined species richness and composition along transects that were spread over three major habitat types: RNP, forest fragments, and matrix (secondary vegetation and plantations). We calculated functional diversity using a set of different life history traits and morphological traits. We hypothesize that amphibian communities in RNP, fragments and matrix sites differ in functional diversity, and that the functional groups from which species are lost are non-random. We further identify traits which predispose for local extinctions.

Merian Award Applicant

ARTIFICIAL LIGHT AT NIGHT AFFECTS SEED DISPERSAL BY BATS

Daniel Lewanzik[1,2], Christian C. Voigt[1,2]

[1]Department of Evolutionary Ecology, Leibniz Institute for Zoo and Wildlife Research, Berlin, DE, lewanzik@izw-berlin.de
[2]Freie Universität, Berlin, DE, lewanzik@izw-berlin.de

Artificial light at night (LAN) has been shown to affect various organisms including plants as well as invertebrate and vertebrate animals. Obligate nocturnal animals such as bats can be expected to be particularly affected by LAN, since LAN is present in urban as well as in many rural habitats during their nocturnal activity period.

Among bats, a large diversity of feeding habits can be found. Temperate species feed exclusively on insects, whereas in the tropics - besides several generalists - many bat species are specialized on other food items such as nectar and fruits. Consequently, bats offer a multitude of ecosystem services, of which many are invaluable for humans. Bats are important pollinators and dispersers of many tropical plant species. Short-tailed fruit bats (genus *Carollia*), for example, are specialized on fruits of the genus *Piper* and constitute the main disperser of many *Piper* species - important pioneer plants in the Neotropics that grow at forest edges or gaps and thus are key to forest regeneration. However, due to this habitat preference, *Piper* plants are predisposed to become affected by LAN, for example if street lights become installed along roads.

We asked whether LAN is reducing the visitation rate, and thus the dispersal of seeds by *Carollia* when frugivorous bats avoid illuminated areas due to an improved visibility to predators. We captured individuals of *Carollia sowelli* in a Costa Rican rainforest and transferred them singly to a flight cage. After a short acclimatization period, bats could choose to harvest fruits in a dark compartment or in a compartment dimly illuminated by a street light. On average, *C. sowelli* chose the dark compartment for its first entry into the choice area more often than would be expected by chance. Also, they conducted more flights and, importantly, harvested more fruits in the dark than in the illuminated compartment.

We conclude that LAN reduces the variety and quantity of ecosystem services that bats provide, i.e. specifically a reduction of seed dispersal and probably also of pollination. This might be particularly relevant in the tropics, where ecosystem services of bats are ecologically important for ecosystem functioning, and where at the same time the potential for light pollution to increase is very high.

Merian Award Applicant

WESTERN LOWLAND GORILLA POPULATIONS AND LOGGING CONCESSIONS: IS THE COEXISTENCE POSSIBLE?

Barbara Haurez[1], Charles-Albert Petre[1,2], Jean-Louis Doucet[1]

[1]*Gembloux Agro-Bio Tech, University of Liège, Gembloux, BE, bhaurez@doct.ulg.ac.be*
[2]*Projet Grands Singes-Royal Zoological Society of Antwerp, Antwerp, BE*

Timber exploitation is rapidly expanding throughout the Congo Basin. Around 26 % of the moist forest are devoted to logging activities. Logging concessions largely overlap with the range of western lowland gorilla (WLG) considered as critically endangered by IUCN. However, this species could play an essential role in maintaining vegetal diversity notably through seed dispersal services. Particularly some tree species harvested for their timber may be dispersed by WLG.

In this communication interactions between WLG and a timber exploitation are studied in Central Gabon. WLG density is estimated in an *Annual Allowable Cut* (*AAC*), and nesting behavior is described. Seeds dispersed by WLG are identified through fecal analysis and germination trials are conducted to assess seed viability after gut passage. Four treatments are realized for the most abundant species: passed seeds, passed seeds in fecal matrix, seeds surrounded by fresh pulp and seeds extracted from fresh fruits.

A relatively high WLG density is observed in the *AAC* (2.0 weaned gorillas/km^2). WLG nest preferentially in open *terra firme* forest and frequently use old logging road covered with herbaceous vegetation for nesting and feeding. They avoid nesting in closed *terra firme* forest. Seed dispersal and impacts of the passage in gorilla's gut on seed germination are currently described. Germination success after gut passage depends on the seed species and varies from 0.0 to 100% in the course of monitoring time.

The first results of this study suggest that timber exploitation and WLG conservation are not mutually exclusive. WLG are important agents of forest regeneration by dispersing seeds in logged areas. Nest sites in logging gaps could be particularly favorable for seedlings development. This consideration must encourage forest managers to strengthen WLG-conservative practices in their concessions.

SESSION:

ECOLOGY, CONSERVATION AND MANAGEMENT OF TROPICAL FORESTS

Chair: Prof. Dr. Wolfgang Wanek, Prof. Dr. Peter Hietz
Contact: wolfgang.wanek@univie.ac.at

[Short title: Tropical forest ecology and conservation]

Human activities have greatly impacted the ecology and functioning of tropical forests. Climate change, atmospheric deposition, hunting, and fuel use strongly affect the functioning and biodiversity of 'undisturbed' forests while deforestation and land-use change (abandonment of agricultural areas) result in the fragmentation of intact forests and the generation of secondary forests and agricultural ecosystems, causing strong losses in biodiversity and ecosystem functioning, and releasing large amounts of greenhouse gases. Strategies for sustainable use of tropical forests, conservation of undisturbed forests and optimization of agricultural and forestry land-uses are therefore of utmost important at the regional, national and global scale to maintain ecosystem services and biodiversity and mitigate GHG emissions under changing climatic conditions. In this session important aspects of the ecology, management and conservation of the diverse range of tropical forest types will be covered, and modeling, remote sensing and meta-analytical approaches applied.

GLOBAL EVALUATION OF BIODIVERSITY AND CARBON IN TROPICAL FOREST ECOSYSTEMS

Christine B. Schmitt[1], Yude Pan[2]

[1]Landscape Management, University of Freiburg, Freiburg, DE,
christine.schmitt@landespflege.uni-freiburg.de
[2]USDA Forest Service, Newtown Square, PA, US

The current rates of tropical deforestation and forest degradation cause not only a loss of biodiversity but also high emissions of greenhouse gases, and have gained much attention at the international policy level, e.g., under the Convention on Biological Diversity (CBD) and the United Nations Convention on Climate Change (UNFCCC). Global initiatives for the creation of synergies between biodiversity conservation and climate change mitigation actions require information on the distribution of biodiversity and carbon in tropical forest ecosystems worldwide, which is complicated by large variations in assessment methods and ecosystem classification schemes. Based on a literature review, this study explored the major issues in the definition of tropical forest ecosystems and the assessment of forest cover, biodiversity and carbon. It also developed a new method for the reporting of carbon by tropical and subtropical forest types. The study shows that the current ecosystem classification schemes are primarily based on either climatic criteria or species distribution patterns and can differ strongly in the treatment of tropical forest ecosystems that are governed by edaphic conditions or fire. Remote sensing studies, which refer to measured global forest cover, differ regarding the definition of tree cover thresholds and the inclusion of managed and degraded forest areas, intricate issues in particular in dry forests and savannas. The assembly of biodiversity and carbon data is complicated by the reporting of different biodiversity (e.g., species richness, endemism) and carbon (e.g., above-ground, below-ground) components and the usage of different ecosystem classification schemes. In conclusion, the study suggests a straightforward classification of tropical and subtropical forest types at the global level and presents a preliminary assessment of above-ground carbon for these forest types. At the national and subnational level more elaborate classification schemes need to be employed in order to adequately capture variations in forest biodiversity and carbon. The study was conducted under the IUFRO / CPF Global Forest Expert Panel on Biodiversity, Forest Management and REDD+.

MODELLING THE DYNAMICS OF TROPICAL RAIN FORESTS - STATE OF THE ART AND PERSPECTIVES

Andreas Huth[1]

[1]*Helmholtz Center of Environmental Research - UFZ, Leipzig, DE, andreas.huth@ufz.de*

Tropical rain forests cover roughly 12 % of the earth's land surface, but are habitat for more than a half of the species of the world. Logging of timber, land clearing and ongoing fragmentation are threatening tropical rain forests. Understanding the dynamics of disturbed and undisturbed tropical rain forests is an important issue for conservation and adapted management of these forests.

In this contribution we will present a review on forest models for tropical rain forests. On one hand we will discuss largely simplified models like the neutral models (Hubbell approach) for describing the dynamics of tree species. On the other hand we will discuss the role of process and individual-based rain forest models to analyse the structure and dynamics of these species rich forests. Process-based models e.g. allow the calculation of detailed carbon balances and carbon fluxes. Typical results of different model types will be shown. Key ecological results, limitations and future perspectives will be discussed.

CLIMATIC CONTROLS ON PRIMARY PRODUCTIVITY AND THE PARTITIONING BETWEEN CANOPY AND WOOD PRODUCTION IN TROPICAL RAINFORESTS

Florian Hofhansl[1], Sigrid Drage[1], Eva-Maria Pölz[1], Andreas Richter[1], Wolfgang Wanek[1]

[1]University of Vienna, Department of Terrestrial Ecosystem Research, Vienna, AT, florian.hofhansl@univie.ac.at

Aboveground net primary production (ANPP) of tropical forests is driven by soil fertility and climate, the latter receiving special attention as recent projections of global circulation models predict large tracts of tropics to become drier and warmer. Given the scarcity of manipulative experiments, global climate-ecosystem relations and interannual climate variations caused by El Niño Southern Oscillation have been used to assess potential responses of tropical ANPP to projected climate change. The focus of this study was (1) to investigate how seasonal and interannual climate variations affect ANPP and the partitioning between canopy and wood production on three forest sites differing in soil fertility and disturbance regime in SW Costa Rica, and (2) to identify major drivers of tropical forest ANPP by integrating our results into a dataset of 101 tropical old growth forests where canopy and wood production have been measured. Across all forest sites MAT was the strongest predictor of ANPP (0.31 Mg C ha^{-1} yr^{-1} per °C). Moreover the results suggest a shift in the allocation of biomass towards greater nutrient conservation (i.e. production of wood biomass) in warmer, wetter and more productive tropical forests while nutrient recycling processes (i.e. production of canopy biomass) predominate in less productive, colder and drier tropical forests. We finally demonstrate that both ANPP components are sensitive to seasonal and interannual climate variation at the three forest sites studied, but that the controls differ for canopy and wood production locally. We conclude that the balance between both ANPP processes is climate sensitive, both in a local and a global context. Climate change may therefore shift the balance between nutrient recycling (canopy production) and carbon sequestration (wood production) and thus adversely affect ecosystem functions of the tropical forest biome.

GROUPING OF TROPICAL FOREST TREES FOR MODELLING

Martin Kazmierczak[1]

[1]*UFZ Leipzig, Leipzig, DE, martin.kazmierczak@ufz.de*

When working with tropical forest models, the high number of different species makes it necessary to group them into a lower number of groups called plant functional types. Ideally, each of these groups includes species with very similar characteristics and environmental responses so the least possible amount of detail is lost. When such a grouping is done, it is generally assumed that there is a trade-off between simplicity and manageability on the one hand and complexity and realism on the other. However, there is no universally accepted theory on how this grouping is to be done. Using the established forest model FORMIND, inverse modelling and field data from Barro Colorado Island, we compare groupings which differ in detailedness and the number of plant functional types. We investigate the apparent trade-off between complexity and simplicity and the impact of this trade-off on the simulation of processes like biomass accumulation, diameter distribution and succession.

THE STRUCTURE OF TROPICAL RAINFORESTS: WHAT CAN WE LEARN FROM TREE SIZE DISTRIBUTIONS?

Franziska Taubert[1], Hans-Jürgen Dobner[2], Andreas Huth[1]

[1]Helmholtz Centre for Environmental Research - UFZ, Leipzig, DE, franziska.taubert@ufz.de
[2]University of Applied Science (HTWK), Fachbereich Informatik, Mathematik und Naturwissenschaften, Leipzig, DE

Tropical forests play an important role in the global carbon cycle. Natural undisturbed tropical forests store a large amount of carbon. The high biomass is closely related to their structure and dynamics, often characterized by their stem size distribution. Local variations in forest biomass can be traced back to variations in the number of stem sizes. Analyses of such size distributions are therefore beneficial for reliably estimating the biomass potential of tropical forests. We apply on the one hand statistical methods for estimating unknown parameters of assumed probability distributions possibly describing empirical stem size distributions. On the other hand, we used geometrical 'crown packing' methods for analysing these distributions. Field data from tropical forests in total of approximately 85 ha size are used for the analyses. Results indicate the rejection of the widely-spread assumption of power-law distributed stem sizes.

Merian Award Applicant

WOOD ANATOMICAL VARIABILITY AND ADAPTATION TO DROUGHT IN TROPICAL TREES GROWING IN DIFFERENT FOREST TYPES OF COSTA RICA

Alexander Scholz[1], Steven Jansen[1]

[1]*Ulm University, Ulm, DE, alexander.scholz@uni-ulm.de*

The xylem tissue plays an important role in balancing hydraulic demands for optimal growth with protection against risk of drought-induced mortality. We investigated anatomical and morphological features related to the hydraulic architecture of three common plant genera (*Cordia*, *Ocotea*, *Tabebuia*) growing in seasonally dry forest, lowland rain forest, and cloud forest in Costa Rica. Variation within a tree, within a species, and between species was quantified using microscopy and linked to climate data (e.g., mean annual precipitation, mean annual temperature, vapour pressure deficit, mean precipitation driest quarter, elevation, and soil-type).

Large variation within a tree, as well as between specimens and species was found, especially with respect to vessel diameter, vessel density, and vessel length. Wood specific gravity, vessel density, and Huber-values were significantly influenced by mean annual precipitation and temperature. Overall, these data illustrate that understanding xylem plasticity in response to environmental conditions requires integration from the individual tree to intra-specific variability across populations and forest communities.

Merian Award Applicant

THE CARBIOCIAL PROJECT: MODELLING AND IMPLEMENTING CARBON-OPTIMIZED LAND USE STRATEGIES FOR THE SOUTHERN AMAZON

Gerhard Gerold[1], Stefan Hohnwald[1]

[1]Dept. of Landscape Ecology, Georg August University of Göttingen, Göttingen, DE, ggerold@gwdg.de

Deforestation in the Southern Amazon of Brazil continues, especially along the highway BR-163 (Cuiabá-Santarém), making the region one of the globally relevant land use frontiers. The highly dynamic land use change is especially associated with further major Carbon (C) losses and greenhouse gas (GHG) releases. Curtailing these emissions is of global interest as the relevance of the affected rainforests and savannahs for C storage and GHG cycling is high. Model calculations of C and GHG fluxes from the respective ecosystems for different land use scenarios are still uncertain because dynamic land use patterns are not fully captured and GHG models need precise *in situ* calibration. Consequently, regionally specified models are essential and the key target of this project. The main goals of this multi- and interdisciplinary approach for Brazilian-German cooperation within the BMBF-FONA-programme are viable C-optimized land management strategies, mitigating GHG-emissions and maintaining ecosystem services under changing climate conditions. They are urgently needed to meet the goals set by Brazilian national plans and international treaties. Three regions along the land use frontier of the Southern Amazon were selected: Novo Progresso (south-west Pará): most active deforestation; Sinop (northern Mato Grosso): young soy bean production; Cuiabá (Central Mato Grosso): established cultivation (>20 years) and adapted mechanised cropping (e.g. no till). Analyses focus on soil C-turnover, climate, ecosystem functions and socio-economic processes. Simulation models will be combined as software packages to support the decision-taking process based on field and acquired data, including a step-by-step up-scaling from local to landscape and regional scale. All research and implementation activities include direct involvement of the stakeholders. Furthermore, joint field experiments for improving C storage and ecosystem functions will be performed on-farm in tight cooperation with state (environmental agencies, district administration) and private organisations (farmer) of Mato Grosso and southern Pará. The presentation will give an overview on the Brazilian-German collaborative research and progress of research results.

THE CURRENT CONSERVATION STATE OF CAATINGA FORESTS. A BRAZILIAN LITERATURE REVIEW

Melanie Forker[1,2]

[1]Hochschule für Technik und Wirtschaft (HTW), Dresden, DE, forker@htw-dresden.de
[2]TU Berlin, Department of EcologyEcosystem Science / Plant Ecology, Dresden, DE, forker@htw-dresden.de
[3]TU Dresden, Dresden, DE

A very severe drought dominated the Caatinga (Brazil) and its dwellers in 2012, a fact that emphasizes the importance of research on forms of sustainable land-use in seasonally dry tropical forests (SDTFs) that withstand climate change. SDTFs may be considered the tropical habitat that suffer most from high pressure of human settlements and exploitation, and South America is the region with the largest remaining area (54.2%) of this forest type. The two most extensive contiguous SDTF areas are the Caatinga and the Dry Chaco.

However, STDFs received less attention from the scientific community than tropical rainforests. In 1993, already 28%, of the Caatinga had been transformed into pasture, agricultural land, and other types of intensive land use but only 1% of its extent are currently conserved. As a response to the backlog of knowledge on SDTFs most recently the collaborative BMBF-project INNOVATE opened the frame for doing research in the Caatinga biome.

The presentation will summarize the results of a literature review on the use and conservation approaches of the forest resource of the Caatinga. The work enhances the reception of Brazilian literature, that to a large extend is published in Portuguese. First, a short introduction on general facts of the biome will be given, together with an assessment of the current land use matrix, though regarding the figures on forest resources, there exist large disagreement in the literature. Considering about 50 relevant articles or monographies by Brazilian scientists and several publications of the Brazilian Environmental Ministery (MMA), the review shall give an idea on where the main focus of Brazilian research lies, and where the open questions are to be found. As an outlook the proposed doctoral research study on conservation status and regeneration potential of seasonally dry tropical forests in Brazil will be presented, building upon two short field trips in 2012/2013 and referring to the planned field work.

ECOLOGICAL RESILIENCE IN COMPLEX AGRO FOREST LANDSCAPE, GENES, TREES AND TOY PLANES!

Chris Kettle[1], Colin Maycock[2], David Burslem[2], Eyen Khoo[4], Aline Finger[3], Sascha Ismail[1], Kirsty Nutt[2], Jaboury Ghazoul[1]

[1]ETH Zurich, Zurich, CH, chris.kettle@env.ethz.ch
[2]Department of Biological Science, University of Aberdeen, Aberdeen, UK
[3]Royal Botanic Garden Edinburgh, Edinburgh, UK
[4]Forest Research, Sandakan, MY

Tropical deforestation and fragmentation continue to be the major drivers of biodiversity loss and compromise ecosystem services and rural livelihoods in many developing regions. Developing policies which ensure the resilience of tropical forests within complex agro-forest landscapes is thus one of the major challenges of the 21 Century. Ensuring that the foundation tree species can survive and provide the structural component of these landscapes is a basic requirement. I present the results of a comprehensive review conducted to evaluate masting phenology, seed storage and seed dispersal distances across important tropical timber tree families. Using the dipterocarpaceae as an example of a dominant timber family in Southeast Asia, I outline the major threats to tropical tree species in fragmented landscapes. I propose a framework upon which forest restoration and conservation could be established to conserve forest biodiversity, help mitigate climate change and support rural livelihoods. Technological advances in molecular ecology and low cost remote sensing can help to inform the management of fragmented forest to enhance the resilience of these novel and rapidly expanding tropical agro-forest landscapes.

Key words: Tropical forest landscapes, Restoration, Fragmentation, Conservation Genetics.

GENETIC AND ECOLOGICAL THREATS TO IMPORTANT TIMBER SPECIES IN COMPLEX AGRO-FOREST LANDSCAPES

Sascha A. Ismail[1], Jaboury Ghazoul[1], G. Ravikanth[2], C.G. Kushalappa[3], R. Uma Shaanker[3], Chris J. Kettle[1]

[1]ETH Zurich, Zurich, CH, sascha.ismail@env.ethz.ch
[2]Ashoka Trust for Research in Ecology and the Environment, ATREE, Bangalore, IN
[3]University of Agricultural Sciences, Bangalore, IN

Forest fragmentation and degradation of remnant forest patches commonly co-occur, making it difficult to disentangle relative importance for species persistence. How tropical tree species as keystone organisms recruit in the face of these ubiquitous habitat changes is essential to maintaining ecosystem integrity and services in these novel systems.

We present detailed ecological survey data on demography and recruitment combined with molecular data of nursery grown seedlings to investigate the potential drivers of recruitment failure in *Dysoxylum malabaricum* (meliaceae) a threatened timber species.

The study was carried out in South India within a highly fragmented agro-forest landscape containing a high density of small 'sacred grove' forests, which are repositories for biodiversity within a matrix of paddy and coffee plantations. Within this landscape we established a full inventory of adult *D. malabaricum* trees over an area of 216 km^2. We recorded indicators of habitat patch quality in 17 sacred groves and relate these to seedling densities of our study species. Additionally we evaluated growth performance of 296 seedlings in a nursery experiment. The seedlings were genotyped at eleven nuclear microsatellite loci. We applied parentage analysis to estimate inbreeding as relatedness of parent pairs and investigated if inbreeding affects growth.

By considering degradation together with genetic effects of fragmentation we demonstrate that both processes affect reproduction. Fragmentation causes reduced seedling vigour through inbreeding and habitat degradation reduces seedling densities. The co-occurrence of both effects makes interactions between genetic effects and adverse local conditions likely.

We discuss the importance of considering degradation and fragmentation togetherto develop a better understanding of the genetic and ecological processes likely to undermine the survival of many other rare and threatened tropical hardwood species in agro-forest landscapes.

Merian Award Applicant

LOST IN TRANSITION: PLANT DIVERSITY OF TROPICAL MOUNTAIN FORESTS VERSUS LAND-USE ECOSYSTEMS

Julia Gawlik[1]

[1] *FAU, Erlangen-Nürnberg, DE, julia.gawlik@geographie.uni-erlangen.de*

The tropical mountain rainforest of the Andes in Southern Ecuador constitutes one of the world`s five megadiversity hotspots of vascular plants. However, this ecosystem is endangered by anthropogenic interventions in terms of land-use change. Natural forests are cleared by "slash and burn" practices and converted into extensively used pastures, unused burned fallows or pine plantations. In this study we focus on the loss of phytodiversity caused by this transformation process and deduce possibilities for a more sustainable land use management.

Vascular plant composition (incl. trees, understory plants, and climbers) was investigated in 54 plots of 100 m^2 in (i) the natural forest stands, (ii) exotic afforestation (pine), (iii) fallows recovering from burning, and (iv) actively used pastures. In total we found an amount of 932 native and 20 introduced plant species from 112 families. Species richness of the tropical mountain forest was more than twice as high as on all anthropogenic sites combined. The conversion into a matrix of human manipulated landscapes caused a loss of about two third of the natural forest plant species and an alpha diversity loss of more than 80%. Impoverishment was highest on the pastures, where only 2.4% of the forest species were observed. Our findings underline that anthropogenic systems have to be managed and redesigned in a sustainable way, in order to improve biodiversity conservation in tropical rainforest regions.

Merian Award Applicant

DEVELOPING TREE SEED SOURCES CONCEPTS FOR THE CONSERVATION AND MANAGEMENT OF NATURAL FORESTS IN SOUTHERN ECUADOR

Baltazar Calvas[1], Bernd Stimm[1], Sven Günter[2], Reinhard Mosandl[1], Eduardo Cueva[3], Therese Hertel[1]

[1]Institute of Silviculture, Center of Life and Food Sciences Weihenstephan, Technische Universität München,, Hans-Carl-von-Carlowitz-Platz 2, 85354 Freising, DE, calvas@forst.wzw.tum.de
[2]Latinamerican Chair for Protected Areas and Biological Corridors "Kenton Miller", Tropical Agricultural Research and Higher Education Center, CATIE 7170,, 30501 Turrialba,, CR
[3]Naturaleza y Cultura Internacional, Pío Jaramillo Avenue and Venezuela street 1101-332, Loja, EC

Ecuador is well known by its high biodiversity but contradictorily suffers from the highest deforestation rate in South America (-1.7%) due to unsustainable land use practices (forest conversion into alternative uses that make more economic sense to the land owners). Reforestation of deforested land could be a promising strategy for reducing the pressure from natural forests and thus, contributing to conservation of biodiversity. Only 200,000 ha of plantations have been established so far, and approx. 90% consist of introduced species, especially *Pinus* spp. and *Eucalyptus* spp., these monocultures are hardly compatible with aims for conservation of biodiversity. After ten years of research in the tropical mountain rain forests of Southern Ecuador we have established a scientific baseline for restoration, reforestation and enrichment plantings with native species where other native species of high timber value showed surprisingly good performance in gaps of pine plantations. The shelter effect which is well known from other regions of the world is new for Ecuadorian pine plantations. Reforestation of native species and mixed forests with higher ecological and economic stability are not yet considered in practical forestry in Ecuador up to now as there is still a lack of institutions for technology transfer. Thus we aim at fostering the establishment of mixed forests (monocultures shall be converted into mixed forests) with native species by underplanting pine plantations and Alnus stands and by application of silvicultural treatments. The big challenge consists in the development and adoption of a new concept which can be nationalized for the identification and selection of seed sources in the still remaining native forests and secondary forests. To avoid a lack of knowledge on seed ecology, it is necessary to start with the evaluation of the current status of the regional tree seed supply with native forest species and toprovide concepts to the local environmental authorities to improve seed management.

Merian Award Applicant

DIRECT SEEDING ON BURNT AREAS IN SOUTHERN ECUADOR

Julio Mora[1], Daniel Kübler[1], Antonin Cermak[1], Kai Tacke[1], Patrick Hildebrandt[1], Nikolay Aguirre[2], Bernd Stimm[1], Michael Weber[1], Reinhard Mosandl[1]

[1]Institute of Silviculture, Technische Universität München, Freising, DE, morajulio@hotmail.com
[2]Universidad Nacional de Loja, Loja, EC

Fire events affect large areas in the tropics leading to degradation in terms of biodiversity and productivity. As an alternative for restoration by artificial regeneration we tested direct seeding of native tree species *Alnus acuminata*, *Cedrela montana*, *Tabebuia chrysantha* and exotic *Pinus patula* in the San Francisco valley in Southern Ecuador.

Experimental field plots (latin squares of 60 by 60 m) have been installed on two sites A and B, where fire destroyed the former vegetation 6 respectively 18 months before. Each latin square consisted of 25 plots (4 tree species, one control) divided in 36 sample units of 50 by 50 cm with a spacing of 1.5 m.

Initially, seed quality was tested under laboratory conditions: *A. acuminata* (71%), *P. patula* (65%) and *T. chrysantha* (63%) had a regular germination rate, the germination rate *C. montana* was lower (27%). However, the results in the field have not been completely consistent with these tendencies and showed site dependent preferences: The germination rates of *A. acuminata* (site A: 14%; site B: 21%), *P. patula* (site A: 12%; site B: 27%) and *T. chrysantha* (site A: 16%; site B: 32%) were considerably lower in the field and in favour for one of both sites. The overall rate of germination for *C. montana* was comparable, but indicated contrasting site preferences (site A: 34%; site B: 15%). Mortality rates of seedlings have been high and varied for species and sites as well: *A. acuminata* (site A: 92%; site B: 74%), *P. patula* (site A: 58%; site B: 32%), *T. chrysantha* (site A: 90%; site B: 93%)and *C. montana* (site A: 68%; site B: 71%);

Moreover, a high variability of germination and mortality between sample units has been observed on both sites. Therefore we analysed the effects of micro site characteristics like inclination, exposition as well as climatic impacts in terms of air temperature, relative air humidity and soil moisture.

SESSION:

BIOTIC INTERACTIONS IN A CHANGING WORLD

[Short title: Biotic interactions in a changing world]

Chairs: Prof. Dr. Nina Farwig, Dr. Eike Lena Neuschulz
Contact: farwig@biologie.uni-marburg.de

The increasing impact of land use and climate changes has lead to modifications in structure and composition of natural ecosystems across the globe. Particularly, land use intensification results in a dramatic loss of biodiversity, which in turn can affect species interactions, food webs and important ecological functions. More than half of the world's forest ecosystems are used for timber production and other forest products, threatening the long-term existence of species and ecosystem functionality of forests. The potential of secondary forests for conservation of old-growth forest species is, however, an area of considerable uncertainty. Hence, quantification of the value of secondary forest habitats for forest-adapted species is crucial for the future of biodiversity and associated ecosystem processes. This session aims to compile work on the functionality of biotic interactions in changing landscapes.

INTERACTIVE EFFECTS AMONG ECOSYSTEM SERVICES AND MANAGEMENT PRACTICES ON CROP PRODUCTION: POLLINATION IN COFFEE AGROFORESTRY SYSTEMS

Jaboury Ghazoul[1], Virginie Boreux[1]

[1] *ETH Zurich, Zurich, CH, jaboury.ghazoul@env.ethz.ch*

Crop productivity is improved by ecosystem services, including pollination, but this should be set in the context of trade-offs among multiple management practices. We investigated the impact of pollination services on coffee production considering variation in fertilization, irrigation, shade cover, and environmental variables such as forest cover and proximity, rainfall, soil pH and nitrogen availability. After controlling for management interventions, bee abundance did improve coffee production. However, some management interventions, such as irrigation which is used to trigger asynchronous flowering, dramatically increased bee abundance at coffee trees. Others, such as the extent and type of tree cover, reveal interacting effects on pollination and, ultimately, crop production. Irrigation and addition of lime had, however, far more substantial positive effects on coffee production than tree cover. These results suggest that pollination services matter, but managing the asynchrony of flowering was a more effective tool for securing good pollination than maintaining high shade tree densities as pollinator habitat. Complex interactions across farm and landscape scales, including both management practices and environmental conditions, shape pollination outcomes. Effective production systems therefore require the integrated consideration of management practices in the context of the surrounding habitat structure.

STRONG EFFECTS OF INCREASING RELATIVE INVASIVE ABUNDANCE AND LAND-USE INTENSITY ON NATIVE PLANT-POLLINATOR INTERACTIONS

Ingo Grass, Dana Berens, Franziska Peter, Nina Farwig

Philipps-Universität, Marburg, DE, grass@staff.uni-marburg.de

The continuing spread of invasive alien plants and increasing human land-use are two major drivers of global change threatening ecosystems, species and their interactions. Separate effects of these two drivers on plant-pollinator interactions have been thoroughly studied, but we still lack understanding of combined effects on plant-pollinator communities. In a subtropical landscape in South Africa, we studied 17 plant-pollinator networks along two independent gradients of relative invasive abundance and land-use intensity. Generally, pollinator visitation rates on invasive plants were lower than on native plants. Correspondingly, visitation rates on native and invasive plants were not related to relative invasive abundance, and only pollinator visitation rates on native plants increased with increasing land-use intensity. Further, specialization of native plants and their pollinators decreased with increasing relative invasive abundance and intensified land-use, while specialization of invasive plant-pollinator interactions remained overall unaffected. We further detected changes in pollinator composition with increasing relative invasive abundance and intensified land-use, however, with low variation explained. Our results suggest increasing diet breadth of pollinators with respect to native plant resources, as pollinators generally seemed to neglect invasive plant resources, regardless of relative invasive abundance. Further, increasing relative invasive abundance and intensified land-use may have altered the availability of resources and nesting sites, and the abundance of habitat specialist plants, resulting in less specialized plant-pollinator interactions. Our findings emphasize the value of community approaches to the study of plant-pollinator interactions and highlight the need to consider multiple drivers of global change in conservation research and management.

Merian Award Applicant

AN INVASIVE ANT SPECIES CAUSES COLLAPSE OF ECOSYSTEM SERVICES -AN ALTERED INTERACTION NETWORK IN A CHANGING ENVIRONMENT

Arno Wielgoss[1,2], Yann Clough[1], Brigitte Fiala[2], Teja Tscharntke[1]

[1]Agroecology - Dep. of Crop Sciences - University Göttingen, Göttingen, DE, arno.wielgoss@uni-wuerzburg.de
[2]Tropical Biology and Animal Ecology - Zoology III - University Würzburg, Würzburg, DE, arno.wielgoss@uni-wuerzburg.de

In tropical agroforestry systems ants may indirectly affect crop plant by interacting with their mutualists and antagonists. In Indonesian cacao agroforests intensification has led to proliferation of disturbance-adapted dominant ant species. Such changes in ant communities often are followed by altered species richness, eveness and abundance and may indirectly affect the crop plant.

We simulated the effects of such an ant community structure alteration and its effects on pests and pathogens of cacao using a highly replicated ant manipulation experiment in 15 smallholder cacao agroecosystems with two subplots each:

We established colonies of the invasive dominant ant Philidris cf. cordata in the cacao trees of one subplot and used the second subplot with unmanipulated ant communities as control. Compared to the control Philidris dominated ant communities had reduced species richness and evenness, but elevated worker abundances.

Until now many studies analysing ecosystem services of ants have focused on single interactions with their prey. But pest control is just one of many direct and indirect links of the predator community and the crop plant. We show that ants drive a surprisingly complex interaction network providing ecosystem services for cacao, like indirect pollination facilitation on direct pest suppression, but also disservices like indirect and direct enhancement of other pests and phytopathogen dissemination. Therefore amount of marketable yield should be the response to measure the entity of ecosystem services. In our study yields were highest with even, unmanipulated communities, while low evenness due to invasive ants and its specific traits decreased yield by 34%. Our results suggest that ant community structure affects the balance between services and disservices, with high evenness ensuring highest benefits.

Merian Award Applicant

BIRDS AND BATS SUSTAIN PRODUCTIVITY IN AGROFORESTS OF CENTRAL SULAWESI, INDONESIA.

Bea Maas[1], Yann Clough[1], Teja Tscharntke[1]

[1]*Agroecology, Goettingen, DE, beamaas@gmx.at*

Flying vertebrates like birds and bats are considered to be important insect predators in the tropics. They are highly mobile, functionally diverse and engage in a multitude of direct interactions with other species. Nevertheless, the contribution of birds and bats to ecosystem services like pest insect control in tropical agroforestry systems is still poorly understood. This could be tied to the fact that these often complex and multi-trophic interactions are difficult to demonstrate experimentally.

In our study, we investigated the importance of birds and bats for biological control of pest insects and the productivity of differently managed cacao plantations in relation to local and landscape factors. We used exclosure experiments of diurnal and nocturnal predators to relate changes in herbivory, tree productivity and insect community to the presence of birds and bats. All 60 exclosure treatments and the associated 15 study sites differed in local shade tree availability (0-25%, 25-50% and more than 50%) and were integrated in a landscape gradient (distance to primary forest between 0 and 3000 m). Local and landscape gradients were not correlated and each cacao plantation represents a unique combination of these factors. Additionally, side experiments were performed simultaneously to detect species and order specific interactions in the food web. The study was conducted over a period of 20 month, continuously.

Our results show, that the absence of flying predators such as birds and bats lead to a decrease of marketable cacao yield of more than 30 %. Especially bats seem to be greatly underestimated in limiting pest insects. The predation of flower and fruit eating insects seems to be as important as the limitation of leaf-feeding insects for crop productivity. Exclusion treatments released a chain of events in the interactions between plant, phytophagous and predatory species which not only affect the amount of herbivory but also lead to a different amount of harvested fruits (quantity of yield) and marketable outcome (quality of yield). Surprisingly, the effect of flying vertebrates did not differ between plantations differing in shade tree cover or distance to forest, which are both expected to result in a higher richness and density of flying vertebrates.

Given the importance of cacao yield quality and quantity for local farmer income, our study demonstrates that the activity of flying vertebrates delivers previously unrecognized but critically important ecosystem services for smallholder farmers. Ensuring a continued insectivore activity in these highly dynamic agricultural landscapes is likely to be a key for sustaining crop production and farmer livelihoods.

Merian Award Applicant

TAMARINS AND SECONDARY FOREST

Laurence Culot[2], Eckhard W. Heymann[1]

[1]Deutsches Primatenzentrum, Göttingen, DE, eheyman@gwdg.de
[2]Behavioral Biology Unit, University of Liège, Liège, BE

An ever increasing area of primary tropical rainforest is deforested and fragmented, and where regeneration is possible at all, secondary forests establish. Depending on the degree of ecological flexibility, organisms may or may not colonize and persist in such secondary forests. New World primates of the family Callitrichidae (tamarins and marmosets) are capable of living in secondary forests, and it has been suggested that they may even thrive in such habitats. The establishment close to our primary rainforest study site (Estación Biológica Quebrada Blanco, NE-Peru) of a ca. 10 ha buffalo pasture in 1990 and its abandonment in 2000 provided the opportunity to follow the process of use of the regenerating pasture by one of our tamarin (*Saguinus mystax* and *Saguinus nigrifrons*) mixed-species study troops, and to examine biotic interactions in secondary forest. Use of the secondary forest sharply increased between 2003 and 2005, and seemed to vary seasonally. During their entries into secondary forest, the tamarins dispersed seeds from non-pioneer, primary forest plants. This suggests that the tamarins can contribute to the natural regeneration of secondary forests.

FOREST TYPE AFFECTS PREY FORAGING OF SADDLEBACK TAMARINS *SAGUINUS NIGRIFRONS*

Denis Kupsch[1,2], Matthias Waltert[2], Eckhard W. Heymann[1]

[1]*Behavioural Ecology and Sociobiology Unit, German Primate Centre, Göttingen, DE, dkupsch@gwdg.de*
[2]*Department of Conservation Biology, University of Göttingen, Göttingen, DE, dkupsch@gwdg.de*

Increasing human activity in tropical forest ecosystems raises the question whether the associated secondary forests and their inherent ecosystem processes match the ecological importance of primary forests. Small New World primates of the family Callitrichidae are capable of persisting in secondary forests and are even supposed to benefit from elevated prey abundance in such forests. However, the question of how tamarins forage for prey in secondary forest compared to primary forest has not been examined.

In this study, we compare prey foraging and capture success of two groups of saddleback tamarins (*Saguinus nigrifrons*) in north-eastern Peru, one ranging in primary forest, the other with access to a 10-year old anthropogenic secondary forest. We used scan sampling and focal animal sampling to collect data on the activity, diet composition, prey foraging, and habitat utilization.

There was a trend for higher prey search activity in secondary forest, but prey feeding, prey capture success and prey size was lower compared to primary forest. Tamarins also avoided the forest floor, used vertical supports less often and searched on a lower variety of substrates in secondary forest. As a consequence, tamarins did not capture flushed prey in secondary forest, which accounts for a substantial part of the total prey biomass in primary forest. Reduced prey foraging success is unlikely to reflect reduced prey availability, since more Orthoptera were found in secondary forest through ultrasonic surveys. Finally, tamarins only used secondary forest seasonally and diurnally at times of fruit scarcity and high energy needs.

Our results suggest that young secondary forests meet just a minor part of feeding ecological demands of *S. nigrifrons*, since prey search activity seemed rather opportunistic, presumably influenced by altered predation patterns, vegetation structure, as well as prey diversity.

Merian Award Applicant

SECONDARY DISPERSAL BY ANTS ENHANCES SEEDLING RECRUITMENT IN A FIRE-DEGRADED TROPICAL MONTANE FOREST

Silvia C. Gallegos[1,2,3], Isabell Hensen[1], Matthias Schleuning[2]

[1]Institute of Biology, Martin-Luther-University Halle-Wittenberg, Am Kirchtor 1, 06108, Halle, DE, Silvia.Gallegos@senckenberg.de
[2]Biodiversity and Climate Research Centre (BiK-F), Senckenberganlage 25, 60325, Frankfurt am Main, DE, Silvia.Gallegos@senckenberg.de
[3]Herbario Nacional de Bolivia, Universidad Mayor de San Andres, Campus Universitario Cota Cota, La Paz, BO, Silvia.Gallegos@senckenberg.de

Andean tropical montane forests have been extensively deforested in the last decades, principally by anthropogenic fires. Nowadays many forest patches are surrounded by fire-degraded areas, commonly dominated by bracken *Pteridium aquilinum*, in which forest regeneration processes are poorly understood. Although vertebrates are the primary dispersers for most tropical forest trees, the role of secondary dispersal is being increasingly recognized as important. We studied the effects of secondary dispersal by ants on seed predation, germination and seedling recruitment of a primarily bird-dispersed forest tree *Clusia trochiformis* (Clusiaceae) in a tropical montane forest in Bolivia. At six sites, we carried out exclosure experiments that allowed or excluded access to seeds by vertebrates in three habitat types: forest interior, forest edge and fire-degraded habitat. We offered a total of 1440 seeds (both with and without an aril) and marked half of them with a thread to follow their fate after 48 h and after one month. The main secondary dispersers were ants from different guilds, mostly attracted by the lipid-rich aril, and secondary dispersal was highest in the forest interior. However, we found that secondary dispersal significantly enhanced seedling recruitment in the fire-degraded habitat. This effect was mainly due to reduced predation and increased germination of seeds that were moved into more suitable microhabitats. These findings highlight the importance of secondary dispersal by ants for promoting forest recovery at disturbed sites.

Merian Award Applicant

SPIDER-PLANT RELATIONSHIPS IN PADDY FIELDS OF CHANGING INDIAN LANDSCAPES

Lydia Betz[1,2], Prajeesh Parameswaran[3], Teja Tscharntke[2]

[1]Institute for Environmental Planning, Leibniz University Hannover, Hannover, DE, betz@umwelt.uni-hannover.de
[2]Agroecology, Department of Crop Science, Georg-August University Goettingen, Goettingen, DE, betz@umwelt.uni-hannover.de
[3]CAbC Kalpetta, MS Swaminathan Research Foundation, India, Kalpetta, IN

Intensification of crop cultivation practices and landscape-wide land-use are current global trends, which also affect small scale agriculture in the Wayanad District, South India. In the past, paddy was the most important crop in this region, but nowadays manifold factors change cultivation towards cash crops like e.g. banana or ginger. Nevertheless small scale rice cultivation, mainly for home consumption, is still common. However, rice cultivation practices change from traditionally low input and organic to high input agriculture.Since little is known about the rice ecosystem in Wayanad and its response to changes, the aim of this study is to investigate the composition of herbs and spiders in paddy fields and to understand their relationship with respect to changes in land-useand management.To involve local farmers and their experience and concerns, field research was done in a transdisciplinary manner, including feedback-loops. Data collection took place from September till November 2012 in Wayanad. In total 18 fields adjacent to either homegardens or banana plantations (representing the land-use change) were sampled. In order to grasp the within field variation and range of influence of close-by habitat, samples were taken at the edge, middle, and bund of the rice fields.The following hypotheses will be tested: (1) Rice fields adjacent to homegardens or banana plantations differ in the diversity of spiders and herbs. (2) Traditionally managed rice fields hold higher herb diversity which in turn promotes spider diversity. (3) Diverse bund vegetation has a positive effect on the spider composition in a rice field. The answers of these hypotheses fill in the gap of missing data on rice ecosystems in Wayanad. Understanding the impacts of a changing landscape and different agricultural practices on various aspects of the rice ecosystem will be important for future agricultural strategies in Wayanad.

THE VALUE OF LAND COVER CHANGE TIME SERIES FOR FOREST MANAGEMENT DECISIONS DEMONSTRATED BY MEANS OF BIRD DIVERSITY AND CARBON STORAGE

Gertrud Schaab[1], Tobias Lung[2], Trillium Levine[1], Nina Farwig[3], Katrin Böhning-Gaese[4]

[1]Karlsruhe University of Applied Sciences, Faculty of Information Management and Media, Karlsruhe, DE, gertrud.schaab@hs-karlsruhe.de
[2]Joint Research Centre, Institute for Environment and Sustainability, Ispra, IT
[3]Philipps University of Marburg, Faculty of Biology, Dept. of Ecology - Conservation Ecology, Marburg, DE
[4]Biodiversity and Climate Research Centre, Biodiversity and Area Dynamics of Vertebrates, Frankfurt/Main, DE

Effective forest management planning for nature conservation should consider biodiversity per se as well as ecosystem service provision of different forest management types. Kakamega Forest in west Kenya with a well-studied forest use history as well as a thorough forest management planning allows for a spatially explicit modelling of biodiversity and ecosystem services at the landscape scale. Although rather small in area (the gazetted area covers 240 km^2), it is special in regard to its mix of different forest types: besides near-natural forest and secondary forest also forest plantations of mixed indigenous species, and monocultures of indigenous or of exotic species are found. By employing a long-term land cover time series (Schaab et al., 2010) as well as different land use scenarios (ambitious nature conservation, realistic approaches, revenue-driven forest management), the effects of land cover change on bird diversity and carbon stock are estimated.

Bird diversity is estimated dependent on forest type, forest patch size, patch shape, patch connectivity und distance to farmland based on statistical analysis of field data on 115 bird species (Farwig et al., 2008) in combination with GIS-derived spatial measures. The amount of carbon stored in the forest is modeled by a re-stratification of field data-based calculations of above ground biomass (94 plots; Glenday, 2006) to the land cover classification distinguishing between six forest classes, an age-adjustment and the consideration of other carbon pools. The modeling results for the land use scenarios serve the purpose of showing the potential of conservation actions for Kakamega Forest in regard to improving both bird diversity and carbon storage. While the land cover change time-series can be used to put the various scenarios in relation to past situations in forest states over the last 100 years. Here, accordant visualizations are valuable means to successfully communicate about nature conservation.

SESSION:

KILIMANJARO ECOSYSTEMS UNDER GLOBAL CHANGE: LINKING BIODIVERSITY, BIOTIC INTERACTIONS AND BIOGEOCHEMICAL ECOSYSTEM PROCESSES

[Short title: KiLi project]

Chairs: Dr. Marcell Peters
Contact: marcell.peters@uni-wuerzburg.de

Biodiversity and supportive ecosystem processes maintained by tropical mountain ecosystems are threatened by the combined impacts of global warming and the conversion of natural to human-modified landscapes. The KiLi project uses the steep climatic and land use gradients of Mt. Kilimanjaro, Tanzania, to study the response of tropical mountain ecosystems to environmental changes. Using a network of 60 study plots located between 860 and 4550 m asl in both natural and disturbed ecosystems, we assess data on biodiversity, biotic interactions, biogeochemical processes, and ecosystem properties. In experimental gardens at different altitudes, transplant experiments are performed to study species adaptability under modified climate conditions. By reanalyzing study sites with historical floral and faunal records, shifts in species distributions are explored. In this session we will present results of the first two years of research of the KiLi project.

BIODIVERSITY AND ECOSYSTEMS PROCESSES ON MT. KILIMANJARO UNDER GLOBAL CHANGE: THE KILI PROJECT

Andreas Hemp[1], Ingolf Steffan-Dewenter[1], Victor Kakengi[1], Claudia Hemp[1], Marcell Peters[1], Katrin Böhning-Gaese[1], Thomas Nauss[1], Markus Fischer[1]

[1]Andreas Hemp, Bayreuth, DE, andreas.hemp@uni-bayreuth.de
[2]Ingolf Steffan-Dewenter, Würzburg, DE
[3]Markus Fischer, Bern, CH
[4]Claudia Hemp, Würzburg, DE
[5]Marcell Peters, Würzburg, DE
[6]Katrin Böhning-Gaese, Frankfurt, DE
[7]Thomas Nauss, Marburg, DE
[8]Victor, Kakengi, TZ

Biodiversity and supportive ecosystem processes maintained by tropical mountain ecosystems are threatened by the combined impacts of global warming and the conversion of natural to human-modified landscapes. In a long term German-Tanzanian research program we assess biodiversity and ecosystem processes along altitudinal and disturbance gradients on Mt. Kilimanjaro (Tanzania, Africa), capitalizing on its world-wide unique range of climatic and vegetation zones. On a total of sixty study sites in both natural and human-disturbed ecosystems biodiversity (e.g. plants, soil arthropods, ants, bees, frogs, lizards, bats, birds), related ecosystem processes (decomposition, seed dispersal, pollination, herbivory, predation), and biogeochemical processes and properties of ecosystems (climate, soil properties and nutrient status, regulation of water and carbon fluxes, trace gas emissions, primary productivity, functional diversity) are analyzed. Further, in experimental gardens at different altitudes, transplant experiments will be performed to study species adaptability under modified climate conditions. By reanalyzing study sites with historical floral and faunal records we explore shifts in species distributions. Overall, the data will allow us (1) to infer the influence of climate and anthropogenic disturbance on both biogeochemical processes and biodiversity, (2) to quantify biodiversity-ecosystem functioning relationships along elevational gradients, (3) to estimate resilience and adaptive potential of natural and modified ecosystems to global change, (4) to examine negative feedbacks of disturbance on local climate and ecosystem processes and (5) to quantify temporal shifts in species distributions due to climate and land use change. The aim of this presentation is to give an overview over study area, design and structure of the KiLi project.

EAST AFRICAN RAINFALL AND VEGETATION DYNAMICS IN RESPONSE TO A CHANGING EL NINO

Tim Appelhans[1]

[1]*Philipps Universität Marburg, Umweltinformatik, Marburg, DE, tim.appelhans@staff.uni-marburg.de*

In recent years, a number of studies have presented evidence that toward the end of the 20th century El Nino events exhibit a significant change in both spatial location and magnitude of maximum SSTs as well as tropical-midlatitude teleconnections. Classical El Nino events, characterised by warm SST anomalies in the eastern Pacific (Eastern Pacific Nino - EPN), are considered to be the most important cyclic climatic feature on interannual time scales and have been shown to influence regional climates worldwide. However, over the last two decades, maximum Pacific SST anomalies have been more frequently observed in the central Pacific (Central Pacific Nino - CPN). These anomalies are generally flanked by cooler SSTs towards the east and west and it has been shown that the nature of associated teleconnection patterns differs from those associated with EPN. Furthermore, a continued frequency increase of these CPN events has been projected for the 21st century. Here, we investigate whether changes in response patterns to such a shift in El Nino can be observed over tropical East Africa. There is a wealth of studies in the international literature that establish clear links between climatic and ecological dynamics of the eastern African equatorial region and El Nino. Both precipitation and vegetation dynamics in the region respond clearly to El Nino (and La Nina) events. Therefore, it can be expected that a change in the inherent characteristics of El Nino will affect climatic (and ecological) responses in equatorial East Africa. Using empirical orthogonal teleconnection analysis (EOT) we show that such effects are detectable. Especially during the 1990s and early 2000s a very stable relationship between CPN and tropical East African rainfall patterns is seen. Before this period, the relationship is fundamentally different with regard to sign and magnitude (in response to mainly EPN events). Afterwards, the influence of Pacific SST dynamics on East African rainfall seems to weaken. In terms of explained variance, CPN is found to be more influential for East African rainfall than EPN. Furthermore, we show that, during the above mentioned stable period, SST influences in the Indian Ocean exhibit similar stability. Finally, a careful consideration of the SST signal in the Pacific Ocean (i.e. EPN vs. CPN) in combination with Indian Ocean SSTs allows for establishing statistically significant relationships between SST dynamics and rainfall at selected sites in East Africa.

GREENHOUSE GAS EXCHANGE LINKED WITH N CYCLING ALONG A LAND-USE GRADIENT AT MT. KILIMANJARO, TANZANIA

Friederike Gerschlauer[1], Klaus Butterbach-Bahl[1], Ralf Kiese[1]

[1]Karlsruhe Institute of Technology, IMK-IFU, Garmisch-Partenkirchen, DE, friederike.gerschlauer@kit.edu

Land use change caused by anthropogenic perturbations is one of the main drivers of changes in biogeochemical C and N cycles and associated greenhouse gas (GHG) exchange, with feedback on climate change. Biodiversity and supportive ecosystem processes maintained by tropical mountain ecosystems are particularly threatened by the combined impacts of global warming and the conversion of natural to human-modified landscapes. To capture these effects across ecosystems with varying human influence at Mt. Kilimanjaro a detailed understanding and description of the current biotic and abiotic controls on ecosystem C and N fluxes is needed.

In the framework of the DFG funded KiLi research unit we have investigated nitrogen cycling and GHG exchange (N_2O, CH_4 and CO_2) at selected ecosystems along the southern slope of Mt. Kilimanjaro, Tanzania. We will present results for tropical forests in two different altitudes, homegarden (extensive agro-forestry), and coffee plantation (intensive agro-forestry). Therefore we used a combined approach consisting of a laboratory parameterization experiment (3 temperature, 2 moisture levels) for GHG exchange, in situ static chamber measurements, monitoring of soil water leaching, and characterization of N cycling using 15N stable isotope techniques.

Seasonal variation of temperature and especially of soil moisture across the different ecosystems resulted in distinct differences in GHG exchange. In addition environmental parameters like soil bulk density and substrate availability varying in space strongly influenced the GHG exchange.

Furthermore, significant differences of N turnover and leaching were found across natural and managed ecosystems. We found soil moisture to be the dominant climatic driver for gross N turnover rates within sites but also across sites.

The results from parameterization experiments show that natural forest ecosystems and extensive land use had higher uptakes of CH_4 than intensively managed. N_2O emissions were highest in natural forest ecosystems even though N input in the intensively managed system was considerably higher. In general an increase in temperature as well as in soil moisture caused higher GHG emission/ uptake throughout all investigated natural and managed ecosystems.

Merian Award Applicant

DISTRIBUTION MODELS OF PLANT SPECIES AT MT KILIMANJARO

David Schellenberger Costa[1], Corinna Burkhart[1], Andreas Hemp[2], Michael Kleyer[1]

[1]*University of Oldenburg, Oldenburg, DE,*
david.schellenberger.costa@uni-oldenburg.de
[2]*University of Bayreuth, Bayreuth, DE*

Causes and consequences of diversity along gradients are a much-discussed field in ecology and biogeography. Considerable literature exists explaining theoretically and analysing field data of mostly elevation gradients. Still, reliable results are rare due to the immense sampling effort needed to gain substantial datasets and the difficulty of disentangling environmental parameters governing distributions.

The present work is based on a set of 853 vegetation relevées done by Dr Andreas Hemp during his long-term ecological research at Mt Kilimanjaro, Tanzania. Of the 2500 plant species recorded in the area, the 231 most common were chosen for further analysis. Prevalences in the relevées were investigated for their correlations with three environmental factors of high importance for plant live: elevation, precipitation and land-use intensity. Fitting was done using generalized linear models (glm), with the Akaike information criterion (AIC) as an indicator of best fit. Species' optima were calculated for every independent variable as well as the amplitude of their distributions.

Species richness was evaluated in two ways: Counting optima and counting ranges per gradient interval. Both methods showed highest values at about 2500m a.s.l. on the elevation gradient and in the middle of the disturbance gradient corresponding to extensively used Chagga homegardens. Precipitation did not have such a pronounced effect on the distributions, most species showed quiet a wide effective niche range.

Merian Award Applicant

POLLEN-RAIN - VEGETATION RELATIONSHIP AND CLIMATE INFERENCE FOR THE MONTANE FOREST OF MT KILIMANJARO DURING THE LAST GLACIAL AND THE HOLOCENE

Lisa Schüler[1], Andreas Hemp[2], Hermann Behling[1]

[1]Department of Palynology and Climate Dynamics, University of Göttingen, Göttingen, DE, lschuel@gwdg.de
[2]Department of Plant Systematics, University of Bayreuth, Bayreuth, DE

The aim of this study was to investigate the relationship between vegetation and modern pollen-rain as well as the pollen climate relationship along the elevational gradient of Mt Kilimanjaro. We assessed the taxa level needed for differentiation between forest zones based on the modern pollen-rain assemblage, biodiversity patterns, and pollen and spore drift. The aim was the establishment of a modern pollen-rain – vegetation relationship in different vegetation zones along an elevational gradient in an afromontane ecosystem. The analysis of modern pollen-rain traps and vegetation inventory data of montane forest plots every 100 m elevation. We applied multivariate data analysis (principle component analysis) to assess the relationship between vegetation and modern pollen-rain andquantified the representativeness of forest belts in the pollen traps by calculating a transfer factor. At our study site it is possible to analyse the pollen-rain on plant family level in order to derive the forest zone of the surrounding vegetation. The plant families are differently represented in the modern pollen depending on various reproduction factors. The diversity trend captured in the modern pollen-rain reflects the plant diversity. The pollen and spore dispersal is strongly influenced by the regional wind patterns. The modern pollen-rain study revealed that it is crucial to establish a modern pollen-rain – vegetation relationship for the calibration and interpretation of a fossil pollen record from a mountain site. Our results facilitate the confident use of fossil pollen data to reconstruct more precisely potential vegetation and its dynamics in East African montane forests and also to refine climate past reconstructions in this region for a more accurate comparison of data and modelling.

Merian Award Applicant

IMPACTS OF DISTURBANCES ON TROPICAL FORESTS IN AFRICA: MODELLING THE DYNAMICS OF RAINFORESTS.

Rico Fischer[1], Andreas Huth[1]

[1]*Helmholtz Centre for Environmental Research - UFZ, Leipzig, DE, rico.fischer@ufz.de*

Up to half of the estimated aboveground carbon of global vegetation is stored in tropical forests. Large areas of rainforest are disturbed due to climate change and human influence. Using a modelling approach we analyse how disturbances modify dynamics and carbon flux of African rainforests.

In this study we use the process-based, individual-oriented forest model FORMIND. The main processes of this model are tree growth, mortality, regeneration and competition. Tree growth is calculated on a carbon balance. We investigate tropical rainforests in the Kilimanjaro region.

We analyze the impact of disturbances and climate change on forest dynamic and forest carbon stocks. Droughts and fire events change the structure of tropical rainforests. The species composition shift toward smaller trees and the carbon stocks will be reduced. Human influence like logging could intensify this effect.

Merian Award Applicant

ADAPTATION OF TROPICAL MOUNTAIN PLANTS TO ALTITUDE: A MULTI-SPECIES TRANSPLANT EXPERIMENT AT MOUNT KILIMANJARO, TANZANIA

Andreas Enßlin[1], Neduvoto Mollel[2], Andreas Hemp[3], Markus Fischer[1]

[1]University of Bern, Bern, CH, andreas.ensslin@ips.unibe.ch
[2]Tropical Pesticide Research Institute, Arusha, TZ
[3]University of Bayreuth, Bayreuth, DE

A key question in current global change research is whether plants will be able to keep up with rapid climatic change. Tropical mountain ecosystems harbor a considerable part of the world's biodiversity and a major proportion of endemics. At the same time, they are particularly threatened by rapid climate change as species usually have only limited space to migrate upslope to track the climate. In order to study the adaptation of various groups of tropical mountain herbs to their current altitudinal distribution, we conducted a reciprocal transplant experiment with 120 species at Mount Kilimanjaro (Tanzania). We collected seed families of these species from 28 sites from two altitudinal areas (65 species from the montane area, 40 from the savanna area and 15 from both). They were transplanted, reciprocally, into two experimental gardens (montane garden at 1450m a.s.l., savanna garden at 880m a.s.l.) representing the climatic conditions of each of the two vegetation zones. Plants grew generally better in the montane garden (biomass, leaf area, flower number). Performance of montane plants decreased strongly when grown in the savanna garden (aboveground biomass, plant height, leaf area), whereas plants from the savanna zone only showed a slight (biomass, height) or no (leaf area) decrease in performance when grown in the montane garden. Mortality of the montane plants increased strongly in the savanna garden, whereas it did not differ among gardens for the savanna plants. The results indicate that montane plants are adapted to their altitude and thus may be threatened by future increase of temperatures. In contrast, savanna plants could cope very well with the cooler climate of the montane region suggesting that they are not even currently growing in their temperature optimum.

PLANT SOIL FEEDBACK IN FOUR DOMINANT SAVANNAH TREE SPECIES IN EAST AFRICA

Gemma Rutten[1], Markus Fischer[1], Andreas Hemp[1]

[1]*University of Bern, Bern, CH, gemma.rutten@ips.unibe.ch*

Ecologists are wondering how so many plant species can coexist. Among the proposed underlying mechanisms is plant-soil feedback (PSF), if it causes seedlings to perform worse in soil trained by conspecifics than in soil trained by other species. Such PSF has been shown for plants of European grasslands and neo-tropical forests, however, not for savannah trees. Therefore, we collected soil underneath four savannah tree species common in East Africa, *Acacia nelotica*, *Boswellia neglecta*, *Combretum mole* and *Ozoroa insignes*. We used these soils to inoculate 210 pots in a shade house, half of them with sterilized inoculum. Then we reciprocally grew seeds of all four species on all four soil types. After 5 months we compared seedling performance on own field soil, foreign field soil, own sterilized soil and foreign sterilized soil. Our main result was a positive effect of soil biota in foreign soil but not in own soil (significant sterilisation x own vs. foreign soil interaction). This suggests that plant soil feedback favours the establishment of foreign species and thus may contribute to coexistence of savannah trees.

INFLUENCE OF HABITAT DESTRUCTION AND LAND USE INTENSIFICATION OF COFFEE PLANTATIONS ON ANT COMMUNITIES ON MT. KILIMANJARO

Antonia Mayr[1], Ingolf Steffan-Dewenter[1], Marcell K. Peters[1]

[1]University of Würzburg, Department of Animal Ecology and Tropical Biology, Würzburg, DE, tonimayr86@gmail.com

Ants are abundant and important elements of terrestrial ecosystems and provide a variety of ecological functions. Habitat destruction and the intensification of agriculture may lead to a loss of ant species and thereby to a loss of ecological functionality. The relationship between the richness or composition of species communities and ecological functionality is still little understood, particularly in the species-rich ecosystems of the tropics. In this study, the influence of land use intensification in coffee plantations along the southern slope of Mt. Kilimanjaro (1120-2040m asl) on patterns in alpha-, beta- and functional diversity of ant communitites was investigated. A combination of leaf litter sampling, sweep netting, baiting and hand sampling techniques were implemented on a total of 17 study sites comprising intensively used open coffee plantations, shaded coffee plantations, homegardens of the native Chagga culture and lower montane rainforest. Functional diversity was investigated by morphometric measurements and stable isotope analysis.

In this study a strong influence of forest conversion and land use intensification could be shown on ant species richness and ant assemblages between different land use types, as well as on ant assemblages between and within sites of the same land use type. Furthermore, the functional richness of ant assemblages was strongly influenced by land use intensification. Moreover, ant species richness declined significantly with increasing altitude and species turnover was also caused by altitudinal differences. A curvilinear relationship between species and functional richness of ant communities was found, whereas functional diversity and species diversity showed no correlation, nor could they be explained by any environmental parameter.

This study strongly supports the approach of traditional agroforestry systems and shaded coffee plantations as conservation areas at places where no native forests exist anymore and confirms the loss of ant biodiversity by the transformation of shaded coffee plantations into open coffee monocultures.

WHO REACHES THE SUMMIT? IMPACTS OF LAND USE ON ELEVATIONAL DISTRIBUTION PATTERNS OF INSECTIVOROUS BATS AT MT. KILIMANJARO, TANZANIA

Maria Helbig-Bonitz[1], Katrin Böhning-Gaese[2,3], Marco Tschapka[1,4], Elisabeth K. V, Kalko[1,4]

[1]University of Ulm, Ulm, DE, maria.helbig@uni-ulm.de
[2]Biodiversity and Climate Research Centre, Frankfurt (Main), DE
[3]Goethe University, Frankfurt, DE
[4]Smithsonian Tropical Research Institute, Balboa Ancón, PA

Given the imminent threat of land-use and climate change on biological diversity, it is important to investigate whether ecological communities might be more susceptible to land-use or to global climate changes. Studies on elevational gradients, along a high altitudinal range and a variety of land-use types and habitats offer the opportunity to investigate the sensitivity of species assemblages to land-use and climatic gradients. We studied diversity of insectivorous bats along an elevational gradient from 871 m to 4550 m a.s.l. along the southern slopes of Mt. Kilimanjaro. We investigated the response of bat species richness, occurrence and assemblage structure to elevation and land-use type. We monitored insectivorous bats in natural, degraded, semi-natural and agricultural habitat types, by implementing a standardized acoustic monitoring protocol using bat detectors. In general we hypothesized, that richness of insectivorous bats declines in natural habitats with elevation, resulting in highest values in low to mid elevations. Strong land use intensification is expected to have a negative influence on bat species richness and abundance. Thus, species composition of bat assemblages can be expected to respond to elevation, habitat degradation and land use intensification. Preliminary results confirm both of our hypotheses showing highest bat occurrence and richness at low elevations and in natural to less intensively utilized habitat types, respectively. In general, at low elevations bat diversity may be reduced by land-use intensity while at higher elevations physiological limitations caused by climatical factors may additionally restrict species occurrence.

Merian Award Applicant

SESSION:

IMPACTS OF ENVIRONMENTAL CHANGE ON BIODIVERSITY AND ECOSYSTEM FUNCTIONING / SERVICES IN TROPICAL HIGH MOUNTAINS

[Short title: Environmental change in tropical high mountains]

Chairs: Prof. Dr. Jörg Bendix, Prof. Dr. Dr. h.c. Erwin Beck
Contact: bendix@staff.uni-marburg.de

Biodiversity and ecosystem functioning/services of high altitude ecosystems are known to be exceptionally sensitive to environmental change. This particularly holds for tropical high mountains which harbour many of the world's biodiversity hotspots. However, most interactions of, and feedback mechanisms between ecosystem components resulting in visible impacts of environmental change are hitherto poorly understood, due to the high complexity of the tropical mountain ecosystems. The main goal of the current session is to unveil: § impacts of landuse and climate change on biodiversity and ecosystem functioning/service in tropical high mountains; § the role of invasive species on changes in biodiversity and ecosystem functioning/service of tropical high mountains; § effects of environmental change on interactions, ecosystem processes, trophic networks and ecosystem functioning in tropical high mountains. Contributions presenting new methodologies (modelling, remote sensing etc.) and future projections are just as welcome as insights gained from field surveys and ecological experiments.

CLIMATE AND LAND USE CHANGE IN TROPICAL HIGH MOUNTAINS - THE EXAMPLE OF THE TROPICAL ANDES

Joerg Bendix[1]

[1] *University of Marburg, Faculty of Geography, Marburg, DE, bendix@staff.uni-marburg.de*

Climate and land use change are suspected to be the major drivers for a decline of biodiversity and a deterioration of ecosystem services. This also holds for tropical high mountains. While it is undisputed that land use change is increasingly threatening natural ecosystems of tropical high mountains (in particular the tropical mountain cloud and rain forest) it is not yet finally understood how global warming will affect this complex landscapes, its biodiversity and its ecosystem services. While local warming is already observed in most tropical high mountains, the tendency of rainfall is neither clear regarding the near past nor in future projections derived by global circulation models. The introductory talk will present ongoing land use / land cover and climate changes in the eastern Andes of southern Ecuador, a hotspot of biodiversity. Future projections of men made environmental change will be discussed, as also impacts of past and future environmental change on biodiversity and ecosystem services.

POLLEN RAIN - VEGETATION RELATIONSHIPS IN THE SOUTH ECUADORIAN ANDES

Nele Jantz, Hermann Behling

Georg-August-University, Dept. of Palynology and Climate Dynamics, Göttingen, DE, njantz@gwdg.de

The South Ecuadorian Andes harbour an outstandingly high species-richness. Many different environmental factors influence one another in a most limited space and create unique and complex ecosystems. This area is also highly endangered because of growing human impact through the intensification of land-use and global change. Only little is known about palaeoecological history and landscape dynamics of this area. Nevertheless, the information about *why* and *how* ecosystems changed in the past is crucial for the development of innovative strategies for conservation and future climate predictions. In order to understand the pollen dispersal patterns of the different vegetation types of premontane forest, lower montane forest, upper montane forest and páramo to create a better basis for interpretation of fossil pollen data, a three year study of the modern pollen rain – vegetation relationship was carried out in the Podocarpus National Park region. A comparison of abundance and presence-absence data on a family level for pollen and vegetation showed that diversity, distribution and abundance patterns correspond well to one another in both datasets. However, varying amounts of long-distance transported pollen, uneven pollen productivity of different taxa and heterogeneous wind systems impact the patterns. Analyses of pollen accumulation rates indicated low inter-annual but high spatial variation in the pollen data.

HOLOCENE PALAEOECOLOGY OF MOUNTAIN RAINFORESTS IN CENTRAL SULAWESI (INDONESIA)

Siria Biagioni[1], Petra Lembcke[1], Liang-Chi Wang[2], Hermann Behling[1]

[1]Department of Palynology and Climate Dynamics Albrecht-von-Haller-Institute for Plant Sciences Georg-August-University Goettingen, Göttingen, DE, siria.biagioni@biologie.uni-goettingen.de
[2]Department of Geosciences, National Taiwan University, Taipei, TW

In order to obtain a deeper understanding of future environment/ecosystem interactions in tropical ecosystems a long-term perspective of the interaction between vegetation dynamics, climate change and human impact in the past is needed.

Due to the complexity of tropical ecosystems and site-specific differences on the sedimentary process, it is very important to have data from multiple sites in order to better identify the dynamics and vegetation community responses under different conditions (e.g. human land use change, climate change).

We present the results of pollen and charcoal analyses of three sediment cores located about 30 km apart, close to the north-eastern border of the protected area of the Lore Lindu National Park. The park is situated in Central Sulawesi and has been a UNESCO "Man and Biosphere Reserve" since 1977.

The vegetation of the study region consists of species-rich tropical montane forest. The vegetation gradient ranges from lowland rainforests below 1000 m dominated by Fagaceae, to upper montane above 2000 m a.s.l. where conifers are well represented. The climate of the area is best described by rainfall pattern with humidity increasing towards higher elevation. The interannual conditions are influenced by the occurrence of El Niño event which can lead to severe reduction in rainfall.

The coring sites are located at different altitudes: 1) Rore Katimbu (1°16'44'' S, 120°18'34'' E) situated at about 2400 m a.s.l. within the upper montane forest, 2) Lake Kalimpaa (1°19'35''S, 120°18'32''E) at 1700 m a.s.l., within the mid-montane forest and 3) Lake Lindu (1°19'16''S, 120°04'36''E) at 1000 m a.s.l. surrounded by sub-montane forest. The three sites differ in level of human impact and the records span through the Holocene with similar temporal resolution.

The multi-sites palaeoecological study allows us to test the following hypotheses: I) The response of the vegetation communities to climate change and ENSO events were different along the altitudinal and moisture gradients; II) The montane rainforest was impacted by human activities in the area only in recent times.

The comparative study will lead to a better understanding of how human and climate have shaped the montane tropical rainforest of Central Sulawesi from the early Holocene until modern times.

Merian Award Applicant

FUNCTIONAL DIVERSITY IN A BOLIVIAN MOUNTAIN FOREST: TOPOGRAPHY AND EDGE EFFECTS

Amira Elvia Apaza Quevedo[1,3], Denis Lippok[1], Isabell Hensen[1], Matthias Schleuning[2]

[1]Institute of Biology / Geobotany and Botanical Garden, Martin Luther University Halle Wittenberg, Halle (Saale), DE, amiraelvia@yahoo.es
[2]Biodiversity and Climate Research Centre (BiK-F) and Senckenberg Gesellschaft für Naturforschung, Senckenberganlage, Frankfurt (Main), DE
[3]Herbario Nacional de Bolivia, Universidad Mayor de San Andrés, La Paz, BO, amiraelvia@yahoo.es

Functional Diversity (FD) is one of the major determinants of ecosystem functioning and recognized for its sensitivity to predict changes in ecosystem processes and services, and thus human well-being. Environmental drivers like fragmentation or topography in mountain forest, which involve changes in community structure and/or composition, can also reflect important changes in FD. In Bolivian Yungas Mountain Forest, the continuous action of anthropogenic fire resulted in huge deforested areas with fragmented forests mainly remaining on the mountain tops and gorges. Despite its importance, no information is available about how FD changes at forest edges and respect to topography. Here, we evaluated variations on the community-weighted mean value (CWM) and multidimensional functional diversity indices (Functional richness-FRic, functional evenness- FEve and functional divergence-FDiv) between edge and interior forest and between ridges and gorges of a Yungas mountain forest. We measure five functional traits on 120 woody species (Specific leaf area -SLA, Stomata density, Leaf nitrogen content-LNC, leaf c^^arbon content-LCC, and C:N ratio). Functional diversity metrics were calculated independently per plots and weighted by the abundance of the species. Except for a higher FRic in the ridges respect to gorges, we did not find any significant difference in the multidimensional indices neither between edge and interior areas nor between ridges and gorges. However, CWM for the traits Area, SLA and LNC was lower at edges respect to the interior forest and the contrary for C:N ratio. Respect to topography, CWM was significantly lower in ridges respect to gorges for SLA and LNC. As in other studies CWM were more sensitivity to disturbance than multidimensional indices. Differences in functional composition related with disturbance or topography showed interior forest and gorges as habitats composed for species with more acquisitive characteristics than edges and ridges.

Merian Award Applicant

APPLICATION OF REMOTE SENSING TECHNOLOGY TO DETECT LOGGING ACTIVITIES IN XE SAP NATIONAL PROTECTED AREA IN LAO PDR

Johannes Bender[1], Stefan Ziegler[2]

[1]Goethe University, Frankfurt, DE, johannes.bender@yahoo.de
[2]Goethe University, Frankfurt, DE

During the last decade, there has been growing concern that unsustainable logging is depleting the forest resources of Lao PDR. Those activities are thought to occur particularly along the country's international borders in mountainous areas. This study presents the first comprehensive assessment of alleged illegal logging and logging-related activities within Xe Sap National Protected Area (NPA), one of Laos' biodiversity hotspots which shares almost 100 km borderline with Vietnam. The area is located in the rugged Central Annamites mountain range which is difficult to survey and patrol. We quantified land cover change over time for the period 1989 to 2011 using Landsat and RapidEye imageries with different spatial resolutions of 30 m and 5 m. Signs of anthropogenic disturbance of the forest cover, such as settlements, log landings or road and skid trail networks, were detected by visual examination of the imagery. The corresponding spatial signature was ground-truthed. We identified subsistence slash and burn agriculture, which is still omnipresent in certain areas of the NPA, as well as selective logging, to be the main drivers of forest cover loss. The results also show that the road and skid trail network within Xe Sap NPA spread by more than 152 km between 2006 and 2011. This development increases accessibility into the protected area, and is partly triggered by commercial interest from Vietnam to meet the demand of its growing wood processing industry. We were able to detect several alleged illegal logging hotspots inside the protected area, in close proximity to the Vietnamese border. Our findings conclude that remote sensing is a useful and cost-efficient technique to identify logging hotpots in remote and rugged areas where detection probability of illegal activities is low.

Merian Award Applicant

LONG TERM PHENOLOGICAL STUDIES IN A TROPICAL MOUNTAIN RAIN FOREST IN SOUTHERN ECUADOR

Patrick Hildebrandt[1], Daniel Kübler[1], Johana Munoz[2], Omar Cabrera[3], Sven Günter[4], Eduardo Cueva[5], Jürgen Homeier[6], Thorsten Peters[7], Rütger Rollenbeck[8], Bernd Stimm[1], Michael Weber[1], Reinhard Mosandl[1]

[1]*Institute of Silviculture, Technische Universität München, Freising, DE, hildebrandt@mytum.de*
[2]*Universidad Nacional de Loja, Loja, EC*
[3]*Universidad Técnica Particular de Loja, Loja, EC*
[4]*CATIE, Turrialba, CR*
[5]*NCI, Loja, EC*
[6]*Albrecht von Haller Institute of Plant Sciences Georg August University of Göttingen, Göttingen, DE*
[7]*Institut für Geographie Friedrich-Alexander Universität Erlangen-Nürnberg, Erlangen, DE*
[8]*Fachbereich Geographie Philipps Universität Marburg, Marburg, DE*

As indicated by former studies, photoperiod is not the only factor that is controlling the phenological behaviour on our study site, but also climate parameters, i.e. precipitation and radiation affect the phenological pattern. However, environmental change may considerably influence the phenological behaviour of tropical tree species. Reduced precipitation and increased temperatures are likely to occur on our study site in the future; therefore we tested for correlations between those drivers and the phenological responses during the observed time frame. Moreover, effects of irradiation, air-humidity and wind have been considered as possible climatic triggers.

Forest management by silvicultural interventions can also affect the phenological behaviour by alteration of environmental conditions. Therefore we compared the flowering and fruiting of selected individuals after thinning with the behaviour of respective reference trees.

Moreover, correlations with increment rates have been analysed in order to provide more insight on resource allocation by tropical tree species.

On basis of the results we aim at concluding about resilience of tropical montane ecosystems to climate change and silvicultural interventions.

WHICH ENVIRONMENTAL FACTORS INFLUENCE TROPICAL MOUNTAIN TREE SPECIES? A CASE STUDY IN SOUTHERN ECUADOR (RBSF)

Susanne Spannl[1], Franziska Volland[1,2], Achim Bräuning[1,2,3]

[1] *Institute of Geography - University of Erlangen-Nürnberg, DE*
[2]*Erlangen, DE*
[3]*Erlangen, DE*

For a long time, tropical mountain forests were considered to be stable ecosystems with a continuum in their structure and functioning. However, recent studies have shown that even in such resilient ecosystems short-term extreme events as well as long-term trends of external environmental factors appear and may significantly alter tree physiological processes. In this context, we examine the impact of different climatic (precipitation, drought events, solar irradiation and humidity) and trophic conditions (nitrogen input) on tropical mountain forests in Southern Ecuador.

Despite the perhumid conditions of the area, our results show that some tropical mountain tree species (e.g. *Cedrela montana*, *Alchornea lojaensis*) exhibit seasonal growth rhythms which are manifested in distinct growth boundaries. Furthermore, long term trends in stable carbon isotope fractionation, controlled by climatic changes, were detected.

In addition to the climatic variations, increasing atmospheric nutrient inputs (nitrogen) might influence the ecosystem structure by modifying inter-tree competition. Preliminary results reveal that especially tree species that are well adapted to the nutrient-poor soil conditions prevailing in the study area (e.g. *Graffenrieda emarginata*) show adaptive difficulties, whereas other species might profit from nutrient input.

Merian Award Applicant

ASSESSING THE IMPORTANCE OF ENVIRONMENTAL VARIABLES FOR THE DISTRIBUTION OF 16 TREE SPECIES IN A TROPICAL MOUNTAIN FOREST

Daniel Kübler, Michael Weber

Institute of Silviculture, Technische Universität München, Munich, DE, daniel.kubler@tum.de

Improved access to high-resolution digital elevation models (DEM) enables new approaches for the analysis of spatially explicit biological data. In this study, the distribution of 16 tree species in a tropical mountain rain forest in South Ecuador and its relationship with environmental variables was evaluated at a fine-scale ecological level using two presence-only techniques: The maximum entropy model (MaxEnt) and the ecological niche factor analysis (ENFA). Spatially explicit tree data stems from long-term forest monitoring plots in three microcatchments with a total area of 13 hectares. Environmental variables were derived from a high-resolution DEM. Model performance was assessed using true skill statistic (TSS) and area under curve (AUC) of the receiver operator characteristic (ROC), using both a k-fold approach and independent test data. Performance varied among species and techniques, but generally MaxEnt models showed better performance than ENFA models. Among the explanatory environmental variables, elevation and a Topographic Position Index appear as the main determinants for the distribution of most of the tree species. This study demonstrates that even on a small scale, the use of presence-only techniques is a viable option for modelling suitable habitat for tree species in tropical mountain rain forests.

Merian Award Applicant

WOOD ANATOMY AND TREE HEIGHT AS TRAITS CONTROLLING HYDRAULIC EFFICIENCY, VULNERABILITY AND PRODUCTIVITY OF TROPICAL TREES

Bernhard Schuldt[1], Jürgen Homeier[1], Gerald Moser[2], Michel Edelmann[1], Christoph Leuschner[1]

[1]Georg-August-University, Göttingen, DE, bschuld2@gwdg.de
[2]University of Gießen, Gießen, DE

Under the prospect of more frequent and intense droughts as predicted for parts of South-East Asia and South America, a better understanding of the drought sensitivity of tropical trees is crucial. Increasing drought frequency may increase tree mortality, change tree species composition and reduce overall productivity. Tree mortality is expected to increase, especially among tall tropical trees, but the mechanisms leading to drought-induced mortality are far from being resolved.

Tree size and wood density are traits that are assumed to play a central role in drought sensitivity, but are also related to productivity and water consumption. With this study we present a dataset covering more than 400 tree individuals from 136 tree species from South-East Asia (Central Sulawesi, Indonesia) and South-America (South Ecuador) on sap flow, hydraulic conductivity (limited dataset) and wood anatomical traits in relation to tree size, wood density and stem increment and standing biomass. We found all parameters regarding water consumption to be closely positively related to tree size, but wood density only negatively with stem increment and hence to be unrelated to hydraulic properties of the xylem in tropical angiosperm trees from perhumid environments. A high hydraulic conductance as a prerequisite of high production is mainly achieved by more and larger vessels, and increasing vessel size is related to a higher risk of drought-induced embolism.

We conclude that hydraulic properties of tropical trees from perhumid environments are unrelated to their wood specific gravity, but closely to tree size, and that tree size is a better indicator for vessel anatomical traits and hence hydraulic conductivity. Further, hydraulic conductivity and productivity are closely related. Tall tropical trees, which suffer most under prolonged drought periods, are exposed to a higher vapor pressure deficit compared to the understory and possess a much larger foliar biomass, and both demands for a highly efficient hydraulic system, mainly achieved by larger xylem vessels, which carry a higher risk of drought-induced embolism. Altogether, we hypothesize that tropical trees drought-susceptibility can be predicted from the easily measurable parameters tree height and stem wood anatomy.

Merian Award Applicant

ALUMINUM TOXICITY TO TROPICAL MONTANE FOREST TREES IN ECUADOR

Moritz Bigalke[1], Agnes Rehmus[1]

[1]*Universität Bern, Geographisches Institut, Bern, CH, agnes.rehmus@giub.unibe.ch*
[2]*National University of Loja, Loja, EC*

Aluminum phytotoxicity is believed to occur in tropical acid soils with pH <5.5, when mobility of Al ions is increased.

An hydroponic experiment was conducted to determine dose-response functions of Al for selected tropical montane forest trees in Ecuador. Seedlings of *Cedrela odorata* Moritz ex Turcz., *Heliocarpus americanus* L., and *Tabebuia chrysantha* (Jacq.) G. Nicholson were incubated with a Hoagland nutrient solution containing 0, 300, 600, 1200, and 2400 µM Al. In an additional treatment, we grew the same tree species in native litter leachate collected below the thick organic layers in the study area. Nutrient solutions were sampled and replaced weekly. After seven weeks, plants were harvested. Roots and shoots were scanned and root length and leaf area were determined with the software WinRhizo. Furthermore, we determined macro and micro nutrient concentrations in plant tissue and nutrient solutions before and after incubation with AAS, ICP-MS, and TOC analyzer.

In general, total biomass production was inhibited with increasing Al concentration in nutrient solution (7-wk EC_{25} for *C. odorata* 1100 µM, for *H. americanus* 150 µM). Biomass production of *T. chrysantha* increased by 20% at 300 µM and then decreased.

Leaf area and root length also decreased with increasing Al concentration in nutrient solution. Macro and micro elements in nutrient solution after incubation increased with Al concentration, whereas macro elements in plant tissue decreased.

Increasing Al concentrations reduced biomass production and element uptake of tree seedlings negatively. Yet, Al toxicity occurred at Al concentrations between 300 and 600 µM, which is far above usual total Al concentrations (< 60 µmol l-1, even mostly as non-toxic organo-Al complex) in native litter leachate which can be considered as the plant-available Al pool. Biomass production was lowest if plants grew in litter leachate indicating limitation of plant growth by other factors than Al toxicity. We conclude that Al toxicity in the studied ecosystem is unlikely.

EFFECTS OF CONTINUED NUTRIENT ADDITION ON FOREST PRODUCTIVITY AND TREE PERFORMANCE IN ANDEAN FORESTS

Jürgen Homeier[1]

[1] *Plant Ecology, University of Göttingen, Göttingen, DE, jhomeie@gwdg.de*

Elevated N and P inputs affect virtually all components and processes of terrestrial and aquatic ecosystems since the productivity of plant communitiesis limited by N or P, or both in the vast majority of ecosystems on the globe. Human activities will globally affect the cycles of N and P during the coming decades and tropical Andean forests are likely to respond sensitively to these changes. But the size and direction of these responses are unclear.

The effects of continued nutrient addition was investigated in three Andean forest types within the ongoing Ecuadorian NUtrient Manipulation EXperiment (NUMEX), that started in January 2008 (adding moderate amounts of N (50kg ha^{-1} yr^{-1}), P (10kg ha^{-1} yr^{-1}), and N and P to representative stands). After 4 years of nutrient addition, cumulative stem diameter increments were around 50% increased by combined N and P addition at 2000m and also at 3000 m. At 1000m all treatments on average showed a 20% diameter growth increase compared to the control. On the other hand, tree responses to nutrient addition were highly species-specific. At 2000m, both *Graffenrieda emarginata* (the most common tree species) and the pooled non-common species responded with higher diameter increments to N+P addition, but only the non-common species showed higher increments after P addition.

Fine litter production was positively affected by N and N+P addition throughout all study years and elevations while P addition had only small or even negative effects. Effect size changed during the study and became significant for total fine litter after 3 years of nutrient addition (earlier in the leaf litter fraction).

LINKS BETWEEN VOLCANIC AND BIOMASS BURNING SO_2 EMISSIONS AND SO_4 ATMOSPHERIC DEPOSITIONS IN A TROPICAL MOUNTAIN FOREST

Sandro Makowski Giannoni, Rütger Rollenbeck, Jörg Bendix

Philipps Universität Marburg, Marburg, DE, makowsks@students.uni-marburg.de

In modern times, human activities have been responsible for most sulfur emissions, especially in the northern hemisphere. Industrial and agricultural practices and land use change, which involve burning of fossil fuels, emit large quantities of Sulfur Dioxide (SO_2) into the atmosphere. Yet, volcanic emissions from degassing and eruptions still contribute to around 10% of the world atmospheric SO_2 budget. SO_2 is by far the most emitted sulfur compound and is responsible for a number of environmental problems like acid rain and acidification of soil and water environments. This applies to the tropical mountain forest of southern Ecuador, where the already nutrient-poor and acidic soils make them very sensitive to the negative impacts generated by externally-induced changes in the biogeochemical cycles.

According to studies carried out in the south Ecuadorian tropical mountain forests, it was hypothesized that the bulk of sulphate (SO_4) depositions stem mostly from upwind biomass-burning emissions produced by the slash and burn activity. However, the role played by natural (volcanic) and anthropogenic (biomass burning) SO_2 sources in SO_4 depositionsis not clear yet.

The main goal of the current study is to link spatio-temporal patterns of upwind SO_2 emissions and SO_4depositionsin the San Francisco Valley (eastern Andes of southern Ecuador). The work is based on AURA-OMI retrieved-SO_2 atmospheric concentrations over South America andSO_2biomass burning emissions from the Global Fire Emissions Database ($GFEDv_3$). The emission data is used as input for FLEXTRA backward trajectory modeling to model the transport to the study area. The resulted transmissions are contrasted against SO_4 concentrations from rain and fog water samples from meteorological stations.

Merian Award Applicant

SOIL N-CYCLING RESPONSES TO ELEVATED NUTRIENT INPUTS IN TROPICAL MONTANE FORESTS

Angelica Baldos, Anke K. Mueller, Marife D. Corre, Edzo Veldkamp

Georg-August Universitaet Goettingen - Soil Science of Tropical and Subtropical Ecosystems, Goettingen, DE, abaldos@gwdg.de

Tropical regions are facing increases in atmospheric nutrient deposition. Despite the role of internal soil N nitrogen (N) cycling in regulating processes of N retention and losses, very little is known about how soil N cycling in montane forests will respond to elevated nutrient inputs. Our objectives were to assess changes in gross rates of N production (N mineralization and nitrification) and retention (microbial immobilization of ammonium (NH_4+) and nitrate (NO_3-), and dissimilatory NO_3- reduction to NH_4+ (DNRA)) under elevated N and phosphorus (P) inputs to montane forests. A fertilization experiment was established in montane forests on 1000m, 2000m and 3000m elevation in Ecuador in 2008. Each elevation had four replicate plots for these treatments: control, N (50 kg N $ha^{-1}y$-1), P (10 kg P $ha^{-1}y$-1) and combined N+P. We measured gross rates of soil N cycling using 15N pool dilution technique during the 3rd and 4th years of treatment. In control plots, gross rates of N mineralization (from 235±32 to 191±53 to 73±26 mg N $m^{-2}d^{-1}$) and nitrification rates (from 88±10 to 35±5 to 25±8 mg N $m^{-2}d^{-1}$) decreased with increase in elevation; and microbial immobilization rates of NH_4+ (from 210±46 to 223±36 to 87±21 mg N m^{-2} d^{-1}) and NO_3- (from 90±20 to 31±6 to 20± mg N $m^{-2}d^{-1}$) and DNRA (from 26±3 to 17±3 to 8±1 mg N $m^{-2}d^{-1}$) were tightly coupled (equal to) to their production rates. N and N+P fertilization, but not P fertilization alone, increased gross N mineralization rates at all elevations and decreased NH_4+ immobilization rates only at 1000m and 2000m elevation relative to their respective control plots. Either N or N+P fertilization increased gross nitrification rates at all elevations and decreased NO_3- immobilization rates and DNRA only at 1000m elevation. In these tropical montane forests, increased nutrient input, specifically N, led to increased gross rates of N production and decreased N retention, which may lead to increases in gaseous and leaching losses of N.

NITROGEN-CYCLING RESPONSE TO ELEVATED NUTRIENT INPUTS IN CANOPY SOILS OF ECUADORIAN MONTANE FORESTS

Amanda Matson, Marife Corre[1], Edzo Veldkamp

[1]*Georg-August University of Goettingen, Goettingen, DE, amatson@gwdg.de*

Although the canopy can play an important role in forest nutrient cycles, canopy-based processes are often overlooked in studies on atmospheric deposition. In areas of nitrogen (N) and phosphorus (P) deposition, canopy soils receive not only direct atmospheric inputs, but also indirect enrichment through root uptake and recycling of N- and P-enriched plant litter. Our objectives were to measure rates of N_2 fixation and gross N mineralization along an elevation gradient of tropical montane canopy soils and to assess the indirect effects from elevated nutrient inputs to the forest floor (FF). N_2 fixation was measured using the acetylene reduction assay and gross N mineralization was measured using 15N pool dilution. Measurements took place in the field, using intact cores of canopy soil from three elevations (1000, 2000 and 3000 m asl). The FF had been fertilized biannually with moderate amounts of N (50 kg N ha^{-1} yr^{-1}) and P (10 kg P ha^{-1} yr^{-1}) for 4 years (treatments: control [C], N, P and N+P). N_2 fixation rates in canopy soils did not vary with elevation but were inhibited in N and N+P plots (0.08 ± 0.03 mg N kg^{-1} d^{-1}) compared to C and P plots (0.17 ± 0.08 mg N kg^{-1} d^{-1}). Conversely, mineralization exhibited no clear treatment effects, but exhibited an elevation trend, decreasing from 32.7 ± 7.4 to 24.3 ± 6.3 to 17.5 ± 4.4 mg N kg^{-1} d^{-1} as elevation increased. Results suggest that N_2 fixation is an active process in canopy soils, but is sensitive to even slight increases in N availability. Gross N mineralization appears to be less sensitive - or is perhaps buffered through the reduction in N_2 fixation - but responds to the environmental changes captured in the elevation gradient. Therefore, long-term atmospheric N deposition has the potential to significantly change the dynamics of soil N cycling in these canopies. Long-term deposition will likely cause significant decreases in N-fixing activity, with additional uncertain effects on internal N cycling.

Merian Award Applicant

FRIDAY 11:30

EFFECTS OF NUTRIENT ADDITION ON THE PERFORMANCE OF TREE SEEDLINGS IN A TROPICAL MONTANE FOREST IN SOUTHERN ECUADOR

Daisy Cárate[1], Jürgen Homeier

[1]Göttingen Centre for Biodiversity and Ecology, Göttingen, DE, dcarate@gwdg.de

The Nutrient Manipulation Experiment (NUMEX) is conducted in southern Ecuador with the main objective to investigate how global change might affect Andean forest dynamics by increased nutrient deposition. The effects of continued nutrient addition is investigated in three forest types adding moderate amounts of N (50kg ha^{-1} yr^{-1}), P (10kg ha^{-1} yr^{-1}), and N and P to representative stands.

Studying seedling dynamics is important because processes affecting the success of seedlings can influence population sizes and future species composition.

After one year of monitoring the tree seedling community (mortality, recruitment, herbivory and growth) at the San Francisco reserve in southern Ecuador (2000m asl), we found trends in the response of seedlings to nutrient addition:

P addition seems to have a general positive effect on seedling height growth, whereas species response to N addition was greatly varying. Other processes such as recruitment seemed to be limited by both N and P addition. In addition, there is a trend to increased leaf herbivory after N addition. Mortality and seedling population density do not show apparent changes compared to the control plots.

To conclude, common tree species and families responded differentially to nutrient addition, indicating possible shifts in the composition of future forests under increased nutrient deposition.

Merian Award Applicant

RESPONSE OF SOIL TRACE GAS FLUXES TO ELEVATED NUTRIENT INPUTS IN TROPICAL MONTANE FORESTS

Anke K. Müller[1], Guntars O. Martinson[2], Marife D. Corre[1], Edzo Veldkamp[1]

[1]Georg-August-University Göttingen - Soil science of tropical and subtropical ecosystems, Göttingen, DE, amuelle8@gwdg.de
[2]Max Planck Institute for Terrestrial Microbiology, Marburg, DE

Tropical forest soils are important sources of the greenhouse gases (GHG), carbon dioxide (CO_2) and nitrous oxide (N_2O). Their fluxes are greatly influenced by changes in soil nutrient availability. Atmospheric inputs of nitrogen (N) and phosphorus (P) are increasing in tropical regions but the long-term effects of elevated inputs of these nutrients on GHG emissions are unknown. Our objective is to assess the impact of moderate increases in N and P availability on soil CO_2 and N_2O fluxes. To simulate N- and P-enriched conditions, we established a fertilization experiment in forests along an elevation gradient of 1000, 2000 and 3000 m elevation in Ecuador. In each elevation, control, N (50 kg N ha^{-1} yr^{-1}), P (10 kg P ha^{-1} yr^{-1}) and N+P plots were established in three replicate blocks. Fluxes were measured monthly using vented chambers and over two phases: first during 1-1.7 years, and second during 3.8-5.5 years of treatment. There were no pronounced seasonal patterns of CO_2 and N_2O fluxes but fluxes decreased with increasing elevation: 10.06, 6.20 and 2.59 Mg C ha^{-1} yr^{-1} in 1000, 2000 and 3000 m elevation, respectively; and 0.48, 0.18 and -0.05 kg N ha^{-1} yr^{-1} in 1000, 2000 and 3000 m elevation, respectively. Effects of N and P additions on CO_2 fluxes differed among the three elevations. P addition alone reduced CO_2 emissions in the 1000 m elevation during the second phase and slightly increased fluxes in the 3000 m elevation during the first phase. N and NP addition decreased CO_2 emissions slightly in 1000 and 2000 m elevation and N alone increased fluxes in 3000 m elevation. There were however indications that these effects were in part due to inherent spatial differences. N_2O fluxes increased in all elevations with N and NP additions particularly in the second phase. In general, our moderate nutrient additions elicited only marginal effects on GHG fluxes and their effects may have also been masked by the high spatial variability of fluxes in these forests.

Merian Award Applicant

ROOTS AND MYCORRHIZAL FUNGI AS DETERMINANTS OF SOIL ANIMAL COMMUNITIES AND LITTER DECOMPOSITION IN TROPICAL MONTANE RAINFORESTS

Franca Marian, Mark Maraun, Stefan Scheu

J.F. Blumenbach Institute of Zoology and Anthropology; University of Goettingen, Göttingen, DE, fmarian@gwdg.de

Previous experiments and observations in the tropical mountain rain forest of Southern Ecuador indicate that roots play an important role for the composition of the soil fauna community and the decomposition of leaf litter. To investigate these relationships more closely we set up an experiment to disentangle interactions between roots, mycorrhiza, soil animal community and litter decomposition.

Containers differentially accessible to roots and mycorrhizal hyphae were exposed in rainforests of the Ecuadorian Andes along an altitudinal gradient from 1000 to 3000 m. Each container was filled with soil and litter of the respective location of exposure. The containers allowed rainwater to enter from the top and to leach through an opening in the bottom. Three types of containers were established: (1) Excluding roots as well as mycorrhiza, (2) allowing access to both roots and mycorrhiza, and (3) excluding roots but allowing access to mycorrhizal hyphae. The containers were placed in the field for 12 month. Litter decomposition, soil animal community and microbial biomass as well as soil and leaf litter properties were investigated. The complex design of the experiment as well as preliminary results will be presented.

Merian Award Applicant

RESPONSE OF SOIL MICROORGANISMS AND MESOFAUNA TO EXPERIMENTAL EXCLUSION OF PRECIPITATION IN TROPICAL MONTANE RAINFORESTS

Dorothee Sandmann, Stefan Scheu, Valentyna Krashevska, Mark Maraun

Georg-August-Universität Göttingen, DE, dorothee.sandmann@googlemail.com

Tropical montane forest ecosystems strongly depend on regular cloud formation and high precipitation. Studies on deforestation in adjacent lowland forests and global warming scenarios predict a decline in air moisture content and precipitation in tropical montane forests. Although decomposer food webs control major ecosystem processes little is known on how soil moisture affects the structure and functioning of micro- and mesofauna in tropical montane forests.

We investigated consequences of rain exclusion on soil microorganisms and mesofauna along an altitudinal gradient in tropical montane forests in southern Ecuador. Rain exclusion strongly reduced microbial respiration, microbial biomass and ergosterol content at all altitudes by 60, 41 and 25%, respectively. Rain exclusion deceased densities of springtails (Collembola), moss mites (Oribatida) and predatory mites (Gamasida) and caused a distinct shift in community structure of Oribatida, but the effects declined with increasing altitude. A second sampling revealed that the effect of rain exclusion on mesofauna decreased with time. Densities of Collembola and Prostigmata in the rain exclusion treatments even exceeded that of the control.

The results document that reduced precipitation negatively affects soil microorganisms, but that soil mesofauna is not intimately linked to microorganisms as food. Overall, the results imply that community structure of Oribatid mites and species richness depend on soil moisture content, with the effect being more pronounced at lower altitudes. However, in the long termthe density of major mesofauna taxa is regulated by other factors than soil moisture. High density in rain exclusion plots suggests that microarthropods become increasingly important for decomposition and nutrient cycling under dry conditions.

Merian Award Applicant

ENZYMATIC RESPONSE OF SOIL MICROBES TO FOREST DISTURBANCE AND CONSEQUENCES FOR SOIL ORGANIC MATTER DYNAMICS IN A MOUNTAIN RAINFOREST REGION

Alexander Tischer[1], Evgenia Blagodatskaya[2], Ute Hamer[1]

[1]Technische Universität Dresden, Dresden, DE, alexander.tischer@tu-dresden.de
[2]Russian Academy of Sciences, Pushchino, RU

Ecosystem functions like the storage of C and nutrient supply (e.g. N and P) to primary producers are highly connected to the enzymatic activity of heterotrophic soil microorganisms. The enzymatic response of soil microbes to global change phenomena like forest disturbance and land-use change is crucial to the understanding of soil organic matter dynamics and functioning of tropical mountain ecosystems. We tested the hypothesis that production of extracellular enzymes is directly related to microbial limitation, microbial community structure and substrate availability. In addition, we proved the sensitivity of extracellular enzyme activities as indicators of human-induced alterations of ecosystems. The potential activity of six hydrolytic enzymes which are involved in the cycling of C, N and P was related to abiotic and biotic gradients along a forest-pasture-secondary succession-sequence. We explored three major drivers of enzyme activities according to their response to environmental changes: 1) cellobiohydrolase, β-glucosidase and N-acetylglucosaminidase were related to abiotic controls on microbial biomass (pH, N, organic P), 2) α-glucosidase and xylanase were associated with vegetation dynamics, and 3) acid phosphatase was activated by microbial demand. In general, the low hydrolytic enzyme activities indicated low decomposition intensity compared to lowland tropical ecosystems. Furthermore, a low soil P status was indicated by the extracellular enzyme activities and emphasized the importance of organic P cycling for the studied tropical sites. The activity of acid phosphatase pointed to microbial P-limitation at the natural forest and can be used as indicator for P-limitation at the ecosystem level. In comparison with the natural forest, an improved nutrient turnover was detected by enzyme activities directly after pasture establishment. During pasture use soil microbial activity shifted from C-limitation to N-limitation which led to an adapted enzymatic resource acquisition. The variation in extracellular enzyme activity caused by differences in microbial community structure was low suggesting functional similarity in the decomposition of simple organic material.

FROM ABANDONED SITES TO VALUABLE PASTURE LAND: A STORY OF SUCCESS IN ECUADORS HIGHLAND

Kristin Roos[1], Ute Hamer[2], Karin Potthast[2], Alexander Tischer[2], Erwin Beck[1]

[1]Dept. of Plant Physiology, University of Bayreuth, Bayreuth, DE, kristin.roos@uni-bayreuth.de
[2]Institute of Soil Science and Site Ecology, Dresden University of Technology, Dresden, DE

The problem of abandoning pastures because of heavy infestation by weeds, in particular by bracken fern (*Pteridium* spec.), is a general issue in the tropical Andes. Pastures which have been abandoned for that reason amount meanwhile to 11% of the area at the research site located in the San Francisco valley. Infestation by bracken fern and shrubs is a consequence of the traditional use of fire for clearing of the natural forest and pasture management. Growth of both, bracken and woody weeds, is fostered by recurrent burning. In a 2-phase experiment on a heavily bracken-infested slope at c. 2000 m altitude, substantial control of the weed and subsequent pasture rehabilitation could be achieved. Following our protocol, repasturisation requires about 2.5 years until the pastures can be used. Applying a balanced management of fertilization and grazing can lead into a sustainable reutilization of the abandoned areas and thus alleviate the pressure on the natural forests.

Merian Award Applicant

LAND USE CHANGE AND SPATIO-TEMPORAL DEVELOPMENT OF AN INVASIVE FERN COVER IN A BIODIVERSITY HOTSPOT

Giulia F. Curatola Fernández, Wolfgang Obermeier, Jörg Bendix

University of Marburg, Marburg, DE, gcuratola@pucp.edu.pe

The megadiverse tropical mountain forest of south-eastern Ecuador is mainly threaten by the slash and burn activity, a common technique to gain new pasture areas, and by the expansion of bracken fern, an extremely competitive weed which grows in anthropogenic fire-disturbed ecosystems.

We applied remote sensing techniques to investigate the land use change and landscape fragmentation in the last 30 years with focus on the lost of forest and the expansion of bracken fern and pasture lands. A time-series of Landsat scenes (1975-2002) was pre-processed and classified into the main land cover classes. We also explored the possibility to detect bracken fern frond state (live, fungi-infected, and dead) distribution in a high resoluted QuickBird scene of October 2010 which yielded good results.

We conclude that the deforestation process, the bracken fern colonization, and the landscape fragmentation have increased considerably in the last decades but not always at the same rate. Political decisions about land use management coincide to the changes observed. The resulted QuickBird classification shows a high dominance of dead fronds and a low occurrence of infected fronds. This could be explained by the extreme dry conditions observed that month.

Further classifications of other QuickBird scenes from March 2010 and November 2011 are in progress. Bracken cover change detection and niche modeling will shed some light on how strong climatic variables condition bracken's distribution.

Merian Award Applicant

DEFORESTATION AND FRAGMENTATION DRIVING LOSS OF ENDEMIC BIODIVERSITY IN SOUTH ECUADORIAN FORESTS

María Fernanda Tapia-Armijos[1,2], Jürgen Homeier[2], Carlos Iván Espinosa[1], Christop Leuschner[2], Marcelino De la Cruz[3]

[1]Departamento de Ciencias Naturales, Universidad Técnica Particular de Loja, Loja, EC, mftapia@utpl.edu.ec
[2]Albrecht von Haller Institute of Plant Sciences, Georg August University Göttingen, Göttingen, DE, mftapia@utpl.edu.ec
[3]Área de Biodiversidad y Conservación, Departamento de Biología y Geología, ESCET, Universidad Rey Juan Carlos, Madrid, ES

Deforestation and fragmentation are two of the main causes of tropical biodiversity loss; especially of endemic species which are highly vulnerable due to their restricted distribution and specific abiotic requirements. We evaluate land cover change in South Ecuadorian forests (Loja and Zamora Provinces – 21631 km^2) during 32 years, analyzing deforestation rates and the variation of forest spatial configuration over time by using selected landscape indices in order to understand the influence of these patterns on the habitat loss of endemic species. The area covered by original forest decreased from 19500 km^2 in 1976 to 10550 km^2 in 2008. In other words, approximately 46% natural forest has been replaced by other land covers by 2008. The annual deforestation rate associated to the South Ecuadorian forest was 2%for 1976 – 2008 period. The forest was principally converted to disturbed forest (3954 km^2), pastures (3654 km^2) and crop lands (631 km^2). The total number of natural forest fragments increased from 1957 in 1976 to 3831 in 1989, and then to 9988 in 2008. We found a decreased of mean patch size (15.1 km^2 in 1976 to 1.3 km^2 in 2008) and an increase of patch density, isolation of fragments and irregularity of patches shape which clearly showed a strong fragmentation process in the area. We constructed potential distribution maps for 390 endemic species (only were modeled those that had more than five occurrence points) using MAXENT and then using spatial analysis we defined areas with different concentration of endemic species. Relating the information of land cover change with the map of concentration of endemic species, we concluded that by 2008 the 71% of the surface with high concentration and the 60% of the area with medium concentration of endemic species have disappeared.

VEGETATION MODELLING IN A TROPICAL MOUNTAIN ECOSYSTEM

Silva Brenner, Jörg Bendix

University of Marburg, Marburg, DE, silvab@geo.uni-marburg.de

Local consequences of climate change can only be investigated using proper data and local simulations sharing concepts with global models. In the Rio San Francisco valley, southern Ecuador, a long-term ecological research has provided fundamental data and experience for understanding ecosystem functioning and implications of climate change in a tropical mountain ecosystem. In this work, a vegetation model has been developed to simulate existing physiological settings in interaction with the local atmosphere and substrate. For parameterization we considered two competing species in pastures and two woody-tree species to represent forest areas. The spatial context was given by current and future land use scenarios, as derived by spatial analysis. On one side we show results on the investigation of pasture invasion by a major weed (the bracken fern). On the other side we stress issues on climate regulating mechanisms of forests. We show how these local plant-functional-types respond to climate predictions and how a species-specific approach can be transferred to a basin-wide application using remote sensing. It can be expected that physiological aspects demand amendment of common practices of pasture management, forest and ecosystem conservation.

Merian Award Applicant

ECOLOGICAL QUANTIFICATION OF ECOSYSTEM SERVICES: A CASE STUDY IN THE TROPICAL ANDES OF SOUTH ECUADOR

Erwin Beck[1]

[1]*University of Bayreuth, Bayreuth, DE, erwin.beck@uni-bayreuth.de*

Ecosystem services have been differentiated into those which mainly serve the ecosystem effecting its functioning and stability and others which serve predominantly the well-being of its inhabitants (Millenium ecosystem assessment 2005). Monetary valuation of ecosystem services focuses mostly on traits or elements which warrant human welfare and safety ("The economics of ecosystems and biodiversity" TEEB 2011). This presentation poses the question of a non-monetary but ecological assessment particularly of those ecosystem services that contribute primarily to the maintenance of the ecosystem, the so-called "supporting" ecosystem services (MEA 2005). In a case study from the tropical Andes a comparative ecological valuation of several model ecosystems resulting from the conversion of the natural mountain rain forest into pastures has been attempted and will be presented. The work is based on a wealth of data from field experiments and model calculations in the scope of a Research Unit "Biodiversity and Sustainable Management of a Megadiverse Mountain Ecosystem in South Ecuador" (DFG RU 816).

SESSION:

DIVERSITY AND ECOLOGY OF TROPICAL FUNGI IN THE CONTEXT OF CLIMATE AND LAND USE CHANGE

[Short title: Tropical fungi]

Chair: Univ.-Prof. Dr. Meike Piepenbring
Contact: piepenbring@bio.uni-frankfurt.de

Fungi are often neglected in ecological studies because they are mostly microscopic organisms, difficult to handle, highly diverse, and poorly known, especially in the tropics. Nevertheless, it is impossible to understand and predict the effects of changes in land use and climate in tropical ecosystems without taking into account the fundamental ecosystem services delivered by fungi. In natural ecosystems, fungi decompose dead organic material, mycorrhizal and other mutualistic fungi contribute to the fitness of their partners, and parasites contribute to ecological equilibrium. Fungi interact with probably any other organism. Edible, medicinal, and other useful fungi contribute to human wellbeing, while parasites of crops, agents of diseases, fungi in human dwellings and many other fungi interfere with human interests. In the present session the following aspects shall be addressed, among other subjects concerning tropical fungi: - ecological and systematic diversity of fungi in the tropics - observed and postulated effects of climate change on tropical fungi, their interaction with other organisms, and their ecosystem functions - influence of land use changes on fungal diversity - phenology of tropical fungi - or how tropical fungi are adapted to changing weather conditions.

PHENOLOGY OF FUNGI IN SEASONAL DRY VEGETATION IN WESTERN PANAMA

Meike Piepenbring[1], Tina Antje Hofmann[2], Martin Unterseher[3], Orlando Cáceres[4]

[1]Goethe University, Frankfurt am Main, DE, piepenbring@bio.uni-frankfurt.de
[2]Universidad Autónoma de Chiriquí, David, PA
[3]University of Greifswald, Greifswald, DE
[4]Universidad Autónoma de Chiriquí, David, PA

During a period of two years (2009 - 2011), fungi and plants were surveyed every month on a 500 m long trail in secondary vegetation in tropical lowland of western Panama (Chiriquí Province). The climate of this area is characterized by a dry season approximately from December to April of the following year, as well as a rainy season from May to November, with a total of about 3,400 mm precipitation per year. The amount of leaf litter as well as data on precipitation, relative humidity (vapour pressure deficit), and temperature were recorded.

Species of gilled mushrooms (mainly Agaricales) developed fruiting bodies mainly at the beginning of the rainy season. They were mostly small and ephemeral, probably due to small amounts of nutrients available in litter and soil, mechanical damage by rain, as well as attack by moulds and insects. The number of agaricoid fruiting bodies on litter declined during the rainy season and correlated with the degradation of litter. Saprotrophic, wood-inhabiting fungi (mainly Hymenochaetales, Polyporales, and Xylariales) were abundant throughout the year, but new fruiting bodies mostly developed during the rainy season.

Species of plant parasitic groups like Meliolales, Phyllachorales, Pucciniales, thyriothecioid, and asexual fungi were abundant all over the year, except for the beginning of the rainy season, when most plants exhibited new foliage. Most deciduous and brevideciduous trees of different species were devoid of leaves synchronously at the end of a strong dry season. Thereby, they significantly reduced the incidence of fungal foliar pathogens.

Knowledge about the phenology of tropical fungi is still very scarce although urgently needed in the context of climate change research. Only when we understand adaptations of fungi to seasonal changes in their habitat, possible impacts of different climate conditions can be assessed.

TROPICAL RUST FUNGI

Ludwig Beenken

ETH Zürich, Zürich, CH, ludwig.beenken@env.ethz.ch

Rust fungi (Pucciniales/Uredinales, Basidiomycetes) comprise with estimated 8000 species the largest group of obligate phytoparasitic fungi. They have a complex life cycle with up to five spore types that often occur on different host plants. Most of the species show narrow and specific host ranges. Whereas most of the rust fungi are described from temperate climates, only a small fraction of species is known from the tropics. Whereas the life cycles, host ranges, distribution and further ecological features of many temperate species are well studied, the life of tropical rust fungi is still enigmatic. Most of the tropical species are only known from one or a few collections. Often only one spore stage is described. The determination of host plants is very elaborate or often impossible. By the example of rust fungi on Annonaceae, a pantropical tree family, it will be presented, how molecular technics can help to investigate tropical rust fungi. DNA sequencing allows identifying and distinguishing species that were difficult to separate only by morphology. DNA-barcoding could be a tool to assign several spore stages to one species. Thus host ranges and specificity can be ascertained. The knowledge on these basic characters of rust fungi, species identity, life cycle and host range, will be the fundament of any further ecological studies in tropical rust fungi.

BIODIVERSITY OF MUSHROOMS IN NORTHERN THAILAND FORESTS, ECONOMICS OF SUSTAINABLE FORESTRY PRACTICES

Samantha C. Karunarathna[1,2,3], Peter E. Mortimer[1,2], Jianchu Xu[1,2], Kevin D. Hyde[3,4,5]

[1]World Agroforestry Centre, China & East-Asia Office, 132 Lanhei Road, Kunming 650201, China, Kunming, CN, samanthakarunarathna@gmail.com
[2]Key Laboratory of Economic Plants and Biotechnology, Kunming Institute of Botany, Chinese Academy of Sciences, 132 Lanhei Road, Kunming 650201, China, Kunming, CN
[3]Institute of Excellence in Fungal Research, Mae Fah Luang University, Chiang Rai 57100, Thailand, Chiang Rai, TH
[4]School of Science, Mae Fah Luang University, Chiang Rai 57100, Thailand, Chiang Rai, TH
[5]Mushroom Research Foundation, 128 M.3 Ban Pa Deng T. Pa Pae, A. Mae Taeng, Chiang Mai 50150, Thailand, Chiang Mai, TH

Six areas with sustainable forestry practices in northern Thailand will be surveyed each year to establish the relationships between underground microbial diversity and land use. Our main objectives are threefold: to survey various forest land use plots to establish the underground microbial diversity and fungal production, to understand ethnomycological activities, and how mushroom gathering affects wild mushroom production and peoples' livelihoods.

Forests have a number of uses ranging from protected areas in national parks, natural and monoculture forested areas for timber production, and areas such as shade coffee and Miang tea. We carried out a preliminary survey showing how mushroom diversity is related to forest cover and tree diversity and document mushroom diversity in different forest types.

There is still much research to be done on wild edible fungi in Thailand. Very little is known, for example, about collecting practices in Thailand or the relative importance of wild edible fungi compared with alternative sources of food or income.

Sustainable use of wild edible fungi depends on minimizing the impact of harvesting on mushroom resources and the forest. Sustainable production of wild edible fungi includes how to maximize yields. The key to developing wild edible fungi as a local food or source of income is to examine its different uses and to learn more about local practices and community needs.

BIODIVERSITY AND PHYLOGEOGRAPHIC PATTERNS OF SPECIES OF THE GENUS LACCARIA

Flavius Popa[1], Kathrin Donges[1], Karl-Heinz Rexer[1], Zhu L. Yang[2], Marc-André Selosse[3], Kazuhide Nara[4], Gerhard Kost[1]

[1]Workgroup Mycology, Marburg, DE, F.popa@gmx.de
[2]Kunming Institute of Botany, Kunming, CN
[3]Evolutionary ecology, Montpellier, FR
[4]Department of Natural Environmental Studies, Tokyo, JP

Fungi occur in every part of the world but we are still far from recognizing their distributional patterns. In the past, well known fungi from Europe were identified worldwide across many ecosystems. This led to the impression that numerous fungi were distributed worldwide. On the other hand, many fungal species show a restricted distribution or co-evolution with host organisms. Ectomycorrhizal fungi play a key role in forest ecosystems. As mutualistic symbionts of trees they provide water and mineral nutrients. Many of these species are closely adapted to their hosts and/or habitats, others are considered to be generalists. Based on the ectomycorrhizal model organism *Laccaria amethystina* which has been proven to be a generalist in Europe, we want to question the hypothesis of a worldwide distribution of this species. *L. amethystina* is easily recognized even in the field; therefore records from all over the world exist. Studying collections from East Asia, we could show that none of these represent *L. amethystina* but had to be described as new species. The diversity of the species of the genus *Laccaria* will be shown and the phylogeographic patterns of the *L. amethystina* species complex will be discussed.

Merian Award Applicant

ARBUSCULAR MYCORRHIZAL FUNGI IN A TROPICAL MONTANE FOREST SOIL OF SOUTHERN ECUADOR: EXTRARADICAL HYPHAE AND FERTILIZATION EFFECTS

Tessa Camenzind[1], Alicia May Donnellan Barraclough[2], Antje Gensing[1], Juergen Homeier[3], Matthias C. Rillig[1]

[1]Freie Universität Berlin, Berlin, DE, TessaC@zedat.fu-berlin.de
[2]Lund University, Lund, SE
[3]Georg-August University of Göttingen, Göttingen, DE

The dominance of arbuscular mycorrhizal fungi (AMF) as root symbionts in tropical forests has been shown by numerous studies. However, further research on functionality and patterns related to this ecosystem type is missing. Here, we present the response of AM abundance after nutrient additions in a pristine tropical montane forest, studied within the framework of a multi-disciplinary nutrient manipulation experiment (NUMEX). Our results (after two years of nutrient additions) showed a significant decrease of intraradical AMF structures after nitrogen (N) additions at the ecosystem-scale. However, a more detailed analysis revealed that this pattern may vary among different plant species: in the case of *Graffenrieda emarginata* (Ruiz & Pav.) Triana (Melastomataceae) we observed the opposite response, with N additions causing AMF increase in roots. In contrast, phosphorus (P) additions had no significant effects. These findings suggest an important role of AMF in the N uptake in this ecosystem and point to an involvement of AMF in the outcome of potential plant community shifts.

Additionally, the unusual ramification pattern of the extraradical mycelium in the deep organic layer (characteristic for tropical montane forest sites with slow decomposition rates) was analyzed. After the optimization of methods for this substrate, we were able to detect high extraradical hyphal abundance (on average 10.4 m g-1 soil) that remains hidden by standard methodological approaches. Nearly one third of AM hyphae were closely attached to/or even directly colonized decomposing leaf material, and half of the hyphae were located at the root surfaces. These findings support recent reports that AMF are well adapted to highly organic soils and even may be indirectly involved in soil decomposition processes.

Merian Award Applicant

COMMUNITIES OF ARBUSCULAR MYCORRHIZAL FUNGI IN TROPICAL HIGH MOUNTAINS OF SOUTH ECUADOR

Ingeborg Haug[1], Juan Pablo Suárez[2]

[1]Evolutionäre Ökologie der Pflanzen, Eberhard-Karls-Universität Tübingen, Tübingen, DE, ingeborg.haug@uni-tuebingen.de
[2]Departamento de Ciencias Naturales, Universidad Técnica Particular de Loja, Loja, EC

Arbuscular mycorrhizal fungal diversity and composition is still relatively unknown in many ecosystems and especially in the tropical high mountains. We investigated the communities of arbuscular mycorrhizal fungi of trees and shrubs in the subpáramo (2900 - 3400 m o.s.l.) of Cajanuma in the Podocarpus National Parc, South Ecuador. The arbuscular mycorrhizal fungi were analysed with molecular methods sequencing part of the 18S rDNA. The sequences were classified in Operational Taxonomic Units (OTUs) and analysed with phylogenetic methods. Our studies revealed an astonishing richness of Acaulosporaceae. Members of Glomerales, dominating in many other studies, occurred in lower numbers. We compare our results with comprehensive datasets of arbuscular mycorrhizal fungi in tropical montane forests at the altitudinal level of 2000 m and 1000 m.

ENDOPHYTIC FUNGI FROM PERUVIAN HIGHLAND AND LOWLAND HABITATS FORM DISTINCTIVE AND HOST PLANT-SPECIFIC ASSEMBLAGES

Martin Unterseher[1], Romina Gazis[2], Priscila Chaverri[3], Carlos Fernando García Guarniz[4], Diógenes Humberto Zavaleta Tenorio[4]

[1]Ernst-Moritz-Arndt University, Institute of Botany and Landscape Ecology, Greifswald, DE, martin.unterseher@uni-greifswald.de
[2]Clark University, Biology Department, Worcester, US
[3]University of Maryland, Department of Plant Science and Landscape Architecture, Maryland, US
[4]Instituto Nacional de Innovación Agraria de Amazonas – INIA, Estación Experimental Chachapoyas, Chachapoyas, PE

The biodiversity and ecology of leaf-inhabiting endophytic fungi is not sufficiently assessed yet, because important parameters such as host specificity, substrate change and species concepts in this heterogeneous ecological guild of plant-associated microfungi are not understood. For the past four decades culturing has been the method of choice in endophytology. This has created data sets which are often biased by undersampling of the underlying community. In the present study endophytic ascomyceteous fungi were isolated from the plants Vasconcellea microcarpa and Tillandsia spp. in Peru and sequenced for their ITS rDNA region. Together with additional endophytic sequences from different Peruvian collections the own data were analyzed with respect to host specificity and geographic position. Results from this study showed that the endophytic species composition significantly varied among different Peruvian host plants. In addition, clear phylogenetic overlap between different fungal assemblages were found within some fungal groups (e.g. Xylariales and Pleosporales), irrespective of the host plant. Findings from this study give raise to the formulation of hypotheses in respect to altitudinal change of endophytic communities along the Eastern Andean slopes. These hypothesis and perspectives for fungal biodiversity studies and conservation in Peru are also addressed.

SPECIFICITY OF THE FUNGI USED IN CARTON RUNWAY GALLERIES IN THE *AZTECA BREVIS* / *TETRATHYLACIUM MACROPHYLLUM* ASSOCIATION

Maximilian Nepel[1], Veronika Mayer[1], Hermann Voglmayr[2], Jürg Schönenberger[1]

[1]*Department of Structural and Functional Botany, Faculty Centre of Biodiversity, University of Vienna, Vienna, AT, mnepel@gmail.com*
[2]*Department of Systematic and Evolutionary Botany, Faculty Centre of Biodiversity, University of Vienna, Vienna, AT*

In recent years, more and more ant-plant-fungus symbiotic associations have been discovered in myrmecophytes that include over 10 genera of ants, 24 genera of plants and usually unknown species of fungi. The fungi belong mostly to the order Chaetothyriales (Ascomycetes), the so-called black yeasts. Chaetothyriales are known to have two types of interactions with ants: (1) as components in ant-built carton-like structures, e.g. runway galleries, and (2) as fungal patches within living chambers (so-called domatia), provided by myrmecophytic plants. In carton as well as in domatia, the fungi have seemed to be specific for each ant–plant symbiosis (Voglmayr et al. 2011).

The research presented here was focused on carton fungi and their specificity in the tripartite association among *Azteca brevis* (Formicidae, Dolichoderinae), *Tetrathylacium macrophyllum* (Salicaceae), and Chaetothyriales. In this study, carton fungi of 19 trees colonized by *A. brevis*, were cultivated in pure cultures and analysed molecularly, using the partial SSU, complete ITS, 5.8S, and partial LSU region. An unexpected result was the documentation of 128 different black-yeast genotypes. In addition, these genotypes were found to be distributed all over the phylogenetic tree of Chaetothyriales, except in the domatia symbiont clade. On one hand this supports the hypothesis of specific domatial fungi, and on the other hand the unexpected high diversity of Chaetothyrialean genotypes for carton fungi implies less specificity in this type of interaction. A presence–absence matrix for the distribution of genotypes confirmed this assumption. There was no genotype that could be isolated on all trees. The most common one was present on 9 out of 19 trees. A potential correlation between collection site and set of genotypes was not supported by statistical analyses using Bray Curtis similarities.

The data imply that A. brevis does not cultivate specific carton fungi and statistical analyses point to a stochastic distribution of fungi. Nevertheless the enormous diversity of occurring Chaetothyriales does not seem to be an accident.

VOGLMAYR, H., MAYER, V., MASCHWITZ, U., MOOG, J., DJIETO-LORDON, C. & BLATRIX, R. 2011. The diversity of ant-associated black yeasts: insights into a newly discovered world of symbiotic interactions. *Fungal Biology*115:1077–91.

Merian Award Applicant

THURSDAY 17:15

SESSION:

COMMUNITY ECOLOGY

[Short title: Community ecology]

Chair: PD Dr. Jan Beck
Contact: jan.beck@unibas.ch

Most tropical biota are characterized by extremely dense species packing. Disentangling the rules and processes that regulate the assembly of highly diverse communities remains one of the great challenges of tropical ecology. Intricately connected with this search for assembly rules are two questions that urgently emerge when facing climate and land-use change: (1) How do species-rich communities behave under ongoing pressure accruing from ever increasing human resource demands? (2) To what extent will functional diversity within communities, and thus the ecosystem services provided by tropical biota, be maintained when species composition may radically, and quickly, be altered? The presentations in this session draw together recent research on the patterns and processes in tropical species assemblages, with focal organisms ranging from primary producers and protozoans across invertebrate animals to primates.

FUNCTIONAL DIVERSITY AND FUNCTIONAL REDUNDANCY IN MADAGASCAN TADPOLE ASSEMBLAGES REVEAL PATTERNS OF COMMUNITY ASSEMBLY

Julian Glos[1], Axel Strauß[2], Roger Daniel Randrianiaina[2,3], Ulrich Struck[4], Miguel Vences[2]

[1]University of Hamburg, Hamburg, DE, julian.glos@uni-hamburg.de
[2]Technical University of Braunschweig, Braunschweig, DE
[3]Université d'Antananarivo, Antananarivo, MG
[4]Museum für Naturkunde, Berlin, DE

Functional diversity illustrates the range of ecological functions in a community. It allows revealing the appearance of functional redundancy in communities and thereby processes in community assembly. Functional redundancy illustrates the overlap in ecological functions of community members which may be an indicator of community resilience. We evaluated patterns of species richness, functional diversity and functional redundancy on the world's richest tadpole assemblages in rainforest streams in Madagascar (Ranomafana National Park).

We found a wide range of species richness in tadpole assemblages from two to 18 species in 30m stream sections. Along this species richness gradient, we analyzed functional diversity and redundancy on two sets of variables: (1) we quantified functional diversity (i.e., FD index) of all communities considering the similarity and dissimilarity of species in 18 eco-morphological traits related to habitat use and foraging, and (2) we quantified trophic niches of tadpoles via stable isotope ratios ($\delta^{13}C$ and $\delta^{15}N$).

In particular the most species-rich communities were characterised by an overlap of species function, i.e. by functional redundancy (revealed by null-model analyses). Accordingly, communities with low species richness accumulate functional traits randomly, whereas species in species-rich communities are more similar to each other than predicted by random assemblages and therefore exhibit an accumulation of stream-specific functional traits. Beyond a certain species richness level, therefore, stream-specific environmental filters exert influence whereas interspecific competition between species does not influence trait assemblage at any species richness level.

SELECTIVE LOGGING AND CLIMATE EXTREMES: MUTUAL DETERMINANTS OF COMPOSITION IN TROPICAL AMPHIBIAN ASSEMBLAGES?

Monique Hölting[1,2], Raffael Ernst[1]

[1]*Senckenberg, Dresden, DE, monique.hoelting@senckenberg.de*
[2]*TU, Berlin, DE, monique.hoelting@senckenberg.de*

The analysis of variation in species composition (beta-diversity) can provide fundamental insight into the processes leading to either homogenisation or diversification of tropical ecosystems that are exposed to human disturbances and/or climatic changes. However, observed beta-diversity patterns may not only differ according to the respective driver (human or natural disturbance) but also with regard to the spatial scale of the analysis and/or the diversity component analysed.

In our study we investigate beta-diversity pattern changes of Guiana Shield rainforest amphibian assemblages exposed to (a) selective logging and (b) extreme weather anomalies. We specifically analysed compositional change at three different spatial scales (beta-diversity levels) and different species rarity-dominance weight ratios. Data was collected in three consecutive years (2009-2011) within a controlled polycyclic timber harvesting scheme implemented by our project partner Iwokrama International Centre for Rainforest Conservation and Development. In addition to the logging impacts, the study area was exposed to an extreme weather anomaly during the first sampling year, resulting in a prolonged drought period. We therefore addressed the question whether extreme weather anomalies may enhance potential effects of selective logging on beta-diversity patterns. Our results show that selective logging had a rapid but also complex effect on amphibian composition. Each of the analyzed beta-diversity levels revealed another dimension of the observed shifts in species composition. Furthermore beta-diversity patterns differed not only depending on time since logging, but also with regard to the emphasis given to rare or abundant species in the analysis. The prolonged drought period in 2009 further influenced diversity patterns. Even though impacted communities remained stable under the climate extreme event, pristine communities were very sensitive to the drought. Our results show that it is important to consider synergistic effects when interpreting diversity pattern changes.

GENETIC RELATEDNESS, GENE FLOW AND COMPETITION IN CO-OCCURRING TROPICAL TREES IN BORNEO, IMPLICATIONS FOR SPECIES COEXISTENCE

Claire Tito de Morais[1], Chris J. Kettle[1], Colin R. Maycock[2], Eyen Khoo[2], David F.R.P. Burslem[3], Jaboury Ghazoul[1]

[1]Ecosystem Management, Institute of Terrestrial Ecosystems, ETH, Zurich, CH, claire.tito@env.ethz.ch
[2]Forest Research Center, Sabah Forest Department, Sandakan, MY
[3]nstitute of Biological and Environmental Sciences, Aberdeen, UK

The spatial distribution of genetic diversity in forest trees has considerable relevance for the viability of tropical forest tree species and community structure. Dipterocarp trees are the dominant family of lowland tropical forests in Southeast Asia. They occur at low densities at the landscape level, but may possess clumped distributions at the stand level, largely due to poor seed dispersal. Limited seed dispersal may lead to aggregation of closely related progeny. We explore the fine scale spatial genetic structure (FSGS) in three co-occurring dipterocarp species in a tropical rain forest in Borneo. Our study is located in a 160ha plot in Sepilok Forest Reserve on the east cost of Sabah, Malaysia. All mature dipterocarp trees (N = 850) were mapped, and all individuals from three species were genotyped (N = 668) at 8-10 microsatellite loci. The aim of this study is to investigate the implications of FSGS and relatedness among conspecifics for species coexistence. We hypothesize that species with limited seed dispersal have greater pollen dispersal distances, and reduced competition among more distantly related progeny. Shorea gibbosa, Shorea mecistopteryx and Shorea smithiana share limited seed dispersal but differ in flower size, pollinator size and pollen dispersal. We relate adult tree spatial distribution of genetic diversity patterns to pollen and seed dispersal potentials based on flower size, fruit size and pollinator size associations. In addition, we present initial results on the implications genetic relatedness for competitive interactions among seedlings. Understand drivers of FSGS and its relevance for species coexistence is important to manage such highly diverse and productive plant communities. The disruption of gene flow by forest fragmentation and land-use changes will affect the tree species viability and consequently the community structure of tropical forests. Our results are therefore relevance to forest conservation and restoration in Southeast Asia.

Merian Award Applicant

PROCESS-BASED MODELING OF PLANT SPECIES RICHNESS IN SOUTH AMERICA

Eduardo L. Hettwer Giehl[1], Juliano Sarmento Cabral[2], Holger Kreft[2], Gustavo H. Carvalho[1], Marco A. Batalha[1], Ary T. Oliveira-Filho[3]

[1]Ufscar, São Carlos, BR, eduardohet@gmail.com
[2]University of Göttingen, Göttingen, DE
[3]UFMG, Belo Horizonte, BR

Correlative ecological studies are generally inconclusive because several processes may result in similar ecological and evolutionary patterns. Alternatively, the importance of processes may be tested by simulation experiments, hereafter process-based models. In this study, we simulated process-based models to weigh the importance of dispersal limitation and niche conservatism to explain current plant species richness patterns in South America. We obtained species richness patterns by assembling a dataset for plant distribution with more than 2 million records and counting species overlay on a 1 x 1 degree grid cells over the whole continent. First, we standardized plants names and checked for biases in sampling effort for every grid cell. Next, we excluded incompletely sampled cells and extrapolated species richness for the remaining ones as an estimate of observed species richness. We then simulated species dispersal, generation, and extinction in a spatially explicit framework for the same South American grid. Different parameters enabled us to check for distinct scenarios where dispersal limitation and niche conservatism were either high or low, with two additional parameters controlling extinction and speciation probability. Furthermore, we included an initial tropical-like set of stable climatic conditions, which were followed by climatic fluctuations based on temperature cycles during the last 2 million years before present. Simulated and observed species richness showed slightly higher correlations for scenarios with low dispersal and niche evolution abilities. Thus, process-based models seem to be promising tools for uncovering the most important ecological processes underlying species richness patterns in South America.

GENETIC DIVERSITY AND POPULATION DYNAMICS IN A BIODIVERSITY HOTSPOT

Aline Finger, Markus Ruhsam, Antje Ahrends, Pete Hollingsworth

Royal Botanic Garden Edinburgh, Edinburgh, UK, a.finger@rbge.org.uk

New Caledonia is a global biodiversity hotspot with an immense level of endemism, 77% of the vascular plants being endemic. The region is particularly important for its conifer rich flora. Despite having a small land mass (18,575 km^2) the territory is home to 43 endemic conifer species, seven percent of the World's total conifer species. 13 of the worldwide 19 *Araucaria* species occur in New Caledoniain habitats and soil types ranging from coastal to mountain tops, and from calcareous to ultramafic soils. Due to human settlement and the introduction of invasive species, anthropogenic induced fires, agriculture, urban development and especially mining activities, many species have been reduced in size and lost major parts of their natural habitats. Thus, 29 conifer species are listed as threatened under IUCN classification of which 11 are *Araucaria* species. In this study we explore reasons for the high Araucaria species diversification in New Caledonia and also try to elucidate gene flow barriers and pathways for species by use of nuclear and chloroplast microsatellite markers as only little is known about population dynamics of *Araucaria* species in New Caledonia. Conservation implications are being discussed.

Merian Award Applicant

FEEDING GUILD COMPOSITION AMONG CATERPILLAR ASSEMBLAGES ON SELECTED SHRUBS AND TREELETS IN THE ANDES OF SOUTHERN ECUADOR

Florian Bodner[1], Lisamarie Lehner[1], Darinka Blies[1,2], Konrad Fiedler[1]

[1]*University of Vienna, Vienna, AT, florian.bodner@univie.ac.at*
[2]*Universität Trier, Trier, DE*

The moth fauna of the Podocarpus National Park and the adjacent Reserva Biológica San Francisco, in the montane forest zone of southern Ecuador, has been identified, through extensive light trapping, as a global diversity hotspot of the Lepidoptera.

To assess their functional role in the ecosystem, we surveyed caterpillars and allocated them to feeding guilds based on extensive trials. Altogether we considered seven feeding guilds, the most prevalent of which were ectophagous folivores, semi-endophagous folivores and epiphyll feeders.

Caterpillars were systematically collected from 39 shrub and treelet species from five families (Asteraceae, Chloranthaceae, Melastomataceae, Piperaceae, Poaceae), yielding a total of more than 20 000 individuals. Sampling was performed non-destructively by visual screening and branch-beating. We compared caterpillar assemblages between different habitats (forest and succession sites) and elevations (1000, 2000 and 3000 m a.s.l.).

A surprisingly large fraction of caterpillars on all studied plant taxa showed no trophic connection to living tissues of the plant they inhabited. Overall these contributed ~25% to the dataset, ranging up to 80% on individual plant species. Mostly, these fed on foliose lichens, epiphyllic crustose lichens and algae, or detritus, but also on mosses. The importance of non-folivorous feeding guilds decreased strongly at higher elevations and in open succession habitats. Semi-endophagous caterpillars (shelter builders, concealed feeders) were least prominent at intermediate elevations. They were much more important at low elevations and even more so at the highest elevations, where they also included species from taxa not usually known for this bionomic strategy (e.g. the geometrid genus *Eois*). These results demonstrate that tropical caterpillar assemblages are functionally far more diverse than just foliage-feeders and their functional composition changes along ecological gradients in the Andean montane forest.

TROPHIC DIVERSITY OF BORNEAN SOIL ANTS AS REVEALED BY STABLE NITROGEN AND CARBON ISOTOPES

Dirk Mezger[1], Martin Pfeiffer[1,2]

[1]Institute of Experimental Ecology, University of Ulm, Ulm, DE, dirk.mezger@uni-ulm.de
[2]Department of Ecology, National University of Mongolia, Ulaanbaatar, MN

Ants are a diverse and important arthropod group in all rain forests with a many different feeding habits. We studied the food web of the ground ant fauna in several forest types of Gunung Mulu NP in Sarawak, Malaysia, and analyzed the δ 15N and δ 13C stable isotope values of 151 species. We tested four hypotheses: (A) ant subfamilies, genera and species differ in their trophic position, (B) trophic positions of ant species are non-randomly distributed within a community, (C) trophic position of ant species may change in different forest types, and (D) ant species differ in their use of mutualistic hemipteran trophobionts, sucking at various plant species.

(A) Even on subfamily level, some dietary specialists could be detected, e.g. the Aenictinae which are predators of other ants. Trophic position of ant genera within subfamilies and species within a genus differed as well.

(B) Trophic positions within the ant community were randomly distributed, pointing towards a community with low competition.

(C) Certain species differed in their trophic positions in different forest types (corrected δ ^{15}N values of alluvial versus limestone forest: *Strumigenys rotogenys* 8.44 ‰ vs. 6.15 ‰ and *Technomyrmex lisae* 3.01 ‰ vs. 4.06 ‰).

(D) δ ^{13}C values of plant sucking hemipterans could be related to δ ^{13}C values of their host plants. Ants attended trophobioses on two different groups of plants: climbing bamboo (*Dinochloa* sp.) and various woody plants. *Camponotus arrogans* preferred trophobioses on *Dinochloa* sp., while *Dolichoderus indrapurensis* attended mostly hemipterans on other plants.

Separation of trophic niches in Bornean ant species occurred at different levels of phylogeny. However, food preferences did not structure ant communities and behavioral character displacement of species in different habitats reduced dietary overlap among species. Our results demonstrate the high flexibility of social organisms, which are adapted to the stochastic nature of the rainforest.

Merian Award Applicant

ABUNDANCE PATTERNS OF ARTHROPOD FEEDING GUILDS ON TREELETS ACROSS DIFFERENT AFFORESTATION REGIMES IN THE CLOUD FOREST ZONE OF SOUTHERN ECUADOR

Marc-Oliver Adams, Konrad Fiedler

University of Vienna - Department of Tropical Ecology and Animal Biodiversity, Vienna, AT, marc-oliver.adams@univie.ac.at

Afforestation with native timber species has been proposed as an economically and ecologically viable approach to reclaiming abandoned pastureland, potentially providing local smallholders with subsidiary income, sustaining a larger proportion of local biodiversity and offering better prospects of subsequent restoration. Over the course of two years, we sampled arthropod communities on treelets (64-474cm high) in primary forest and along a gradient of adjacent afforestations, established on recently abandoned pastures, among early secondary shrub vegetation, and under a nursery canopy of *Pinus patula*, respectively. We focused on two high-value timber species (*Tabebuia chrysantha*, *Cedrela montana*) and one fast-growing tree (*Heliocarpus americana*) that may be useful to establish nursery stands. Arthropods were assigned to feeding guilds according to available literature. Overall abundance across the three largest guilds (i.e. predators, chewing and sucking phytophages) was relatively low. Sucking phytophages were essentially dominated by two species of Psyllidae and Tingidae (specific to *C. montana* and *H. americana*, respectively) and one species group of Cicadellidae (specific to *T. chrysantha*). Plantations in early secondary vegetation harbored considerably fewer predators and chewing phytophages than treelets under forest cover. Sucking phytophages as a whole did not differ significantly between habitats, but individual species attacked treelets more in pasture and pine habitats. Host tree species had no effect on the abundance of chewing phytophages, while predators and sucking phytophages were significantly more numerous on *H. americana*. Arthropod abundance varied significantly over time. The observed circa-annual fluctuations in abundance are likely due to seasonal changes in precipitation and humidity, while inter-annual differences probably resulted from a drought event. Tree plantations in secondary shrub vegetation – though floristically more diverse – seem to support significantly fewer arthropods, possibly curtailing their abilitypotential to support local biodiversity.

Funded by the German Research Foundation (DFG) within the Research Unit 816.

SOIL FAUNA COMMUNITY SUCCESSION IN DIFFERENT TREE SPECIES PLANTATIONS ON DISTURBED AREAS IN SOUTH ECUADOR.

Pablo Ramírez[1,2], Lukas Jurkschat[1], Stefan Scheu[1]

[1]Georg August Universität, Göttingen, DE, pd.mandragora@googlemail.com
[2]Universidad Técnica Particular de Loja, Loja, EC, pd.mandragora@googlemail.com

Tropical mountain rain forest of the Andes in southern Ecuador has been converted in large pasture areas. These pastures increasingly become invaded and overgrown by southern bracken fern (*Pteridium arachnoideum*), a fire resistant species, which is difficult to eradicate. To convert such degraded pastures to forests, experimental plots planted with aliso (*Alnus acuminate*), pine (*Pinus patula*) and eucalyptus (*Eukalyptus saligna*) have been established. To investigate changes of soil fauna communities with reforestation we studied changes in soil fauna communities, especially oribatid mites, one of the main soil decomposer groups.

Soil samples were taken for investigating both soil animals and microorganisms. The cores for soil fauna were divided in litter layer (leaf litter and decomposing organic matter) and mineral soil (5 cm bellow the litter layer).

Compared to the abandoned pastures reforestation generally led to an increase in diversity of oribatid mites species and density of soil animals. Also, the different reforestation treatments differed markedly with the *Pinus* sites harboring the highest abundance of soil animals and largest number of oribatid mite species. The results suggest that soil properties as well as abiotic conditions are changing with reforestation due to higher quality litter and input of root exudates providing a more favorable food source and increasing soil moisture through shelter from solar radiation. The reforested sites therefore provide more favorable conditions for soil animals and form a transition stage towards restoring more natural conditions on abandoned pastures.

UNLIKE FELLOWS - A REVIEW OF PRIMATE - NON-PRIMATE ASSOCIATIONS

Eckhard W. Heymann

Deutsches Primatenzentrum, Göttingen, DE, eheyman@gwdg.de

Interspecific associations between different primate species have been studied in detail, but associations between primates and non-primate animals have received considerably less attention. In fact, most pertinent information is of anecdotal nature and few systematic studies exist. I reviewed the available literature on associations between primates and other animals, to examine the following questions: (1) Which kinds of primate – non-primate associations have been reported? (2) Is there a geographic pattern in the kind of association? (3) What are the supposed benefits of these associations, and how are they distributed amongst association partners? Most information refers to primate-bird and primate-mammal associations, while associations with other vertebrates or invertebrates are rarely reported. Primate-bird associations dominate in the Neotropics, while both primate-bird and primate-mammal associations are more or less evenly common in the Paleotropics. In most cases, the non-primate partners are the beneficiaries of association, with benefits mainly relating to increased access to food resources and eavesdropping on the vigilance and alarm calling of primates. Primates on the other hand seem to derive no benefits from associating with non-primates. Thus, these associations can be largely characterized as commensalistic, in contrast to primate-primate associations which are often mutualistic. The implications of such associations for the populations of the non-primate partners are largely unknown, but maybe larger than currently supposed.

OF POPULATIONS, POOLS AND PECCARIES: ECOSYSTEM ENGINEERS FOR NEOTROPICAL RAINFOREST FROGS

Ringler, Max[1,2], Hödl, Walter,[1], Ringler, Eva[1], [3]

[1]University of Vienna - Department of Integrative Zoology, Vienna, AT, max.ringler@univie.ac.at
[2]University of Vienna - Department of Tropical Ecology and Animal Biodiversity, Vienna, AT
[3]University of Vienna - Department of Cognitive Biology, Vienna, AT

'Ecosystem engineering' refers both to technical measures in conservation, as well as to the alteration of the habitat of one species by another. In the latter sense, the mechanism and processes involved have become a focus in ecological research. Here we present the results of a 4-year population-wide experiment, simulating the impact of an important non-human ecosystem engineer for Neotropical rainforest frogs. The installation of artificial pools, mimicking peccary (Tayassuidae) wallows, in a population of the frog *Allobates femoralis* (Aromobatidae) led to almost a doubling in population size within two years. Our detailed pedigree analysis revealed that this increase was only due to higher autochthonous recruitment, resulting from a higher per-capita reproductive rate of males, and a higher proportion of females with reproductive success. This differential response reflects the reproductive behaviour of *A. femoralis*, where males who have to transport the tadpoles to terrestrial bodies of water are the exclusive direct users of aquatic sites. Our study quantifies the impact ecosystem engineers can have on other species and underlines that such non-trophic relations have to be considered in management and conservation. Our results also suggest that 'engineered' conservation measures for anurans, especially Dendrobatoidea, should be considered in the ongoing efforts against the 'global amphibian decline'.

SESSION:

FREE TOPICS

[Short title: Free topics]

Chair: PD Dr. Pia Parolin
Contact: pparolin@botanik.uni-hamburg.de

OIL IN THE PERUVIAN AMAZON: FLUVIAL LOAD, SALT LICKS/ OIL SPILLS CONFUSION, OIL INGESTION & ILLEGAL LOGGING

Marti Orta-Martinez[1,2], Mar Cartro-Sabate[1]

[1]Institut de Ciència i Tecnologia Ambientals - Universitat Autònoma de Barcelona, Barcelona, ES, martiorta@gmail.com
[2]Centro di Documentazione sui Conflitti Ambientali, Roma, IT, martiorta@gmail.com

The Peruvian Amazon is one of the most biodiverse regions on Earth and is also home to around 60 distinct groups of indigenous peoples. Underlaying this territory there are large reserves of oil and gas. An unprecedented 48.6% of the Peruvian Amazon has been recently covered by oil and gas concessions, up from just 7.1% in 2003. These oil and gas concessions overlap 17.1% of the Peruvian Amazon protected area system and over half of all titled indigenous lands and reserves for indigenous people in voluntary isolation. Moreover, up to 69.1% of the Peruvian Amazon has been under oil or gas concession at some point between 1970 and 2009. A similar pattern is affecting the whole western Amazon where about 180 oil and gas blocks now cover 688,000 km^2. At the end of the 1960s, the concessions 1AB and 8 were drawn over the territories of the Achuar and Kichwa indigenous people, in the northern Peruvian Amazon. These blocks are the longest running oil projects in the Peruvian rainforest and the most productive in the country. In this paper, a spatial analysis of oil pollution exposure in block 1AB has been conducted, combining data gathered by an indigenous participatory monitoring project of oil spills with spatial hydrology tools and novel approaches on oil ingestion and fauna mobility. Results show that more than 24 million oil barrels have been spilled in the area and that more than 1000 km of streams and rivers, almost a quarter part of the surface water of the oil block, may be affected. Regarding salt licks and oil spills confusion by game mammals (*Tapirus terrestris*, *Tayassu pecari*,*Pecari tajacu*, *Mazama Americana* and *Cuniculus paca*) and according to our analysis on oil ingestion risk and species' home ranges, we found that the area exposed to oil pollution covers 94.2% of the oil block concession. A multi-temporal analysis of Landsat images conducted to detect illegal logging shown a close association between oil infrastructure and forest disturbance.

Merian Award Applicant

FRIDAY 14:30

SCIENCE AND ACTION IN PROTECTED AREAS: ASSESSING VULNERABILITY AND PLANNING FOR ADAPTATION IN THE SIERRA MADRE ORIENTAL, MEXICO

Alejandro von Bertrab[1], Andrew Rhodes[2], Xóchitl Cantellano[1], Andreas Gettkant[1]

[1]Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), GmbH, Eschborn, DE, alejandro.bertrab@giz.de
[2]Comisión Nacional de Áreas Naturales Protegidas (CONANP), Mexico, DF, MX

The project „Climate Change and Protected Area Management" (01.2011-11.2014), commissioned by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), is implemented together with the National Commission on Protected Areas (CONANP) of Mexico's federal government in the central region of the Sierra Madre Oriental. This region is considered a biodiversity hotspot and hosts a wide variety of forest and wetland ecosystems, flagship and endemic species (amphibians, felines, birds, trees, etc.). There are several protected areas in the region with which the German Development Cooperation (GIZ) is working. The key aim of the project is to ensure that protected areas integrate climate change as a key element in their strategies, management plans and concrete actions that contribute to climate change adaptation and mitigation as well as to nature conservation.

One of the activities carried out in the onset of the project is a multidisciplinary vulnerability analysis to climate change and other factors (such as land use change, ecosystem degradation, among others) of ecosystems and local rural populations. Some of the most important results of this study, which compared and contrasted key scientific information with local farmer perceptions of change, include the identification of threats and impacts related to climate change on key ecosystems, species and local livelihood strategies. Based on the findings, a catalogue of adaptation and mitigation measures and various practical tools for project implementation have been developed in order to assist the GIZ and CONANP in working with local rural communities and municipalities in planning and implementing measures. Key themes addressed in the measures include the promotion of agroecological practices to improve agrobiodiversity, agroforestry, water management, ecological restoration, connectivity of forest areas and integrated fire management.

AGRICULTURE IN THE TROPICS: APPLICATION OF AN INTEGRATIVE LAND-USE APPROACH

Luz Maria Castro[1], Baltazar Calvas, Thomas Knoke

[1]Institute of Forest Management, Technische Universität München, Freising, DE, luces_c@yahoo.es

In order to feed a population estimated to reach 9 billion people by 2050, food production must increase by 70%. This can be accomplished by raising yields on land already being farmed using agricultural technologies to avoid further land-use change and impacts on climate. The application of intensive practices affects the ecosystems at both the micro and macro scales. At the farm level, intensification can produce negative externalities such as water pollution, soil degradation and the reduction of biodiversity due to the overuse of fertilizers and pesticides. At the landscape level, the use of monocultures led to the homogenization of the landscape preventing the flow of biodiversity. To moderate the negative effects of intensification, we propose the application of the Odum´s compartment Approach (OCA) which combines the benefits of sustainable agricultural intensification with the restoration of previously abandoned lands through reforestation. The model was applied for medium-scale farm of 100 hectares in Ecuador using crops currently produced in monocultures (rice, banana, maize, soybean and cacao) and two tree species (laurel and balsa). For optimized land allocation the OCA was coupled with the Modern Portfolio Theory, based on the financial performance of the assets. Our results showed that the application of an integrative land-use approach can lead to a diversified portfolio with 38% rice, 13% maize, 9% soybean 1% cocoa, 26% balsa and 13% laurel. This mix resulted in a mean annual financial yield of US$325 ha^{-1} $year^{-1}$±49. The share of forestry is almost 40% of the total land under use, due to the use of short rotation tree species able to deliver returns in relatively short time. The portfolio matches the principles of OCA, as land-use diversification to avoid landscape homogenization and building of natural capital to restore degraded lands is considered prominently.

DIVERSITY AND DISTRIBUTION OF RATTAN (SUBFAMILY CALAMOIDEAE) IN EAST AND WEST SUNDA: HABITATS, SEED DISPERSAL AND PHYLOGENETIC STUDY

Asyraf Mansor, Mohd Shahril Firdaus AB Razak, Amirah Alwi, Nadine Ruppert, Shahrul Anuar Mohd Sah, Ahmad Sofiman Othman

School of Biological Sciences, Universiti Sains Malaysia, Penang, MY, asyrafm@usm.my

Rattan (Calamoidae) is an important economical resource from tropical forests. However, not much is known about the ecology and population dynamic (e.g. seed dispersal mechanisms) of this thorny palm family. Three major scopes of this research project are; 1) assessment of habitats associated with rattan populations; 2) rattan-small mammal interactions, specifically on the role of small mammals in seed dispersal, and 3) phylogenetic tree of the Subfamily Calamoidea (Arecaceae) in the east and west of Sunda, specifically on the *Korthalsia* spp. Firstly, from inventory exercises of rattan conducted from January 2011 to June 2012, we have successfully recorded a total of 54 species (7 genera) from 15 sites in Peninsular Malaysia. The most common rattan species in terms of occurrence is *Calamus diepenhorstii* (60% of total sampling sites). Secondly, in order to find out more about the composition of small mammal communities in relation to different abundances of rattan species, we have conducted a 'mark and recapture' trapping program in a primary jungle reserve on the west coast of Peninsular Malaysia. A total of 171 small mammals from 11 species and 9 genera were caught. The most abundant species was *Tupaia glis*, followed by different species of the Muridae and Sciuridae. The Shannon-Wiener Index H` for the α-diversity ranges between 1.60 and 1.87 for four different 1 ha-sized trapping plots, and the value of evenness ranges between 0.82 and 0.86. Finally, we have constructed a phylogenetic tree of rattan using PRK gene (i.e. *Korthalsia* spp. for the first stage). We have extracted a genomic DNA using a CTAB method with some modification. The result of DNA sequencing of the PRK gene for selected species of *Korthalsia* showed low in genetic variation. This is reflected in the constructed phylogenetic tree of this *Korthalsia* spp. which is low in bootstrap value at node branch.

HIDING BEFORE USING BODYGUARDS: THE UNIQUE ADAPTIVE TRAITS OF *MACARANGA BANCANA*

Nik Fadzly, Wan Fatma Zuharah Wan Musthapa, Asyraf Mansor, Rahmad Zakaria

Universiti Sains Malaysia, Penang, MY, nroselnik@myvuw.ac.nz

Macaranga bancana (Miq.) Müll.Arg. from the Euphorbiaceae family is a common tree species in the South East Asia region, especially in Malaysia. Considered as a pioneer species, M. bancana are usually found along roads and recently disturbed areas. The species is also well known as an example of myrmecophytic relation with ants. The hollow space within the twigs provides excellent shelter for ants and in return, the ants provide protection to the plants. Although there had been numerous studies on the myrmecophyte relation with ants, there is almost no information on other types of adaptive strategies by M. bancana. Here we suggest that M. bancana utilizes different adaptive tactics throughout its ontogeny. Using a portable spectrometer, we measured the colour reflectance of M.bancana seedlings (less than 20 cm in height). We also measured the leaf litter reflectance, adult M.bancana leaves and also several other species of seedlings found in the vicinity of M. bancana seedlings. Spectral graph shows that the reflectances of M. bancana seedlings are nearly similar to the leaf litter background. We suggest that this cryptic colouration is crucial during the early stages of the plant when it cannot rely on the protection of ants.

Merian Award Applicant

THE LARVICIDAL EFFICACY OF MALAYSIAN ENDEMIC PLANT EXTRACTS ON DENGUE HEMORRHAGIC FEVER VECTOR, *AEDES AEGYPTI*

Wan Fatma Zuharah[1], Yousaf Ali, Nik Fadzly, Asyraf Mansor

[1]*Universiti Sains Malaysia, Penang, MY, wfatma@usm.my*

Vector control is still one of the primary weapons to combat mosquito spread diseases in endemic areas. Since 1980, Malaysia with a population at approximately 27.7 million and a population density of 84 per sq. km, has consecutively recorded rising cases of dengue outbreaks. The rampant use of insecticides inadvertently causes resistant evolution in pest, pest resurgence, environmental pollution, and contamination to human and other living things. Plants may be a source of alternative agents for control of vectors because they are rich in bioactive chemicals. The objectives of this research are to evaluate the larvicidal activity of Family Anacardaciae plants namely, *Mangifera indica*, *Anacardium occidentale*, *Gluta renghas* and *Melanochyla fascculifloraagainst* dengue hemorrhagic fever vector, *Aedes aegypti*. The crude leaves extract of these four plants was extracted using Soxhlet apparatus and acetone as solvent. Larvicidal efficacy was tested using WHO standard larval bioassay test method using serial dilutions technique. Larval mortality was observed after 24 hours exposure. The highest susceptibility and toxicity was recorded by *Ma. indica* with the lowest lethal concentration 50 (LC50) at 603.32ppm followed by *A. occidentale* (656.42ppm), *M. fasciculiflora* (2337.89ppm) and *G. renghas* (254.07ppm). This indicates that crude plant extract is very effective in killing *Ae. aegypti* mosquitoes. This finding may lead to new low cost alternative, environmentally friendly method for mosquito control programs.

Merian Award Applicant

FRIDAY 15:45

DETERMINANTS OF FITNESS IN SPECIES WITH COMPLEX LIFE CYCLES - AN ISLAND EXPERIMENT IN THE NEOTROPICAL FROG ALLOBATES FEMORALIS

Eva Ringler, Max Ringler, Walter Hödl, Andrius Pasukonis

University of Vienna, Vienna, AT, eva.ringler@univie.ac.at

Amphibians hold a unique position as the only vertebrate group where basically all members feature complex live cycles with two distinct free-living stages that have to face entirely different challenges in their respective environment. In a current project we will investigate the determinants of fitness in the Neotropical frog *Allobates femoralis*, by exploring the effects of parental relatedness and parental investment on individual reproductive success at various life cycle stages and the associated patterns of space use. To this end we have installed an experimental population of *A. femoralis* on a river island of ~5 ha in size. The island is situated in close distance to a population on the mainland where we have been conducting research from 2008 to 2011. Additionally, we perform specific breeding and behavioural experiments with an ex-situ breeding population at the University of Vienna. The combined approach of controlled and natural field studies, and laboratory experiments will allow us to address questions on the effects of parental relatedness on fertilization success, larval survival in the clutch and survival of post-metamorphic juveniles. At the same time the island population and experiments in captivity allow us to answer questions on patterns of juvenile dispersal and adult spatial behaviour, as well as the use of spatial, visual, and acoustic information for parental behaviour and space use in males and females.

Merian Award Applicant

FLORAL FOOD-BODIES AND A BELLOWS-LIKE MECHANISM IN BIRD-POLLINATED AXINAEA (MELASTOMATACEAE)

Agnes Dellinger[1], Darin S. Penneys[2], Jürg Schönenberger[1]

[1]*Department for Structural and Functional Botany, Faculty Centre of Biodiversity, University of Vienna, Vienna, AT, agnesdellinger@gmx.at*
[2]*Department of Botany, California Academy of Sciences, San Francisco, California, US*

Pollen as the only reward for bee pollinators is characteristic for most Neotropical Melastomataceae. For eight genera belonging to four different tribes, however, nectar secretion and both vertebrate and invertebrate pollinators have been reported. The flowers of the mainly Andean genus, *Axinaea* (Merianieae), are characterized by distinctive bulbous anther connective appendages. It has been hypothesized that these appendages play a key role during pollination and serve as food-bodies to attract pollinators other than bees. To test this hypothesis, we conducted field studies in southern Ecuador, and investigated floral structure in detail using micro-computed tomography (microCT) and other methods. We found that the flowers are not nectariferous and that they attract various species of Tanagers (Thraupidae) that consume the brightly coloured bulbous appendages. In addition to their function as a food reward, the anther appendages are also an integral part of a complex bellows pollination mechanism. The bellows is activated when a bird squeezes the appendage with its beak in order to remove the stamen from the flower. This action results in a cloud of pollen being expelled from the terminal pore of the anther and landing on the bird's beak and head. Accidental contact with the stigma effectively transfers pollen during floral visits. Usually, an anthetic flower is visited two to three times before all anthers are removed. The resulting seed set is high. As Tanagers were the only observed visitors capable of activating this mechanism, they can be recognized as the legitimate pollinators. The evolution of the bulbous connective appendages in *Axinaea* may serve as another example of a shift in pollination syndromes correlated with growth at higher elevations where bees are less efficient pollinators than birds.

Merian Award Applicant

SCIENTIFIC POSTER SESSION – ABSTRACTS

VARIATION IN HABITAT NUTRITIONAL QUALITY AND BIOMASS OF LEMUR COMMUNITIES

Bruno Simmen, Annette Hladik, Laurent Tarnaud

CNRS/ Muséum National d'Histoire Naturelle, Brunoy, FR, simmen@mnhn.fr

The variation in the abundance of primate species living in forest environments under low anthropogenic pressure is largely determined by variation of primary production. As a matter of fact, the nutritional quality of primate habitats appears to also affect species abundance: a large part of the variance in the biomass of folivorous primates or whole primate communities is explained by variations in plant nutritional quality across forest habitats. This relation was demonstrated on Colobine monkeys using a chemical index that reflected the average nutrient concentration in mature leaves of common tree species within each habitat. Here, we investigate to what extent primate communities in Madagascar follow this pattern, using previous data published for evergreen rain forests and deciduous forests, and recent results obtained on lemur densities and plant chemistry in a gallery forest South of the island. The results show a positive relation between biomass of prosimian communities and the mean protein:fibre ratio of leaves. The data also reveal that the biomass of lemur communities in Madagascar are low compared with those of African and Asian primate communities for a given protein:fibre ratio. Low biomass at Madagascar is best explained by the extinction of several large lemur species during the past 2000 years and lack of ecological compensation by extant lemur species. From these broad correlations, how current climate changes affect lemur abundance could theoretically be inferred by analyzing climate-related variations of plant metabolism. However, predictions are uneasy because (1) Malagasy prosimians are possibly in a transitional evolutionary phase due to recent impoverishment of lemur species diversity (e.g. "the evolutionary disequilibrium hypothesis"), and (2) most of the forest habitats in Madagascar are subject to increased, direct anthropogenic effects that outweigh the influence of climate changes in terms of nutrients available to consumers.

DOES THE TROPICAL AGRICULTURAL MATRIX BEAR POTENTIAL FOR PRIMATE CONSERVATION? A BASELINE STUDY FROM WEST UGANDA

Victor Blanco[1,2], Matthias Waltert[1]

[1]*Georg-August-Universität Göttingen, Göttingen, DE, mwalter@gwdg.de*
[2]*University of Edinburgh, Edinburgh, UK*

As for most large mammals, conservation research on primates usually focuses on protected areas, and yet not much is known about primate communities in land-use systems in the absence of hunting. Using line transects, we estimated population densities for four primate species in a mixed agroforest landscape up to a distance of 4000 m from a forest reserve, in a region where no primate hunting takes place. We then modelled encounter rates and cluster size in relation to landscape parameters by means of bivariate analysis and Generalized Linear Models (GLMs). Black-and-white colobus (*Colobus guereza*) were most common, with confidence intervals for density estimates of 31.1-62.8 individuals/km^2. Red-tailed monkeys (*Cercopithecus ascanius*) and blue monkeys (*Cercopithecus mitis*) occurred at 15.2-37.9 ind/km^2 and 13.9-36.7 ind/km^2 respectively, and chimpanzees (*Pan troglodytes*) at 1.0-2.8 ind/km^2. Chimpanzee nest numbers and distribution appeared to be significantly constrained by transect forest coverage, forest coverage within 500 m and distance from the main forest, whereas those of monkeys were generally less restricted by landscape variables. The considerable population density of monkeys suggests that, in the absence of hunting, mixed agroforest systems may play a relevant role in primate conservation and highlight that it is useful to consider primate ecology in land sharing approaches to conservation.

DIVERSITY OF HUMMINGBIRDS AND THEIR FLORAL RESOURCES IN OIL PALM PLANTATIONS AND RAINFOREST HABITATS IN THE LOWLANDS OF SOUTHERN COSTA RICA

Kerstin Friesenbichler[1], Christian H. Schulze[2], Philipp Mollik[2], Martina Weber[1], Anita Freudmann[2], Jürg Schönenberger[1]

[1]Department of Structural and Functional Botany, University of Vienna, Vienna, AT, kerstin.friesenbichler@gmail.com
[2]Department of Tropical Ecology and Animal Biodiversity, University of Vienna, Vienna, AT

The conversion of natural forests into oil palm plantations leads to a dramatic loss of biodiversity. We studied to what extent species richness and abundance of hummingbirds and hummingbird flowers are affected. Therefore, we conducted 15 min point counts between February and March 2012 in oil palm plantations (OP) and at forest margin (FM) as well as forest interior sites (FI) as references (N = 46 census points per habitat). In addition, hummingbirds were mist-netted in all three habitats (N = 5 sites per habitat) between February and May 2012. During point counts a total of 100 hummingbirds belonging to 12 species were observed. Additionally, 176 hummingbirds from 10 species were caught with mist nets. Both methods document lowest abundance and species richness of hummingbirds at OP sites, highest values at FM sites, and intermediate values at FI sites. However, the pattern was less distinct for the mist-netting data. The analysis of pollen samples collected from mist-netted hummingbirds indicates that resource use is rather species-specific than shaped by habitat. This suggests that hummingbird individuals belonging to the same species use similar nectar resources and their occurrence in different habitats does not necessarily indicate the availability of adequate nectar resources. Strong positive correlations between flower abundance and the abundance of hummingbird individuals and between species richness of hummingbirds and species richness of hummingbird plants were found for our point census data. Oil palm plantations provided very low numbers of flowering plants known to be visited by hummingbirds. While hummingbird flowers were found at 73.9 and 60.9% of the FI and FM census points, respectively, only 10.9% of the OP sites provided such potential nectar resources. Both species richness and flower abundance of hummingbird plants were lowest at OP sites. Our results provide clear evidence, that hummingbirds might either visit oil palm plantations to search for insects or pass through this land-use system but hardly will find any adequate nectar resources. Hence, oil palm plantations largely miss a habitat requisite important to maintain a high diversity and density of these nectarivorous birds.

Merian Award Applicant

TRADING ENDANGERED SPECIES AS AN ECOSYSTEM SERVICE FOR HABITAT AND SPECIES CONSERVATION IN MADAGASCAR'S SPINY FOREST

Jörg Ganzhorn

Universität Hamburg, Hamburg, DE, ganzhorn@zoologie.uni-hamburg.de

The spiny forest of southern Madagascar is one WWF's 200 Ecoregions and a prominent biodiversity hotspot even within Madagascar itself. Yet, it is the forest with the highest deforestation rates of the island because local people depend on the forest resources and overuse it just to stay alive. While the region has limited potential for improved agriculture, it is home to the Radiate Tortoise (*Astrochelys radiata*), one of the most valued land tortoises in the international pet trade. Since the species is listed as Critically Endangered due to a very substantial population decline over the last three generations and is listed under CITES I, it can't be traded commercially. Yet, hundreds of tortoises are taken from the forests every week and either consumed locally or smuggled out of the country for the international pet trade. In Asia one tortoise is sold for the price of two cows, 20 goats or 200 chicken. In Europe, they are offered for about 4000 € per animal. This is equivalent to about 40 cows or 4000 chicken in Madagascar. If the trade could be legalized, animals could be marked individually and permanently with transponders. This would allow to keep track of each individual nationally and internationally. Each village could be allowed to sell 1-2 animals per year. This is well above the revenue that can be obtained by any other form of land use in the region. It would provide a substantial incentive for the villages to maintain their community forests intact.

Supported by BMBF, SuLaMa.

IMPACT OF LAND USE TYPES ON THE RICHNESS AND COMPOSITION OF BIRD COMMUNITIES IN SOUTHWESTERN MADAGASCAR

Lalatiana Randriamiharisoa[2], Soafara Raonizafinarivo[2], Marie Jeanne Raherilalao[2,4], Julie Ranivo[2], Daniel Rakotondravony[2], Lucienne Wilmé[3], Jörg Ganzhorn[1]

[1]Universität Hamburg, Hamburg, DE, ganzhorn@zoologie.uni-hamburg.de
[2]Université d'Antananarivo, Antananarivo, MG
[3]Missouri Botanical Garden, Antananarivo, MG
[4]Vahatra, Antananarivo, MG

In the past, research in Madagascar has been focused on "pristine" ecosystems at the neglect of anthropogenic habitats. As a result, next to nothing is known on responses of plants and animals to anthropogenic disturbance and the potential of anthropogenic landscapes to act as buffer zones around protected areas or corridors that could facilitate the exchange of individuals between populations. Within a project on sustainable land use in south-western Madagascar, we analyzed the distribution of birds in various forms of land use in order to evaluate how different types of land use might affect species richness and composition. Species distributions and composition were quantified using standardized point counts within littoral forest, dry spiny bush, farmland, pasture, and vegetation structures associated with these forms of land use, such as hedges and fences.

Bird species declined with declining structural components from forest to farmland and pasture and in relation to human presence. The latter is due to the important role even small sized bird species play for bushmeat consumption. The most important bird species in farmland were seed-eating species that can become pests for agricultural production. Thus, while it seems possible to structure agricultural landscapes in a way that could serve as buffer zone or corridors, promoting habitat for birds is likely to generate conflicts of interest with local farmers.

This study is part of a BMBF funded project on development of sustainable land use in Madagascar ("SuLaMa").

IMPACTS OF HABITAT TYPES AND LAND USE ON TORTOISES (*PYXIS ARACHNOIDES*, *ASTROCHELYS RADIATA*) IN SOUTHERN MADAGASCAR

Sylwia Marcek[1], Jutta Hammer[1], William R. Mananjara[2], Rahantovolona V.J. Rasoma[2], Soazara Ranivoarivelo[1], Jörg Ganzhorn[1]

[1]*Universität Hamburg, Hamburg, DE, Sylwia19@web.de*
[2]*Université d'Antananarivo, Antananarivo, MG*

The spiny forest ecosystem of southern Madagascar harbours many endemic species with restricted ranges and special adaptations to the arid environment. The tortoise species of the region, *Astrochelys radiata* and *Pyxis arachnoides*, suffer from habitat destruction, overexploitation of the habitat through livestock, hunting for food and for the pet trade. Since 2006 we assess the distribution and abundance of these species in various forms of land use.

The distribution and abundance of the Radiated tortoise (*Astrochelys radiata*) could not be linked to different forms of land use or types of habitats. Densities ranged unpredictably between 0 and 500 individuals / km^2. This is likely due to excessive hunting for food and the pet trade on the one hand and full protection due to local taboos on the other hand. Neither one is related to different types of vegetation. Therefore it was not possible to assess the suitability of different forms of land use for Radiated tortoises.

Spider tortoises (*Pyxis arachnoides*) occur with two subspecies in the region, including transitional forms. Densities decline with proximity to the next village irrespective of vegetation type. This reflects hunting pressure close to villages.

Both species occur in *Opuntia* hedges along agricultural fields and seem to be able to maintain high population densities in degraded areas. Thus, for the time being, hunting for food or the pet trade has a higher impact on their distribution and abundance of these two tortoise species than the transformation of their original habitat into an agricultural landscape.

The study has been supported by the BMBF („SuLaMa"), the Deutscher Akademischer Austauschdienst (DAAD), Deutsche Forschungsgemeinschaft (DFG, Ga 342/ 15), European Association of Zoos and Aquaria (EAZA), VW-Stiftung and WWF Deutschland.

IMPACT OF LAND USE TYPES ON THE RICHNESS AND COMPOSITION OF REPTILE COMMUNITIES IN SOUTHWESTERN MADAGASCAR

Balten Lauströer[1], Enzo Braskamp[1], Franck Mananjara[3], Domoina Rakotomalala[2], Yedidya R. Ratovonamana[1], Joachim Nopper[1], Susanne Kobbe[1], Jörg U. Ganzhorn[1]

[1]University of Hamburg, Hamburg, DE
[2]WWF, Tuléar, DE
[3]University of Tuléar, Tuléar, MG
[4]University of Antananarivo, Antananarivo, MG

The natural habitat of the semi-arid Mahafaly region in Southwestern Madagascar harbors a high level of biotic endemism but substantial parts of the natural vegetation are threatened by degradation and fragmentation through agricultural clearing and overgrazing. It is not known how species occurring on the Mahafaly Plateau are affected by the different anthropogenic disturbances. This study aims at analyzing the distribution of reptiles in various forms of land use in order to evaluate how disturbed areas might affect species richness and composition. So far little has been known about the unique reptile assemblage of the area. Therefore, habitat preferences of the species were investigated. Species distributions and composition were quantified using standardized inventories in differently affected habitats. Transect walks and mark-recapture methods were conducted within agricultural used land, littoral forest, dry spiny bush, dry forests and savannas. The reptile species assemblage was separated according to their microhabitat use into arboreal, terrestrial and fossorial species. We hypothesized following the idea of the intermediate disturbance theory that species richness would peak at intermediate disturbances and drop drastically with high anthropogenic impact (slash and burn practices). No such correlation was found. Species richness did not seem to be affected. However, species composition changed between the different habitats in all three studied groups of reptiles (fossorials, arboreals, and terrestrials). Generally, there is clear evidence that habitat disturbance alters the reptile assemblages. We give first insights into the causes of changes in the reptile species assemblages with habitat disturbance and its implications for future conservation planning.

This study is part of a BMBF funded project on development of sustainable land use in Madagascar ("SuLaMa").

THE IMPORTANCE OF NON-NATIVE PLANT SPECIES FOR NATURE CONSERVATION IN MADAGASCAR

Anne Gérard[1], Jörg Ganzhorn[1], Stéphanie Carrière[2]

[1]Universität Hamburg, Hamburg, DE, annegerard@gmx.de
[2]IRD, Montpellier, FR

Madagascar, well-known for its high biodiversity and high proportion of endemism, is one of the most threatened areas in the world. High risks of extinctions are predicted for the endemic fauna, mainly due to habitat fragmentation and climate change. Building corridors to connect isolated patches of native ecosystems is important to maintain viable populations of Madagascar's biota. Several aspects need to be considered: First, plant communities within corridors have to serve as habitat and food for animals. Second, fast realization must be secured. Third, local people must not have disadvantages. Certain introduced plant species are promising to combine these three features.

In an extensive literature search 100 (7.25 %) of the 1379 non-native plant species in Madagascar (Kull et al. 2012) were found to be used by endemic animal species. As food, they serve mainly to primates, bats and birds, and as habitat to all vertebrate animal groups. Ninety-nine vertebrate species were found to use introduced plants, hereof six critically endangered and ten endangered species.Thus, with introduced plants contributing to the survival of threatened animal species by providing food and habitat for endemic animals, fast growing species have the potential to build up corridors and buffer zones. As many introduced plants have economic importance, benefits for the local people can be achieved simultaneously.

INSECT AND FLOWER INTERACTIONS IN *HETEROPTERIS PTEROPETALA* A. JUSS. (HBK) (MALPIGHIACEAE): POLLINATORS AND FLORAL HERBIVORES

Helena Maura Torezan-Silingardi, Thais Coelho

Universidade Federal de Uberlândia, Uberlandia, BR, torezan@inbio.ufu.br

Angiosperms are affected by biotic and abiotic factors and their maintenance are dependent on seed production. Flowers are adapted to attract pollinators, but they also attract robbers, pillagers, florivores and their predators. We investigated the flower visitors of *Heteropteris pteropetala* (Malpighiaceae) and their influence on fructification in the Brazilian savanna, locally called Cerrado. The investigation on floral biology and reproductive biology evidenced the high pollen viability (95,8%) and the importance of cross pollination, as the species do not fructifies after self-pollination. The species had high dependence of melitophilous pollination, with 14 bee species visiting the flowers, mainly the Centridini and Tapinotaspidini. The main florivores were young Hemipterans and Ortopterans, and the main predators were spiders, ants and Hemipterans. Pollinators, florivores and predators had a bimodal pattern during the day time, absent on the hottest hours. The study indicates *H. pteropetala* has many animals associated to its flowers, some benefiting and some prejudicing the fruit production, so, the species can be considered as a key-species for studies of multitrophic relations. Financial Support: CNPq / Fapemig

DYNAMIC OF SEED DISPERSAL BY LARGE FRUGIVORES IN A FOREST-SAVANNA MOSAIC SUBJECT TO ANTHROPIC PRESSURES IN WESTERN DR CONGO

Franck Trolliet, Alain Hambuckers

Université de Liège, Liège, BE, franck.trolliet@ulg.ac.Be

The Western congolian forest-savanna mosaic is home to a variety of large frugivores known to play a crucial role for zoochorous tree species and likely to help the natural regeneration of the forest. This ecotone is however subject to fire regimes and slash-and-burn agriculture which shape a patchwork of savanna and forests at varying stages of regeneration. We thus address two questions: 1) How hunting pressure, distance from forest edge and tree fecundity can influence the dispersal capacity of a large seeded tree species (*Staudtia kamerunensis*, Myristicaceae)? And 2) How a large frugivores species, the bonobo (*Pan paniscus*) can influence the dynamic of early stages of forest regeneration? Dispersal of Myristicaceae species is widely documented for the neotropics but still poorly investigated in Africa, and the bonobo is one of the largest frugivore in the area and likely to disperse lots of light-demanding species which are disproportionally present in this ecosystem. Thanks to focal observation and camera trapping at *Staudtia k*. fruiting trees in two forests subject to different hunting pressure and at varying distances for forest edge we recorded frugivores disperser species. Using fruit traps we quantified proportions of seeds dispersed. Collecting seeds in bonobo's feces and directly in fruits we were able to compare germination characteristics in order to assess the effect of seed transit in gut on seed germination capacity. The main disperser of *Staudtia k.* (>95% of time) in both habitats is a species of calaos, *Bycanistes albotibialis*. This bird is more often seen in the more hunted forest, where more seeds are also dispersed, though densities of fruiting trees might bias these results. Calaos are seen more frequently at fruiting trees further from forest edge but trees fecundity might also bias this result. On 10 seed species dispersed by bonobos, several important species have are light demanding and seed transit in bonobo's gut enhances the median time of germination and germination velocity. For *Staudtia k.*, we will increase the sampling effort with more fruiting trees and more forests. For the seed transit study we will compare more species dispersed in order to highlight bonobo's role into growth enhancement of early forest successional stages via the germination improvement of light demanding seed species.

Merian Award Applicant

DOES HERBIVORY INFLUENCE TREE SPECIES DISTRIBUTION ALONG A RAINFALL GRADIENT?

Julian Gaviria[1], Bettina Engelbrecht[1,2]

[1]University of Bayreuth, Bayreuth, DE, julian.gaviria@uni-bayreuth.de
[2]Smithsonian Tropical Research Institute, Balboa, PA

Different species distribution patterns lead to the high diversity found in tropical forests. Understanding the mechanisms that shape these patterns is crucial when taking decisions for conservation and reforestation programs. Many studies emphasize the importance of rainfall in species distribution. Beside of the direct effects of water availability, other co-varying factors like herbivory may interact to shape the distribution patterns. Some studies have tested the influence of herbivory on seedling distribution, but little focus has been made on earlier stages of plants, like seed germination and seed-to-seedling transition. We tested the hypothesis that herbivory shapes tree species distribution acting as a filter at the seed and early seedling stage by distinctively inhibiting growth and germination of species of contrasting origin in a rainfall gradient.

On a wet and on a dry forest site in Panama, seeds of 30 species with different origin (wet vs. dry) were planted. Half of the seeds got a combined treatment of an insecticide and a fungicide. Germination and survival of the seedlings where recorded during one wet season (April till December).

Around one third of the seeds germinated. Neither the origin nor the site nor the treatment had any effect on the germination rate. Therefore, seed predation does not seem to have an effect in shaping tree species distribution.

Three quarters of the germinated seeds survived till the end of the wet season. The treatment only enhanced the survival of wet origin species on the wet site. As the other combinations of origin and site were not affected by the treatment, other factors beside of herbivory are thought to shape the species distribution at the early stages. Light and other abiotic factors should be considered in future studies.

Merian Award Applicant

WHICH ROLE DO FROGS PLAY IN A RAINFOREST FOOD WEB? A QUANTITATIVE INVESTIGATION OF ANURAN PREDATION IN BORNEO

Nikolai Knapp[1], Oliver Konopik[1], Wuu-Yih Bon[2], Ingolf Steffan-Dewenter[1], T. Ulmar Grafe[2]

[1]University of Würzburg, Würzburg, DE, nikolai.knapp@hnee.de
[2]University Brunei Darussalam, Bandar Seri Begawan, BN

Facing global decline, it is crucial to understand the roles amphibians play in ecosystems for predictions of possible consequences on food webs and ecosystem services. We estimated the daily amount of prey consumed by a tropical anuran community in the lowland mixed-dipterocarp rainforest of the Ulu Temburong National Park in Brunei Darussalam (Borneo). Diet compositions of 714 individuals of 30 frog species were derived from stomach flushing samples. For quantification of prey consumption over time, we combined the information on diet spectra with abundance data on frogs and estimates of daily nutritional requirements. Different digestion rates of hard and soft bodied prey items were corrected for by measuring digestion courses of such prey. Frog densities along streams were surveyed and extrapolated to 1,064 individuals per km. According to our calculations, frogs are capable of consuming 44 g of prey dry mass per stream km and day, which results in a total consumption of more than 20 tons per year in the 49,000 ha national park. Social insects, ensiferans and beetles accounted for the largest fractions in the community's diet composition, but the total diet covered a wide spectrum of taxa including occasional vertebrates. Further, we allocated prey items to functional groups, to assess the impact of amphibian predation on different trophic levels. Our results provide a rough estimate of total predation by a tropical anuran community and suggest that frogs play an important role as predators of social insects and herbivorous insects in the rainforest food web.

Merian Award Applicant

ANTHROPOGENIC AND TERMITE-DRIVEN DISTURBANCES ACT IN CONCERT TO SHAPE VEGETATION PATTERNS IN THE SUCCULENT KAROO BIOME

Natalie Kuntz

Plant Ecology and Systematics, *University of Kaiserslautern*, *Kaiserslautern*, *DE*, *Kunz-Natalie@web.de*

Heuweltjies are large circular earth mounds created by termites and are important features of the landscape in the Succulent Karoo biome in South Africa. This study demonstrates that heuweltjies and livestock grazing act together to shape vegetation patterns in the region. Using a multifactorial approach, I investigated the combined effects of heuweltjie-induced habitat conditions, grazing pressure and physical disturbance by livestock and native animals as well as the interactions among two distinct plant functional groups, on the composition and cover of vascular plant vegetation. Heuweltjie soils had significantly higher pH-values, finer texture, and higher concentrations of carbon, nitrogen, and phosphorus than those of the surroundings. Neither perennial nor ephemeral cover was different on- and offmounds. However, species richness, cover of highly palatable plants and livestock grazing pressure were significantly higher between mounds. Grazing pressure generally resulted in a loss of perennial species and a shift to more ephemeral species, probably through the competitive release of annuals and geophytes from perennial plants. We propose that the apparent contradiction between superior nutrient conditions and inferior plant food quality on heuweltjies is caused by a combination of otherwise unfavourable soil properties and historic overgrazing of heuweltjies resulting in local degradation of the vegetation.

Merian Award Applicant

UNRAVELLING 50 KA OF VEGETATION AND CLIMATE DYNAMICS ON MT KILIMANJARO: A POLLEN AND SEDIMENT RECORD FROM THE MONTANE FOREST

Lisa Schüler[1], Andreas Hemp[2], Hermann Behling[1]

[1]*Department of Palynology and Climate Dynamics, University of Göttingen, Göttingen, DE, lschuel@gwdg.de*
[2]*Department of Plant Systematics, University of Bayreuth, Bayreuth, DE*

This pollen and sediment record of past vegetation and climate dynamics in tropical East Africa generally extends back to about 50 ka BP. The WeruWeru study site is located in the montane forest at an elevation of 2650 m on the southern slope of Mt Kilimanjaro. The palynological and sedimentological analyses were performed in high resolution and therefore allow detailed reconstruction of the vegetation response to environmental changes during the last Glacial and the Holocene.

Our results suggest that past climate change caused the vegetation belt to shift along the elevational gradient. During the Glacial the major taxa which from the montane forest today were present. That indicates that Mt Kilimanjaro served as forest refugia. The pollen record further proposes the presence of more drought tolerant *Cassipourea* forests during the early Holocene. In the course of the Holocene, the taxa of montane forest of the wetter southern slope, which also form the forests today, become more abundant. Apart from the pollen data, also the results of the geochemical analysis of the soils profile suggest different phases of enhanced wind intensities and rainfall which can be associated with enhance monsoonal activities observed at other study sites in tropical East Africa. Further, the palynological study gives no indication for the presence of a bamboo belt on the southern slope of Mt Kilimanjaro as it is found on other East African mountains with suitable climate conditions. Although, fires occur regularly throughout the investigated time period, they do not seem to play an important role in the vegetation dynamics. The succession of different forest types proposes that past environmental changes did not only cause an elevational shift of vegetation but also profound re-structuring of the forest ecosystems. Hence, this reconstruction of former vegetation and climate dynamics unravels the ecosystem responses to climate change in the past and adds to the understanding of the state and functioning of the ecosystems of Mt Kilimanjaro.

Merian Award Applicant

BIODIVERSITY OF MACROMYCETES IN COSTA RICA

Antje Heideroth, Gerhard Kost

Philipps Universität of Marburg, FB 17, Systematic Botany & Mycology, Marburg, DE, antje.heideroth@gmx.de

The mycoflora of Costa Rica is very rich and composed by a high number of fungal species in a high biodiversity. But in contrast to this, the abundance of fruit bodies producing species is very low in tropical rainforests. The distribution patterns of the tropical fungal species are quite different. Besides some cosmopolitan distributed species such as *Ceratiomyxa fruticulosa, Coprinellus disseminatus, Macrocystidia cucumis, Mycena pura, Pseudoclitocybe cyathiformis, Schizophyllum commune, Trametes hirsuta* and others, many more fungal species are only known from tropical regions. Fruiting bodies of *Xylariales* and the genera *Mycena, Marasmius*, and lepiotoid agarics can be found worldwide, but the highest number of the species of these taxa appears in the tropics. Additionally, some genera are characteristic and exclusive elements of the tropical lowland rainforests, such as *Caripia, Cookeina, Cryptotrama, Favolaschia, Filoboletus, Podoscypha*, and many others. It is obvious that some macromycetes are reported from the Neotropis and Palaeotropis. Characteristic examples of these pantropic species will be presented. In the tropical lowland forest most of the macromycetes are saprotrophic. Only few mycorrhizal species of selected genera can also be found in the lowland forests, but the ectomycorrhizal species are more frequent in high mountain rainforests, where the main ectomycorrhiza associated trees of Fagaceae, Betulaceae and Pinaceae grow.

CLIMATE DYNAMICS IN TWO DIFFERENT TROPICAL MOUNTAIN ECOSYSTEMS IN THE ANDEAN HIGHLANDS

Katja Trachte[1], Lenin Campozano[2], Rolando Celleri[2], Jörg Bendix[1]

[1]Laboratory for Climatology and Remote Sensing, Philipps-University Marburg, Marburg, DE, katja.trachte@geo.uni-marburg.de
[2]Grupo de Ciencias de la Tierra y del Ambiente, Universidad de Cuenca, Cuenca, EC

The Andes Mountains of Ecuador are one of the most biologically diverse regions of the world with high ecosystem diversity. Due to the complex structure of the terrain climate dynamics varies at small spatial and temporal scales, which influences species richness and composition, but also the water availability. The current study focuses on two different ecosystems in the Andean highlands: the tropical mountain rain forest in the Reserva Biologica Rio San Francisco with an altitudinal gradient ranging from 1000 m asl to 3000 m asl and the Paramo of the Caja National Park with an altitudinal gradient of 3150 - 4450 m asl. Investigations over the last years in the rainforest ecosystem in the Rio San Francisco valley (DFG FOR 816) revealed local climate patterns with strong differentiation of air temperature, rainfall distributions and orographic cloud development. Moreover, highland-lowland interactions that cause nocturnal convective activities could be identified and verified, which lead to unexpected early morning rainfall events. The regional water balance and supply is an essential component for the Ecuadorian economy concerning the electric power generation. The Paramo of the Cajas feed the adjacent Paute catchment which produces a major proportion of electric power.

The poster presents results of climate dynamics of the last decade regarding both ecosystems in southern Ecuador. In doing so, the Weather Research and Forecasting (WRF) model was implemented and compared to observational rainfall and air temperature data. The model results aim i) to capture the climate variability, ii) to present the ability of the model to distinguish between the two different ecosystems and iii) to obtain an higher resolved data set of the altitudinal gradient.

LATE QUATERNARY OF VEGETATION DYNAMICS, HUMAN IMPACT AND CLIMATE VARIABILITY INFERRED FROM EL CRISTAL, IN THE SOUTHEASTERN ECUADOR.

Andrea Villota[1,2], Hermann Behling[1]

[1]Georg-August University Göttingen, Göttingen, DE,
andrea.villota@biologie.uni-goettingen.de
[2]Pontificia Universidad Católica del Ecuador, Quito, EC

Late Pleistocene and Holocene vegetation, climate and fire dynamics of mountain rainforest and páramo, as well as human impact, are presented from the El Cristal region, in the Cordillera Real of the southeastern Ecuadorian Andes. The sediment core from a small basin at 2056 m a.s.l, which was analysed by pollen and charcoal analysis and dated by 6 radiocarbon dates, indicates that during the late Pleistocene (ca. 18,000–12,000 cal yr BP) the upper mountain rainforest (UMF) with some smaller areas of páramo and subpáramo were the main vegetation type in the study area. There is evidence of *Polylepis* forests at low elevations in northern part of the so-called Andean Depression, which does not longer exist. There are no clear vegetational signals in the record reflecting the warmer Bölling/Alleröd interstadial and the cooler Younger Dryas period; probably due to the location of the study site at the Andean Depression. During the early Holocene between ca. 12,000 to 6500 cal yr BP upper mountain forest vegetation expanded. The mid-Holocene, from ca. 6500 to 1300 cal yr BP, is characterized by high values of UMF and subpáramo vegetation and high frequency of fires reflecting a warmer and drier period. The expansion of UMF stopped with increasing fires at ca. 3300 cal yr BP and open grassy vegetation became established. Furthermore, after ca. 3500 cal yr BP *Polylepis* forest decreased, probably due to higher fire frequency. Landscape disturbance is also reflected between ca. 2000–1300 cal yr BP with Asteraceae, *Muehlenbeckia* /*Rumex* and high presence of *Osmunda* and *Huperzia* spores. During the late Holocene from ca. 1300 cal yr BP to present times, vegetation changes suggest a moister and cooler environment. The UMF and subpáramo vegetation decrease markedly and an expansion of páramo, open grassy area, was mainly caused by Poaceae. Fire was rare during the late Pleistocene but became more frequent after about 3500 cal yr BP, probably due to the dry event during the mid-Holocene and increased human activity.

Merian Award Applicant

THE THIRD DIMENSION OF BAT MIGRATION: EVIDENCE FOR ELEVATIONAL MOVEMENTS ALONG THE SLOPES OF MOUNT KILIMANJARO

Christian C. Voigt[1], Maria Helbig-Bonitz[2], Stephanie Kramer-Schadt[1], Elisabeth K.V. Kalko[2]

[1]Leibniz Institute for Zoo and Wildlife Research, Berlin, DE, voigt@izw-berlin.de
[2]University of Ulm, Ulm, DE

Bats are important ecosystem service providers, and therefore most relevant for both lowland and highland habitats; particularly in the tropics. Yet, it is poorly understood to what extent they perform large-scale movements, in particular movements along mountain slopes. Here, we studied the elevational migration of African bats captured between 800 and 2,400 m above sea level at Mount Kilimanjaro in Tanzania. We analyzed stable isotope ratios of carbon, nitrogen and hydrogen in fur keratin to delineate the elevational origin of frugivorous and insectivorous bats. For sedentary bat species, we expected correlations between stable isotope ratios of the non-exchangeable portion of hydrogen in fur and the elevation of capture site, but not necessarily for stable carbon and nitrogen isotope ratios. In bats of both feeding ensembles, we found fur nitrogen isotope ratios to correlate positively with the elevation of capture sites, yet we could not document such an elevational gradient for stable hydrogen isotope ratios in fur keratin. In frugivorous bats, stable carbon isotope ratios increased with increasing capture elevation. Based on nitrogen isotope ratios, we used an isoscape origin model to predict the elevational origin of the prospective migrant *Miniopterus natalensis*, an insectivorous bat captured only between late August and early November at a median elevation of 1,800 m above sea level. Our model suggests that bats originated from around 1,400 m a.s.l. By looking at within-individual variation of stable carbon and nitrogen isotope ratios in fur and wing membrane tissues of *M. natalensis* and of a sedentary insectivorous species, we received supporting evidence that *M. natalensis* migrates seasonally between low and high elevations along the slopes of Mount Kilimanjaro.

HEMIEPIPHYTES INCREASE STRUCTURAL COMPLEXITY BUT NOT TAXONOMIC DIVERSITY OF MONTANE FORESTS IN COSTA RICA

David Bröderbauer[1], Carina Lenotti[1], Werner Huber[2], Christian Schulze[2]

[1]Department of Structural and Functional Botany, University of Vienna, Vienna, AT, david.broederbauer@univie.ac.at
Department of Tropical Ecology and Animal Biodiversity, University of Vienna, Vienna, AT

The diversity and abundance of holo-epiphytes in tropical rainforests was subject to numerous studies. In contrast, little is known about the species composition and the frequency of occurrence of hemiepiphytes. We studied the diversity and abundance of primary hemiepiphytes in six 0.5 ha plots situated in five different undisturbed rainforests in Costa Rica. The study sites were located across an altitudinal gradient ranging from lowland to montane forest on the Pacific slope, a lowland forest on the Carribean slope and a montane forest influenced by both climates. We found that the likelihood of tree colonization by hemiepiphytes was significantly related to tree dbh at all sites. Nevertheless, colonization rate differed significantly between altitudes with 65-70% of trees carrying hemiepiphytes in the montane forest sites but only 10-20% of trees colonized in the lowland forest sites. Moreover, the number of hemiepiphytes per colonized tree was higher in the montane forest habitats. Despite the differences in the abundance of hemiepiphytes, species richness differed only slightly among the forest sites situated at different altitudes. Regardless of differences in the geographic location, the species composition was similar among the three lowland forests but clearly distinct from the two montane forests. Therefore, we conclude that altitude has a stronger impact on the composition of hemiepiphyte communities than geographic location. Although our data provide evidence that primary hemiepiphytes lack a mid-elevation peak in species richness as found for epiphytes, their increasing abundance at higher altitudes might contribute significantly to the structural complexity of montane forest in Costa Rica.

Merian Award Applicant

RESPONSES OF ARBUSCULAR MYCORRHIZAL FUNGI TO NUTRIENT ADDITIONS IN A MONTANE TROPICAL FOREST IN SOUTHERN ECUADOR

Antje Gensing[1], Tessa Camenzind[1], Jürgen Homeier[2], Bärbel Wittich[2], Alícia May Donnellan Barraclough[3], Matthias C. Rillig[1]

[1]*Freie Universität, Berlin, DE*
[2]*Georg-August-Universität, Göttingen, DE*
[3]*Lund University, Lund, SE*

Arbuscular mycorrhizal fungi (AMF) form mycorrhizae with 80% of land plants and are dominant root symbionts in many tropical forests, including the study area RBSF (Resérva Biológica San Francisco) in Southern Ecuador. A main function of AMF is to improve nutrient uptake for their plant symbionts. According to the functional equilibrium model, increased soil nutrient availability is hypothesized to decrease AMF abundance, due to reallocation of carbon towards aboveground tissues. Here, we aim to evaluate the effects of increased nutrient deposition on AMF abundance in a tropical forest at the RBSF with a focus on examining different tree species.

A pot experiment was set up to test the mycorrhizal dynamics under low nitrogen (N), high nitrogen and phosphorus (P) additions. Four native tree species were selected: *Leonia crassa* (Violaceae) and *Hedyosmum spruceanum* (Chloranthaceae) naturally occurring at 1000 m, and *Tabebuia chrysantha* (Bignoniaceae) and *Heliocarpus americanus* (Malvaceae) from 2000 m above sea level.

AM intraradical abundance tended to be reduced by P additions, but not significantly so. In contrast, for N fertilization we found a significant increase in *Leonia crassa* and *Hedyosmum spruceanum*. This variation depending on tree species was also observed in seedlings sampled from the field site at 2000 m, in the course of the nutrition manipulation experiment NUMEX.

These findings indicate an impact of increased nutrient deposition on AM abundance, which by virtue of being species-specific may potentially affect plant community composition.

Merian Award Applicant

PROTOZOANS IN COSTA RICAN BROMELIADS AND WHAT THEY CAN TEACH US ABOUT COMMUNITY STRUCTURE

Jana Petermann[1,3], Pavel Kratina[2,3], Diane Srivastava[3]

[1]Freie Universität, Berlin, DE, jana.petermann@fu-berlin.de
[2]University of California, Davis, US
[3]University of British Columbia, Vancouver, CA, jana.petermann@fu-berlin.de

What are the drivers of diversity? Despite decades of research we have not been able to answer this question. After considerable debate about the dominant role of niches or neutrality in structuring communities we have finally begun to focus on the "whens" and "hows" of deterministic and stochastic influences. Furthermore, we are starting to test theoretical predictions under more realistic scenarios.

In this field experiment we used a natural system: aquatic protozoan communities inhabiting Costa Rican bromeliads. We manipulated a number of parameters to test how abiotic environmental variables, top-down and bottom-up biotic forces (predators and resources) and a potentially neutral factor (dispersal limitation) affect their community structure.

We found strong bottom-up control. Resource addition changed communities dramatically: overall abundance increased, richness decreased and community composition shifted in predictable ways. Certain functional groups benefited while others decreased in abundance and richness. However, this predictable shift at the functional group level was accompanied by stochastic changes at the species level, increasing beta diversity. Contrary to our expectation, environmental factors, dispersal manipulation and predator pressure had only weak effects in our study.

Our results show thatfunctionally defined higher-order structure is governed by deterministic forces such as competition and therefore predictable. Below these levels, communities appear to be subject to stochastic assembly processes. The reason for the increase of beta diversity with resource input may be that strong environmental filters operate under natural conditions, allowing only a small, predictable set of species with suitable adaptations to persist. This study not only shows that natural communities are structured by a combination of stochastic and deterministic forces but it also moves us closer to being able to predict when and how.

BAOBAB (*ADANSONIA DIGITATA* L.) - MORPHOLOGICAL AND GENETIC DIVERSITY OF A NEGLECTED POPULATION IN THE NUBA MOUNTAINS, SUDAN

Martin Wiehle[1], Kathleen Prinz[2], Katja Kehlenbeck[3], Sven Goenster[1], Seifeldin Ali Mohamed[4], Reiner Finkeldey[2], Andreas Buerkert[1], Jens Gebauer[5]

[1]Organic Plant Production and Agroecosystems Research in the Tropics and Subtropics (OPATS), University of Kassel, Witzenhausen, DE, wiehle@uni-kassel.de
[2]Forest Genetics and Forest Tree Breeding, Georg-August-University Göttingen, Goettingen, DE
[3]Tree Genetic Resources and Domestication, World Agroforestry Centre (ICRAF), Nairobi, KE
[4]Department of Horticulture, University of Khartoum, Khartoum, SD
[5]Sustainable Agricultural Production Systems with Special Focus on Horticulture, Rhine-Waal University of Applied Sciences, Kleve, DE

The Baobab tree (*Adansonia digitata* L.) is one of the best known indigenous fruit trees of semi-arid sub-Saharan Africa, with a strong association to human settlements. Baobab is a multipurpose tree, its fruit pulp plays an important role in local nutrition, national economies and even export markets. For Western and Southern Africa, information is available on the tree's ecology, distribution and genetic and morphological diversity, however, data are still lacking for most of East Africa. Within that region, Sudan harbors the northernmost population which potentially has developed special adaptations to dry conditions. However, this population is said to be threatened by habitat loss, lack of rejuvenation, climate change and human impact.
A morphological and genetic investigation of 306 randomly selected baobab trees was conducted at seven different locations in the Nuba Mountains, South Kordofan, Sudan. Dendrometric and fruit morphometric traits were recorded to study morphological variation. Leaves were sampled, and microsatellite markers used to create individual matrices, based on the presence and absence of alleles.
Means of the dendrometric parameters diameter at breast height and tree height differed among locations at $P<0.05$ with highest values for the south-eastern area, whereas fruit morphology exhibited low differences. A Bayesian clustering approach structured the samples genetically into two groups: cluster 1 with almost all individuals of the southwest location and cluster 2 with almost all individuals of the remaining six locations. Samples from the southwest location had the highest genetic diversity. Baobabs sampled in or close to homesteads areas obtained slightly higher genetic diversity compared to trees classified as 'far from homesteads'.
The local differences in dendrometric traits indicated location-specific recruitment patterns and history, whereas no trends for fruit morphometric traits were found regarding environmental gradients. Genetic data revealed shifts in diversity most likely due to human mediated admixture of plant material into inhabited areas.
More detailed information on diversity and differentiation at the studied local scales is needed in order to develop reliable *ex* and/or *in situ* conservation strategies for this important tree species in Sudan.

USE OF DIFFERENT TYPES OF CLIMATE DATA FOR SPECIES DISTRIBUTION MODELLING AND THEIR EFFECT ON PREDICTION OF PSEUDAGRION KERSTENI IN AFRICA

Nirmal Ojha, Gertrud Schaab

Karlsruhe University of Applied Sciences, Faculty of Information Management and Media, Karlsruhe, DE, nirmal.ojha@hs-karlsruhe.de

Bioclimatic variables describe the climatic pattern across a region. Among the environmental variables, temperature and precipitation related variables are common bioclimatic variables used in species distribution modelling. The Worldclim database provides 19 different bioclimatic variables related to temperature and precipitation. Here, we present the effect of using all 19, a subset of six bioclimatic variables, and the raw temperature and precipitation data when modelling the distribution of *Pseudagrion kersteni*, a wide spread odonata species in Sub-Saharan Africa. For modelling, elastic-net penalised logistic regression is used. The subset of six of the bioclimatic variables are: 1) annual mean temperature, 2) temperature seasonality, 3) temperature annual range, 4) mean temperature of coldest quarter, 5) annual precipitation, 6) precipitation seasonality.

Using all 19 bioclimatic variables, the spatial distribution of prediction is able to offer a general shape of the range but most of the East and Central Africa suffer under prediction. Further, the Maghreb region, north of Sahara, is falsely predicted as presence area. The use of six bioclimatic variables selected according to their habitat relevance improved the prediction range in the East and Central Africa, but introduces false predictions in the western part of Central Africa. Moreover, the false prediction area in the Maghreb region increases as well as some additional wrong areas in Libya and Egypt shows up. Instead the use of raw monthly precipitation and monthly minimum and maximum temperature improve the results considerably. The false predictions in the north of Sahara as well as the western part of Central Africa are almost non-existing. This result suggests that although bioclimatic variables may offer climatic pattern, the use of raw data instead of synthesised bioclimatic data are better suited for species distribution modelling.

A NOT SO PLEASANT BOUQUET: LEAF-CUTTING ANTS LEARN TO REJECT *VITIS VINIFERA* SSP. *VINIFERA* PLANTS WITH INDUCED VOLATILE PLANT DEFENCES

Theresa Thiele[1], Christian Kost[2], Rainer Wirth[1]

[1]*Department of Plant Ecology & Systematics, University of Kaiserslautern, Kaiserslautern, DE, tthiele@rhrk.uni-kl.de*
[2]*Department of Bioorganic Chemistry, Experimental Ecology and Evolution, Max Planck Institute for Chemical Ecology, Jena, DE*

Besides being dominant herbivores of the Neotropics, leaf-cutting ants (LCA) are million dollar pests, causing severe crop failures in many agricultural regions, including some of America's most precious viticultural areas. Both their foraging ecology and the patterns/mechanisms of food plant selection have therefore received considerable research attention. In this context, recent studies have documented LCAs to exhibit delayed rejection of previously accepted food plants following experimental treatment with a synthetic fungicide that made them unsuitable as substrate for their symbiotic fungus. Here, we investigated whether the same rejection mechanism occurs in a natural scenario for plants with induced chemical defense. We conducted GC-MS analysis of volatile emissions and dual-choice bioassays with naïve and experienced LCA colonies (*Atta sexdens* L.). Ants were given choice between untreated control plants and jasmonic acid-induced test plants of *Vitis vinifera* ssp. *vinifera*. The results of the chemical analysis clearly confirmed the emission of a typical set of herbivore-induced volatile organic compounds in JA-induced vine plants. The choice assays demonstrated that naive colonies show indifferent foraging behaviour towards treatment and control plants, while experienced workers focused 88% of their cutting activity on control plants, removing 28% versus 6% of the leaf area of control and JA-induced plants, respectively. This indicates that *Atta sexdens* foragers learn to avoid VOC-emitting plants, which are supposed to be harmful to their symbiotic fungus due to their fungicidal components. Our findings (i) provide first evidence that avoidance learning, a phenomenon described for fungicide-treated leaves, also occurs in plants emitting defensive volatiles, (ii) add further support for the 'induced defence hypothesis' proposed by Kost et al. (2011) to explain LCA foraging decisions in the field and (iii) and open new perspectives for crop protection, e.g. in organic viticulture.

Merian Award Applicant

FLIGHTLESS ORTHOPTERA AS MODEL GROUP TO UNDERSTAND MODES AND TIME OF SPECIATION PATTERNS IN EAST AFRICA

Claudia Hemp[1], Sigfried Kehl[1], Klaus-Gerhard Heller[1], Wolfgang Wägele[1], Andreas Hemp[1]

[1]*Claudia Hemp, Würzburg, DE*
[2]*Sigfried Kehl, Bayreuth, DE*
[3]*Klaus-Gerhard Heller, Erlangen, DE*
[4]*Wolfgang Wägele, Bonn, DE*
[5]*Andreas Hemp, Bayreuth, DE*

Flightless bush crickets of the subtribe Karniellina (Insecta: Orthoptera: Tettigoniidae: Conocephalinae: Conocephalini) probably evolved at a time when grasslands spread in East Africa due to an increasing aridification of the climate. The earliest lineage, the genus *Karniella*, is adapted to more forested habitats while the majority of the genera of *Karniellina* prefer open grasslands. Major splits within *Karniellina* probably occurred with the emergence of savannah grasslands due to the ongoing fragmentation of forest habitats several millions years ago, but most species within the genera are geologically young, their radiation being boosted by climatic fluctuations of the past 1–2 million years.

VOCAL INDIVIDUALITY IN COHESION CALLS OF GIANT OTTERS (*PTERONURA BRASILIENSIS*)

Christina Mumm[1], Maria Cristina Urrutia[2], Mirjam Knörnschild[1]

[1]*Institute of Experimental Ecology, Faculty of Natural Sciences, University of Ulm, Ulm, DE, CAS_Mumm@gmx.net*
[2]*Department of Animal Ecology and Tropical Biology, Faculty of Biology, University of Würzburg, Würzburg, DE*

The existence of contact or cohesion calls and vocal individuality is common in social mammals. Individually distinct contact calls serve to coordinate group movements, find and reunite separated animals or to keep a group together, even with group members being out of sight. We studied vocal signatures in two cohesion call types of the highly social giant otter, *Pteronura brasiliensis*, namely contact calls and hums. Contact calls are mainly used for long distance communication whereas hums are often produced when animals are in close contact, i.e. when visual or olfactory cues may be sufficient to encode individuality. We therefore expected contact calls to have a greater potential for encoding individuality than hums. Moreover, we expected giant otters to be able to discriminate conspecifics based on their cohesion calls. We analysed both types of cohesion calls from wild and captive giant otters and conducted habituation-dishabituation playback experiments on vocal discrimination with captive individuals Discriminant function analyses revealed a strong individual signature in contact calls and only a weak individual signature in hums. In contrast, our playback experiment showed that giant otters can discriminate both contact calls and hums of unfamiliar conspecifics. Thus, our study demonstrates for the first time that contact calls and hums of giant otters encode enough information for individual discrimination, even though we could not detect the respective parameters encoding individuality in hums. This finding makes contact calls potentially suitable for acoustic monitoring attempts of this highly endangered species. Furthermore, our results highlight the importance of individually distinct vocal signals for the social life and communication of giant otters

Merian Award Applicant

EFFECT OF SEX AND AGE ON THE IMMUNE SYSTEM OF NEOTROPICAL BATS

Karin Schneeberger[1,2], Gábor A. Czirják[1], Christian C. Voigt[1,2]

[1]Leibniz Institute for Zoo and Wildlife Research, Berlin, DE, schneeberger@izw-berlin.de
[2]Freie Universität, Berlin, DE, schneeberger@izw-berlin.de

Human encroachment into pristine tropical habitats increases the contact zone between men and wildlife that carry potentially zoonotic diseases. Especially bats are known to harbour a large set of potentially harmful viral agents such as lyssa and paramyxoviruses. In order to understand how infectious diseases may spread in wild animal populations, it is crucial to know the factors that influence an animal's immune competence. In a previous study, we confirmed for a tropical bat assemblage that diet and roost choice are correlated with aspects of a bat's immune system. Here, we asked whether age and sex affect the cellular and humoral immunity of a bat species. In humans and domestic animals, it has been shown that the immune competence declines with increasing age. Bats are unusually long lived mammals considering their size and high metabolic rate. A long life span could promote the accumulation of pathogens and an impaired immune system of old bats could exacerbate the zoonotic potential of bats. Thus, bats are a particular interesting study object to investigate the influence of age on the immune system. We quantified aspects of the immune system in bats of known age, using the insectivorous Neotropical bat *Saccopteryx bilineata* as a model. We investigated both the cellular and humoral immune system of free-ranging males and females by counting white blood cells, testing the plasma for its bacterial killing ability, and measuring immunoglobulins. We found females to have fewer white blood cells than males. Furthermore, old females had fewer immune cells than young ones, a pattern which we did not find in males. Thus, both sex and age are relevant factors in shaping the cellular immune system of an individual. Humoral aspects of the immune system did not differ between males and females, and were not linked to age. With this study, we do not only show that life-history is an important factor determining the immune system of bats, but also provide first evidence for a sex-specific influence of age on the number of immune cells in a free-ranging mammal.

Merian Award Applicant

BIODIVERSITY OF TERRESTRIAL MICROALGAE IN TROPICAL MOUNTAIN RAIN FOREST HABITATS IN PODOCARPUS NATIONAL PARK (ECUADOR)

Fabian Faßhauer[1], Andreas Beck[2], Thomas Friedl[3]

[1]Göttingen, DE, ffassha@gwdg.de
[2]München, DE
[3]Thomas Friedl, Göttingen, DE

Tropical mountain rain forests are one of the most important but also most endangered biodiversity hotspots worldwide. In this ongoing project, the diversity of green algae from various terrestrial habitats of the Podocarpus National Park in Ecuador is investigated. Goals of the project are 1) to test whether tropical mountain rain forests are also hotspots for the diversity of terrestrial green algae, 2) to investigate whether the terrestrial green algae in the tropical mountain rain forest are different from comparable habitats of temperate regions, 3) to test whether terrestrial green algal diversity changes along an altitudinal gradient, and 4) to develop novel isolates of terrestrial green algae.

Samples of epiphytic crusts and soils were collected at 1000m a.s.l. (Bombuscaro), 2000m a.s.l. (SanFrancisco Valley) and 3000m a.s.l. (Cajanuma). The DNA was extracted directly from the samples of tree bark, leaves and soil followed by PCR using green algae specific primers, cloning and sequencing of an rDNA stretch that reaches from the 3'-end of 18S to the ITS_2 region using two reactions. The ITS_2 is used as DNA barcode while the 18S allows a phylogenetic assessment.

23 green algal phylotypes at the generic level from three classes of Chlorophyta were identified so far. Exept two phylotypes (*Phyllosiphon* and *Heveochlorella*), all were already known from temperate regions. No dependence of biodiversity from altitude was found so far. Using ITS_2 several new groups within *Apatococcus*, *Heveochlorella* and the Scenedesmaceae were identified, but also some already known species from temperate regions.

Merian Award Applicant

DIFFERENCES IN DROUGHT RESISTANCE AND GROWTH PERFORMANCE OF TEN NATIVE TREE SPECIES ON A MIXED PLANTATION OF THE GUANACASTE REGION IN COSTA RICA

Stefanie Enge, Lars Köhler, Christoph Leuschner, Bernhard Schuldt

Georg-August-University, Göttingen, DE

After decades of forest clearing in tropical moist and dry forests, the government of Costa Rica started to reforest their degraded pasture lands. During the last years, many monoculture tree plantations were established without considering differences in tree species ecology and physiology. The present study focuses on wood properties, hydraulic traits and growth strategies as well as diurnal variations between leaf and stem water transport of ten native tree species growing on a seasonally dry mixed tree plantation established in 2006.

Growth rate was positively related to vessel diameter and sapwood area-specific conductivity, and negatively to vessel density and wood density. Tree species with light wood showed the largest vessels, the highest sapwood area-specific conductivity, less negative predawn and midday leaf water potentials and exhibited a high vulnerability to drought-induced embolism, whereas tree species with dense wood were most drought-tolerant and possessed various small vessels with low sapwood area-specific conductivity and experienced the most negative predawn and midday leaf water potentials.

In conclusion, our results suggest that wood density is a strong indicator for wood anatomical and hydraulic traits and drought-tolerance of tree species in tropical dry climates. Surprisingly, species did not differ in stomata closure and stem sap flux at the onset of the dry season before leaf senescence leading to the conclusion that these measurements might have to be repeated during the wet season with saturated soil water conditions. Nevertheless, growth rate was negatively related to the carbon isotope signature of leaf dry mass, indicating that highly productive tree species with low wood density and a highly efficient hydraulic system closed their stomata relatively early in the growing season to prevent xylem dysfunction. To assess which tree species is most suitable in regard to growth performance and vulnerability to drought-induced embolism in mixed plantations, further studies investigating the rooting depth and complementary water use of different soil layers might be necessary.

Merian Award Applicant

VEGETATION RESPONSES TO CHANGES IN DAMMED LAKES

Pia Parolin[1,2], Marilyn Norconk[3], Leandro Ferreira[4]

[1]INRA, Sophia Antipolis, FR, pparolin@botanik.uni-hamburg.de
[2]University of Hamburg, Dept. Plant Diversity, Hamburg, DE, pparolin@botanik.uni-hamburg.de
[3]Kent State University, Kent, US
[4]Museu Paraense Emílio Goeldi, Belém, BR

In Amazonia, many large rivers have already been dammed or are in various stages of planning in order to provide energy from hydroelectric plants. Once dammed, rivers turn into huge lakes which flood the forests in the former river basins. Hills are left as islands in these artificial lakes. The former vegetation suffers from the strong impacts of fragmentation, including microclimatic changes (e.g., artificial edge habitats, erosion, dessication from wind, and altered rainfall patterns) as well as effects of flooding on previously unflooded soils. These conditions lead to high mortality rates of indigenous trees unless they are pre-adapted to wet conditions and to shifts in floristic composition. In this presentation we analyze the short-term responses of the vegetation on 17 islands of 8-100 hectares in a fragmented landscape caused by construction of a hydroelectric power plant in the Brazilian Amazon, and medium-term responses 15 years after flooding in Lake Guri, Venezuela. The short-term responses showed that mean tree density, basal area, seedling density and forest cover were equally affected in marginal and interior island plots. Liana density, number of dead trees and tree damage was also similar all over the islands. The peculiar topographic conditions associated with the matrix habitat and shapes of the islands seem to extend edge effects to the islands' centers independently of the island size, giving the interior similar physical microclimatic conditions as are found at the edges, with deleterious consequences for the forest vegetation. The long-term data show clear shifts of vegetation in terms of composition and structure.

ANNUAL POLLEN AND SPORE SEDIMENTATION RECORD OFF SOUTH JAVA IN INDIAN OCEAN

Anastasia Poliakova[1], Tim Rixen[2,3], Hermann Behling[1]

[1]Georg-August-University, Albrecht-von-Haller-Institute for Plant Sciences, Department of Palynology and Climate Dynamics, Göttingen, DE, Anastasia.Poliakova@biologie.uni-goettingen.de
[2]Leibniz Center for Tropical Marine Ecology, Bremen, DE
[3]Institute of Biogeochemistry and Marine Chemistry University of Hamburg, Hamburg, DE

Marine sediments are excellent archives recording environmental changes in the ocean as well as on land. In particular pollen and spores preserved in marine sediments could provide crucial information on land use and climate changes in the past. However, in order to better understand and interpret sedimentary records studies on modern pollen and spore transportation and sedimentation is needed. Therefore a sediment trap was deployed for about one year (December 2001 – November 2002) off South Java in the Indian Ocean at a water-depth of about 2000 m. Abundance and taxa composition of pollen and spores collected by the sediment trap reflect climatic (monsoon conditions and ocean currents) as well as biological (flowering periods, migration ability of pollen) factors controlling their sedimentation. Pollen and, at a lower rate, Pteridophyta spore concentration tends to increase during non-monsoon period.

Merian Award Applicant

FITTING SCALING LAWS IN ECOLOGY: EXAMPLES FROM TROPICAL FORESTS

Franziska Taubert[1], Florian Hartig[1], Hans-Jürgen Dobner[2], Andreas Huth[1]

[1]Helmholtz Centre for Environmental Research - UFZ, Leipzig, DE, franziska.taubert@ufz.de
[2]University of Applied Science (HTWK), Fachbereich Informatik, Mathematik und Naturwissenschaften, Leipzig, DE

Scaling laws appear in a wide range of natural phenomena. We concentrate on the size distribution of tree stem diameters in tropical forests as a representative example of scaling laws. Fitting such an empirical size distribution, for example with a power-law, a negative exponential or a Weibull distribution, is usually done using maximum likelihood estimation (MLE) and results in reliable estimation of the unknown parameters. However, classification of field data and random measurement errors influence this statistical estimation. We compare three different types of MLE, the common one not accounting for uncertainties in the observation procedure and two modified versions accounting either for binning of data or for random measurement errors. Results show that the two modified MLE methods accounting for such uncertainties are much more robust than the common MLE.

Merian Award Applicant

MODELING OF A LONG-TERM FRAGMENTED TROPICAL FOREST

Mateus Dantas de Paula, Jürgen Gröneveld, Andreas Huth

UFZ, Leipzig, DE, mateus.dantas@ufz.de

In the next decades, the expansion of the human agriculture frontiers will probably continue to transform primary forests in a mixture of small forest fragments and secondary forests, through a process called forest fragmentation. As the forest fragmentation process continues, many regions of the world will be faced increasingly with the presence of many human-managed tropical landscapes. In the long term, it is uncertain whether the biodiversity, social impact and economic value through environmental services of these landscapes will remain.

The Brazilian Northeastern Atlantic Forest (BNAF) inserted on the northern range portion of the Atlantic Forest, is considered one of the most endangered natural areas in the world. The BNAF hosts a variety of endemic species, especially bromeliads, orchids and birds, in forest fragments inserted in a landscape composed of a sugar-cane or pasture matrix, where forest fragments are restricted to hilltops or marginal lands, with areas rarely larger than 500 ha. Most of the Deforestation that occurred in the BNAF forests was carried out several centuries ago (>300 years), since it was one of the first significant colonization areas of Brazil.

This landscape offers then a suitable environment for studying the long terms effects of forest fragmentation, especially as it still contains large-area control fragments, considered to be primary forests. In my PhD work I intend to study the ecological consequences of long term fragmentation through modeling. With a FORMIND model parameterized to a tree and seed field-sampled landscape in the BNAF, I will try to answer the question of whether a modified landscape in the long term is capable of sustaining the ecological attributes and processes of a primary forest; evaluate existing tropicalforest restoration strategies; and finally explore the offer of the main environmental services of modeled forests under diverse fragmentation conditions.

As first preliminary results, I present here the parameterization and simulation (using FORMIND) of two communities, one representative of the original forest structure and biodiversity (based on data from a 3.500 hectare BNAF forest remnant), and another representing forest fragments submitted to long term fragmentation.

POLYPHAGY IS THE RULE? HOST PLANT RANGE IN A NEOTROPICAL COMMUNITY OF FLORIVOROUS LYCAENID (LEPIDOPTERA)

Alexandra Bachtold[1], Lucas Augusto Kaminski[2], Kleber Del Claro[3]

[1]*Universidade de São Paulo, Ribeirão Preto, BR, cuca_bachtold@yahoo.com.br*
[2]*Universidade Estadual de Campinas, Campinas, BR*
[3]*Universidade Federal de Uberlândia, Uberlândia, BR*

Eumaeini (Lycaenidae) is one of the richest butterfly groups in the Neotropics, and larvae of most species feed on reproductive tissues of plant, such as buds and flowers. Based on host plant records, most florivorous species within Eumaeini appear to be polyphagous. Thus we aimed at investigating the host plant range and feeding habits of a local lycaenid community in a cerrado savanna. The study was conducted from February 2011 to January 2012 in Uberlândia city (18°97'S, 48°29'W), Brazil. During this period all flowering plants were examined in a protected cerrado reserve. Eggs and larvae were collected and reared in the laboratory. We classified the species according to the diet breadth: oligophagous (one host plant family); moderately polyphagous (host plants in two families) and polyphagous (more than three families). We found 365 lycaenid immatures on 36 plant species in 16 familiesbeing identified 25 lycaenid species (n=24 Eumaeini). Fifteen species were classified as oligophagous; six as moderately polyphagous and four as polyphagous. The polyphagous *Rekoa marius* was the most abundant species (n=55, obtained in Bignoniaceae, Caryocaraceae, Erythroxylaceae, Fabaceae, Malpighiaceae, Myrtaceae, Ochnaceae and Symplocaceae), followed by the polyphagous *Parrhasius polibetes* (n=26, found in: Chrysobalanaceae, Malpighiaceae, Ochnaceae, Sapindaceae, Styracaceae and Vochysiaceae). *Allosmaitia strophius* (n= 20 found exclusively in Malpighiaceae) and *Michaelus ira* (n= 19 found in Bignoniaceae only) were the most abundant oligophagous species. Studies suggest that most Neotropical lycaenids are polyphagous; however this work unveiled the existence of some oligophagous species, especially those that feed on host plant families with sequential flowering species (e.g. Malpighiaceae). The challenge is to determine whether local patterns can be generalized to other localities, in this sense our results are compared with other lycaenid communities in the cerrado savanna.

Merian Award Applicant

SYMPLOCOS (SYMPLOCACEAE) AS FLAGSHIP SPECIES FOR FOREST CONSERVATION EFFORTS OF INDONESIAN WEAVERS

Marco Schmitt, Steven Jansen

Ulm University, Ulm, DE, marco.schmitt@uni-ulm.de

While most tropical plant species exclude the uptake of aluminium (Al) through a wide range of physiological and structural mechanisms, a small number of diverse taxa accumulate Al in aboveground plant tissues in concentrations above 1,000 mg/kg. Identifying the evolutionary, physiological and ecological significance of these Al accumulating plants increases our understanding of terrestrial nutrient cycles and Al detoxification mechanisms in plants, which has significant implications for cultivating various economic crops, such as soybean, tea, and rice, in acid, tropical soils.

Symplocos species, which were described by Rumphius in the 17th century as *Arbor aluminosa*, accumulate very high levels of Al up to 70,000 mg kg^{-1}. Across Indonesia, this genus is found in remnant forests and communal forests on deeply weathered soils. However, *Symplocos* trees are becoming rare in various areas because of the use of its leaves and bark tissue in tradional dye techniques by Indonesian weavers. Therefore, *Symplocos* has become a flagship species for the conservation efforts of a network of 1,100 women in thirty natural-dye weavers' cooperatives on nine Indonesian islands. Chemical analyses suggest that old leaves contain the highest levels of Al, and that sustainable use of *Symplocos* can be promoted by collecting old leaves from the forest floor in combination with cultivation and re-introduction of Symplocos trees in deforested areas.

Merian Award Applicant

THE INFLUENCE OF TENDING ANTS ON THE OVIPOSITION PATTERN OF LYCAENID BUTTERFLIES IN *PEIXOTOA TOMENTOSA* (MALPIGHIACEAE)

Estevao Alves-Silva[1], Alexandra Bächtold[2], Lucas A. Kaminski[3], Kleber Del-Claro[1]

[1]*Universidade Federal de Uberlandia, Uberlandia, BR, estevaokienzan@yahoo.com.br*
[2]*Universidade de Sao Paulo, Ribeirao Preto, BR*
[3]*Universidade de Campinas, Campinas, BR*

Myrmecophilous lycaenids establish stable associations with tending ants, which protect the larvae against natural enemies. Thus, lycaenid female oviposition preference may be ant-mediated. In this study we examined the influence of ants on the occurrence of florivorous lycaenids associated with the extrafloral nectaried shrub *Peixotoa tomentosa* (Malpighiaceae) in a Brazilian savanna (18°58.855'S - 48°17.685'W). Twenty eight plants were tagged and two branches were selected for the experiments. One branch received a layer of atoxic wax (Tanglefoot) to prevent the ant access to the inflorescences; the other branch was left unaltered. Lycaenid egg sampling was performed once a week from May to June. We found 129 lycaenids belonging to eight species. *Allosmaitia strophius* was the most abundant (76%; n=98 individuals); followed by *Tmolus venustus* (4%; n=5), *Rekoa marius* (3%; n=4), *Parrhasius polibetes* (2%; n=3), *Tmolus* sp. (2%; n=3), *Panthiades hebraeus* (2%; n=2), *Ostrinotes empusa* (1%; n=1) and *Strymon mulucha* (1%; n=1). Eleven eggs (9%) did not hatch in the laboratory. Only 15 (0.54±0.75; Mean ± SD) *A. strophius* eggs were found in ant-excluded branches, the other 83 (2.96±3.07) were found in branches with free ant access (Wilcoxon test T=8; Pairs=28; *P*=0.0002). Most eggs (n=30) were found in branches patrolled by *Camponotus blandus*, followed by branches with *Ectatomma tuberculatum* (n=27 eggs), *Camponotus crassus* (n=8 eggs), *Ectatomma edentatum* (n=2 eggs) and two unidentified ant species (n=16 eggs). *Peixotoa tomentosa* was found to support one of the most diverse lycaenid communities in cerrado. Female oviposition pattern, especially in *A. strophius*, was ant-mediated. An-mediated oviposition in lycaenids appears to be a common process in cerrado savanna, where many facultative myrmecophilous butterflies share the same host with tending ants.

THE FIELD STATION "*TROPENSTATION LA GAMBA*" IN COSTA RICA

Werner Huber, Anton Weissenhofer

Department of Tropical Ecology & Animal Biodiversity, University of Vienna, Vienna, AT, werner.huber@univie.ac.at

The "Tropenstation La Gamba" is situated directly at the edge of the Piedras Blancas National Park near the village La Gamba, in the south-westernmost corner of Costa Rica, viz. the Golfo Dulce region. In the immediate vicinity, a wide range of habitats can be found, e.g. various types of primary humid lowland rainforest, stages of secondary forest succession, cattle pastures, and oil-palm plantations. Hence, this station offers ideal research opportunities for field work, especially with regard to the biodiversity and functioning of primary forest ecosystems and for effects of land-use and human disturbance on tropical biota in the margin zone of an important conservation area. The area is unique within Costa Rica due to its peculiar climate, with perhumid conditions prevailing most of the year (mean annual precipitation >6000mm, mean annual temperature >27°C).

The station comprises a small lab equipped with basic instrumentation for biomass, soil and water analyses, a garden with opportunities for small-scale experiments, and it offers accommodation space for about 35 scientists. Up to now roughly 60 master and diploma theses have been finished. Thus far, these efforts resulted in various scientific publications and books about the biodiversity and natural history of the region (summarized in Weissenhofer et al., 2008).

The station is financed and managed by the University of Vienna, Austria. Conditions for use and other relevant information can be found at www.lagamba.at. Since 1998 many field courses for students from universities in Austria, Germany, England, Slovenia, the US and Costa Rica have been conducted at the "Tropenstation La Gamba".

With about 2,700 species of vascular plants the Golfo Dulce region is one of the botanically most diverse areas of Central America. Up to 179 tree species have been counted on one hectare of primary forest. A biogeographical analysis of the vascular species of the Golfo Dulce region reveals a close relationship to northern South America, especially the Chocó region (viz. parts of Colombia, Ecuador and Peru). Remarkable is the high degree of plant endemism in the Golfo Dulce region. An analysis of seven representative families shows that about 18% of the investigated species are endemic. In Marantaceae, even 32% of the species are endemic.

Weissenhofer A., W. Huber, V. Mayer, S. Pamperl, A. Weber & G. Aubrecht (eds.) (2008): Natural and cultural history of the Golfo Dulce region, Costa Rica. *Stapfia* 88: 1-768.

MALPIGHIACEAE AS KEYSTONE HOSTS FOR *HETEROTHRIPS PEIXOTOA* (INSECTA: THYSANOPTERA) IN A BRAZILIAN SAVANNA

Estevao Alves da Silva, Kleber Del-Claro

Universidade Federal de Uberlandia, Uberlandia, BR, estevaokienzan@yahoo.com.br

Insect herbivores have diverse ways to occupy and explore their host plants. For thrips (Thysanoptera), the patterns of occurrence and abundance in different plant species are important factors that determine their population dynamics, and plant phenology is the key role driving thrips abundance and maintenance. In this context, studies have shown that some host plants are exceptional, relative to others, in preserving thrips populations in time and space (keystone-hosts). In this study we examined the role of a Malpighiaceae community as keystone host for the florivorous thrips *Heterothrips peixotoa* (Heterothripidae). The study was performed in a Brazilian savanna (Cerrado biome - 18°97'S, 48°29'W) and sampling was made from February 2010 to July 2012. At this period, flowers of 62 plant species in 22 families were sampled and *H. peixotoa* was found in all Malpighiaceae species at the area (n=15 species in four genera *Banisteriopsis, Peixotoa, Heteropterys and Byrsonima*). Malpighiaceae presented sequential flowering, offering a predictable microhabitat for the maintenance of *H. peixotoa* all year round, because different plants bloomed in a sequence that allowed for thrips to migrate between hosts, where they could feed, breed and hide from natural enemies. *Peixotoa* and *Banisteriopsis* accounted for the highest thrips abundance and *H. peixotoa* population was 44% higher during the dry season, when rains are rare in cerrado (May-September). The Malpighiaceae community investigated in this study has not been found together elsewhere in other cerrado areas. If the maintenance of *H. peixotoa* is dependent on Malpighiaceae, the lack of any plant may have serious and deleterious consequences for thrips population. To date our results allow us to propose that the community of sequential flowering Malpighiaceae in a Brazilian savanna have a significant and noteworthy role in *H. peixotoa* maintenance in time and space.

ANT-MEDIATED HOST PLANT SELECTION IN FACULTATIVE ANT-TENDED BUTTERFLIES: NEW EVIDENCE FOR TWO NEOTROPICAL LYCAENIDS

Alexandra Bachtold[1], Estevão Alves da Silva[2], Lucas Augusto Kaminski[3], Kleber Del Claro[2]

[1]Universidade de São Paulo, Ribeirão Preto, BR, cuca_bachtold@yahoo.com.br
[2]Universidade Federal de Uberlândia, Uberlândia, BR
[3]Universidade Estadual de Campinas, Campinas, BR

Myrmecophilous butterflies can selection host plants according to ant presence. It was initially demonstrated experimentally for obligate ant-tended species and more recently for facultative myrmecophilous species. In tropical savanna like Brazilian cerrado is common ant presence on plant foliage. Thus, we conducted field experiments to assess the host plant selection on *Heteropterys* sp. (Malpighiaceae), a host plant used by some neotropical lycaenids. Eighteen plants were tagged and two branches were selected for the experiments. One branch received a layer of atoxic wax (Tanglefoot) to prevent the ant access to the inflorescences – treatment branch; the other branch was left unaltered – control branch. Lycaenid egg sampling was performed once a week from May to June. Among ants observed on inflorescences are species of *Camponotus* and *Crematogaster*. We found a total 280 eggs being 111 eggs of *Allosmatia strophius* and 169 eggs of *Rekoa marius* eggs. Oviposition experiments revealed that both *A. strophius* and *R. marius* females select branches of *H. byrsonimifolia* hosting ant compared to branches without ant (for *A. strophius*: G= 42.49, df=1, P < 0.0001; and for *R. marius*: G= 56.00, df=1, P < 0.005). In the sense, our results show ant-mediated host plant selection may be more common than expected and is present even butterflies with low degree of myrmecophily, like is in the case of *A. strophius*.

Merian Award Applicant

CRC 990: ECOLOGICAL AND SOCIOECONOMIC FUNCTIONS OF TROPICAL LOWLAND RAINFOREST TRANSFORMATION SYSTEMS (SUMATRA, INDONESIA)

Claudia Dislich[1], Katrin Meyer[1], Jann Lay[2,3], Matin Qaim[4], Stefan Scheu[5], Kerstin Wiegand[1]

[1]Department of Ecosystem Modelling, University of Göttingen, Göttingen, DE, cdislic@gwdg.de
[2]GIGA-German Institute of Global and Area studies, Hamburg, DE
[3]Faculty of Economic Sciences, University of Göttingen, Göttingen, DE
[4]Department of Agronomy and Rural Development, University of Göttingen, Göttingen, DE
[5]J.F. Blumenbach Institute of Zoology and Anthropology, University of Göttingen, Göttingen, DE

The Collaborative Research Centre (CRC) aims at providing science-based knowledge on how to protect and enhance the ecological functions of tropical forests and agricultural transformation systems at a landscape scale, while at the same time improving human welfare. Further, the program aims at providing baseline information on how to integrate agricultural land use and conservation issues. The research will be implemented in one of the largest regions of tropical lowland rainforest in Southeast Asia, namely Jambi Province in Sumatra, Indonesia. Within Jambi 32 core sites – including transformation systems (oil palm and rubber plantations & extensive rubber) and forest reference sites – were selected for detailed analyses.

The CRC scientific projects will analyze and compare a broad range of issues, including above and below ground biodiversity, soil fertility, water, nutrient and greenhouse gas fluxes, as well as economic, social, cultural and political aspects related to rainforest transformation.

The findings of these projects will be used as input for an integrated modelling framework that will be developed to investigate synergies and trade-offs among and between the various ecological and socioeconomic functions. The guiding question will be what kind of landscape mosaic is needed to optimize the ensemble of biodiversity, ecosystem functioning, and economic benefit.

ECO-IMMUNOLOGY OF NEOTROPICAL BATS

Karin Schneeberger[1,2], Gábor A. Czirják[1], Christian C. Voigt[1,2]

[1]Leibniz Institute for Zoo and Wildlife Research, Berlin, DE, schneeberger@izw-berlin.de
[2]Freie Universität, Berlin, DE, schneeberger@izw-berlin.de

Ecological and social factors are central in the emergence and transmission of infectious diseases, thus bearing the potential for shaping a species' immune competence. Previous studies demonstrated a link between social factors such as promiscuity and the cellular immune system in captive mammals. However, it is yet poorly understood how ecological factors correlate with both cellular and humoral immune parameters. In addition, comprehensive studies on wild mammals are still lacking. Here, we tested if the cellular and soluble mediated constitutive immune system of free ranging neotropical bats is associated with two ecological factors: diet and shelter choice. We found that total and differential white blood cell counts (WBC) of 24 co-existing Neotropical bat species varied with the species-specific diet and body mass. Bats that included at least partially vertebrates in their diet exhibited the highest WBC, followed by phytophagous and insectivorous species, which is consistent with the prediction that the immune system is linked to the pathogen transmission risk of a trophic level. The soluble part of the constitutive immune response, assessed by an *in vitro* bacterial killing assay, decreased with increasing roost permanence. Our results suggest that the ecology is an important factor in the evolution of the immune system of bats and probably also other mammals.

Merian Award Applicant

BIOLOGICAL CORRIDORS IN THE GOLFO DULCE REGION

Anton Weissenhofer[1], Richard Hastik[2], Daniel Jenking[3], Werner Huber[1]

[1]University of Vienna, Vienna, AT, werner.huber@univie.ac.at
[2]University of Innsbruck, AT
[3] Tropical Station La Gamba, Postal 178, Golfito, CR

Numerous studies have revealed that the local fauna and flora of isolated forest patches cannot survive in the long term, due to inbreeding effects and the loss of genetic variability in their populations.
The establishment of 'biological corridors', which connect isolated forests or forest patches, has received great acceptance. The Osa Biological Corridor forms a connection between the lowland forests of the Osa Peninsula and the La Amistad International Park (PILA) in the Cordillera de Talamanca, Costa Rica. The Biologiocal Corridor La Gamba (COBIGA) is part of the Osa Biological Corridor and should connect the lowland forests of the Piedras Blancas Nationalpark with the nearly unprotected mountain forests of the 'Fila Cal'. On the basis of aerial photographs taken in 2003 (CARTA 2003), particularly important prospective corridor areas were identified. At present, most of the envisaged sites are in private hands and the farmers first need to be convinced of the corridor idea. Recently, the Austrian association 'Rainforest of the Austrians' has taken an active part in the COBIGA project and engages mainly in purchasing selected, promising corridor lands, and in restoring and reforesting them. This project's aim is to integrate both the enlargement of forest areas as well as a sustainable land management, through projects of reforestation, agriculture and sustainable development. A monitoring project was started in order to provide useful information on suitable tree species for reforestation in Central America.

GROWTH AND SURVIVAL OF RAINFOREST SEEDLINGS IN REFORESTATION IN LOWLAND COSTA RICA

Peter Hietz[1], Nina Schnetzer[1], Daniel Jenking[2], Anton Weissenhofer[3]

[1]Institute of Botany, Universität für Bodenkultur, Vienna, AT, nina.schnetzer@gmail.com
[2]La Gamba Biological Research Station, La Gamba, CR
[3]Department of Tropical Ecology and Animal Biodiversity, Universität Wien, Vienna, AT

Recreating high-diversity tropical rainforests through reforestation is challenging because suitable seed or seedling material is difficult to come by, and because the performance of many tree species is little known. Nearly 5000 seedlings of 81 rainforest species were planted on c. 8 ha of abandoned pasture in La Gamba, SW Costa Rica, in 2010/11. Plants were obtained from a nearby rainforest as seeds or seedlings and pregrown in a nursery over several months. About one year after planting we evaluated survival and growth of seedlings of 36 species to identify environmental conditions that affect seedling performance and differences among species. Overall mean height was 1.4 m, ranging from 0.5 m (when plants may not have grown in height at all) to 8.0 m (*Ochroma pyramidale*). Total mortality was low (16%, range: 5 - 42%), >80% of surviving plants appeared healthy, and herbivory affected only a few pioneer species (*Ochroma, Inga, Vochysia*). Conditions that enhanced seedling survival and height differed among species, but generally favourable were location in a flat area or lower slope, and intermediate levels of light (i.e., light shading by surrounding plants). The effect of the surrounding vegetation was often inconclusive, but plants growing next to grasses, clubmosses or ferns often had lower survival rates, especially when associated with direct solar radiation on hilltops. These first data will serve as a baseline to monitor trees over the following years, and provide useful information on suitable species and site selection.

SPECIAL STRUCTURAL FEATURES OF YOUNG LEAVES OF THE MANGROVE *LAGUNCULARIA RACEMOSA*

Marie-Luise Schnetter, Reinhard Schnetter

Institut für Botanik, Justus-Liebig-Universität, 35490 Gießen, DE

It is well known that adult mangrove leaves show special morphological characteristics. These are cells with large vacuoles able to absorb ions, salt secreting glands and thick walls of the epidermis to reduce water loss. In comparison, cells of a very young leaf have no vacuoles. Therefore, the important vacuolar absorption of ions cannot take place. Moreover, in young leaves the cuticula is absent or very thin resulting in danger of water loss. *Laguncularia racemosa* (L.) C.F. Gaertn. avoids damages by means of young involute leaves in upright position. Thus the leaf surface is much reduced. Salt glands are already present when the growth of the lamina starts. Growth and differentiation of the leaf takes place in the involute state. When the different tissues are already visible, spherical structures appear at the abaxial side of the lamina near its border. Schnetter et al. (2009)* proved that these structures are hydathodes. Soon after their formation, the leaf begins to expand. At the same time, fissures appear in the epidermis of the hydathodes. As soon as the leaf is completely unfolded the hydathodes die. In the adult leaves, their dead remnants are still visible as a row of black dots at the abaxial side. These dots are known as submarginal glands. For a long time their function was unknown. The appearance of the hydathodes shortly before the unfolding of the leaves and their death after that permits the conclusion that they promote the entrance of water into the expanding leaf.

*Schnetter, M.L., A. Opitz, R. Schnetter, 2009. Estructura y función de las glándulas submarginales del mangle Laguncularia racemosa (Compretaceae). pp. 539-554. In: Beltrán Tejera, E., J. Afonso-Carillo, A. García Gallo, O. Rodriguez Delgado (Eds.): Homenaje al Prof. Dr. Wolfredo Wildpret de la Torre. Instituto de Estudios Canarios, La Laguna, Tenerife.

DAMAGE OF VALUABLE WETLANDS CAUSED BY THE SHIP INDUSTRY

Gaby Hoebart[1,2]

[1]Red Frog Tour S.A., Moin, Puerto Limon, CR, hobartjob@aol.com
[2]Geographer, Humboldt University, Berlin, DE

Research has been done along the Caribbean coast of Costa Rica how the modernisation of the Panama Canal can have an effect on sensitive wetlands. The modernisation of the transit canal between North and South America for the global ship industry is actually an amplification since 2007. The future width will be 3 times of its original size. Next to dredging some hills are blasted way. The future ship generation called Post-Panamax will be 427 m long. The plan is to change the canal from a one-way route to a two-way route. Economist expect the ship industry to keep growing, especially Asian countries like China have a strong interest in increasing their exports.

As a consequence the harbour city of Puerto Limon in Costa Rica is going to build a huge new container dock financed by the world no. 2 container giant MAERSK. The dock will be built in 3 phases, until 2016 a sea wave breaker with a length of 830 m from the coastline into the sea and a platform with container cranes will be built parallel to the shore, being 1.2 km long during the first and second phase. The plan is to extend the platform to 1.5 km in the third phase. Drilling companies will have to remove sea-floor sediments and rocks down to 14m of depth. The destroyed marine area is an area of 80 ha.

Environmentalists fear that the change of the geomorphology and coastal decline will also change the hydro-regime. The local population might loose 20% of their drinking water reserves and the danger exists that valuable wetlands will fall dry. The area protected by MINAET (Ministry for Agriculture and Environment) has not been developed much for tourism yet. The area within the humid tropics receiving 3.000 mm rainfall is an important home for water birds and many other species living in mangroves. Since the building site is so extensive one cannot exclude that also coral reefs further south might be harmed by the loads of sediments the sea current will carry around in circles before moving north in the Atlantic.

Due to the legislation in Costa Rica that people living 200m from the sea shore or 50m from rivers can only receive concessions, the whole village of Moin will be removed and all families having their homes along 5 km at the coast line will loose their homes. As the coastal strip is leasehold land only the established belongings will be compensated and most people have to start a new existence from zero.

FROM BRAZIL TO THE WORLD: HOW *EICHHORNIA CRASSIPES* CONQUERED THE PLANET.

Pia Parolin[1,2], Barbara Rudolph[2], Stephanie Bartel[3], Cécile Bresch[1], Christine Poncet[1]

[1]INRA, Sophia Antipolis, FR, pparolin@botanik.uni-hamburg.de
[2]University of Hamburg, Dept. Plant Diversity, Hamburg, DE
[3]Max-Planck-Institute for Evolutionary Biology, Plön, DE

The water hyacinth *Eichhornia crassipes* (Mart.) Solms is one of the 100 world's worst invaders. Nativeto tropical freshwaters of tropical South America, with a putative origin in the Amazon basin and the Pantanal, the water hyacinth is nowadays distributed worldwide. In tropical regions, *E. crassipes* escaped into local environments and spread out into the freshwaters proliferating aggressively mainly by means of vegetative reproduction. Due to its ability to double its biomass within only 12 days, it rapidly covers whole water bodies and heavily affects the ecology of local plants and whole ecosystems.

We investigated the genetic structure of the water hyacinth in its native range using AFLPs and cpRFLPs. Genetic distance trees and PCOs based on AFLP data show two separated populations of this species with a western population separated from the main South American population. This differentiation is supported by different chloroplast haplotypes.

The origins in different regions of Southern America of the individuals found worldwide could be demonstrated by integrating worldwide samples into the data set. Several independent anthropogenic introductions into the tropics worldwide could be detected. Samples from botanical gardens of Europe cluster within worldwide samples suggesting a distribution pathway via Europe.

Given the environmental and economical dangers related to the expansion of *E. crassipes*, the role of botanical gardens as initiators of invasions and of other anthropogenic migration factors, such as missionaries and colonists in the past as well as tourists, nurseries, private and commercial trade must be taken seriously. The expansion of this highly aggressive species with high growth rates and no local enemies may further increase due to more favourable growth conditions in formerly non-suited habitats as a consequence of climatic changes.

THE CONFERENCE ORGANIZERS

Organizing committee
Konrad Fiedler, Christian H. Schulze
Department of Tropical Ecology and Animal Biodiversit
Wolfgang Wanek
Department of Terrestrial Ecosystem Research, University of Vienna
University of Vienna

Support staff
Dr. Alexander Seidel
Barbara Reischl
Lisamarie Lehner
Petra Bartl-Binder
Anita Freudmann
Philipp Mollik
Daniel Schenz
Dr. Brigitte Gottsberger

Conference management
Heike Kuhlmann
KCS Kuhlmann Convention Service
E-mail: info@kcs-convention.de

Chairs of sessions
Christian H. Schulze
Wolfgang Wanek | Peter Hietz
Nina Farwig | Eike Lena Neuschulz
Marcell Peters
Jörg Bendix | Erwin Beck
Meike Piepenbring
Jan Beck
Pia Parolin

Scientific committee
Jörg Bendix, Siegmar-W. Breckle, David Burslem, Bettina Engelbrecht, Nina Farwig, Konrad Fiedler, Pierre-Michel Forget, Andreas Gettkant, Jaboury Ghazoul, Eckhard W. Heymann, Heribert Hofer, Jürgen Homeier, Gerhard Kost, Holger Kurz, Michael Lakatos, Karl Eduard Linsenmair, Reinhard Mosandl, Eike Lena Neuschulz, Manfred Niekisch, Pia Parolin, Ulrich Saint-Paul, Christian H. Schulze, Simone Sommer, Marco Tschapka, Wolfgang Wanek, Karl Matthias Wantzen, Rainer Wirth

Supporters and Sponsors
Elsevier, Ecomatik, University of Vienna

THE SOCIETY FOR TROPICAL ECOLOGY GESELLSCHAFT FÜR TROPENÖKOLOGIE E.V. - GTÖ

The Society for Tropical Ecology (Gesellschaft für Tropenökologie – gtö), founded in 1987, is Europe's largest scientific association in the field of tropical ecology. It aims to enhance the understanding of the biodiversity and function of tropical ecosystems, and to drive decision making and management at all levels. The society also aims to promote the conservation and rehabilitation of tropical biodiversity and ecosystems through research and its application. It is with these missions in mind that gtö, in collaboration with the University of Vienna, has organized its 2013 conference "Tropical organisms and ecosystems in a changing world".

gtö vision

Understanding biodiversity and functions of tropical ecosystems drives decision making and management on all levels.

gtö mission

Promoting the conservation and rehabilitation of tropical biodiversity and ecosystems through research and its application.

Become a member!
www.gtoe.de

gtö Executive Board

President:	Manfred Niekisch
Vice President:	Karl Eduard Linsenmair
Secretary General:	Pia Parolin
Treasurer:	Holger Kurz

MERIAN AWARD

In honor of Maria Sibylla Merian the best three oral presentations and posters will be awarded a prize. Eligible candidates are students and PhDs who finished their dissertation less than three years ago. Please subscribe for participation using the online registration/submission form. The award ceremony takes place during the Conference Dinner on Thursday evening.

INDEX OF PARTICIPANTS

First name	Family name	Organisation		Reference Page
Markus	Adamek		DE	
Marc-Oliver	Adams	University of Vienna	AT	126
Estevao	Alves da Silva	Universidade Federal de Uberlandia	BR	178, 179
Amira Elvia	Apaza Quevedo	Martin Luther University	DE	86
Tim	Appelhans	Philipps Universität Marburg - Umweltinformatik	DE	72
Alexandra	Bachtold	Universidade de São Paulo	BR	174, 176, 179
Angelica	Baldos	Georg-August Universitaet Goettingen	DE	95
Jan	Beck	University of Basel	CH	29, 118
Erwin	Beck	Dept. of Plant Physiology, University of Bayreuth	DE	82, 102, 106
Ludwig	Beenken	ETH Zürich, Institut für Integrative Biologie	CH	110
Hermann	Behling	Department of Palynology and Climate Dynamics, University of Göttingen	DE	75, 84, 85, 154, 157, 171
Johannes	Bender	Institute of Physical Geography, Goethe University	DE	87
Jörg	Bendix	University of Marburg / LCRS	DE	82, 83, 94, 103, 105, 156
Lydia	Betz	University of Göttingen	DE	68
Siria	Biagioni	Department of Palynology and Climate Dynamics Albrecht-von-Haller-Institute for Plant Sciences Georg-August-University Goettingen	DE	85
Florian	Bodner	University of Vienna	AT	124
Siegmar	Breckle	Dept Ecology Bielefeld	DE	
Silva	Brenner	Uni Marburg	DE	105

First name	Family name	Organisation		Reference Page
Arthur	Broadbent	Universität Bern	CH	
David	Bröderbauer	Department of Structural and Functional Botany/University of Vienna	AT	159
Arndt Rüdiger	Brodkorb	ARSAMA III - WFD/BMZ	GN	
Baltazar	Calvas	Lehrstuhl für Waldbau/ Technische Universität München (TUM)	DE	58, 133
Tessa	Camenzind	Freie Universität Berlin	DE	113, 160
Daisy	Cárate Tandalla	Göttingen Centre for Biodiversity and Ecology	DE	
Luz Maria	Castro	Technische Universität München	EC	133
Priscila	Chaverri	University of Maryland	US	28, 115
Sei-Woong	Choi	Mokpo National University	KR	
Giulia	Curatola Fernández	Philipps-Universität Marburg	DE	103
Mateus	Dantas de Paula	UFZ	DE	173
Agnes	Dellinger	University of Vienna	AT	138
Claudia	Dislich	University of Göttingen	DE	180
Thomas	Engel		DE	
Andreas	Enßlin	University of Bern	CH	77
Raffael	Ernst	Senckenberg Natural History Collections Dresden	DE	120
Nik	Fadzly	Universiti Sains Malaysia	MY	135, 136
Nina	Farwig	University of Marburg	DE	60, 62, 69
Fabian	Faßhauer	EPSAG, University of Göttingen	DE	168
Konrad	Fiedler	University of Vienna	AT	124, 126
Aline	Finger	Royal Botanic Garden Edinburgh	UK	55, 123
Rico	Fischer	UFZ Leipzig	DE	76
Melanie	Forker	HTW Dresden	DE	54
Anita	Freudmann	University of Vienna	AT	40, 143
Kerstin	Friesenbichler	University of Vienna	AT	143

First name	Family name	Organisation		Reference Page
Silvia Cecilia	Gallegos Ayala	Halle University	DE	
Jörg	Ganzhorn	Universität Hamburg	DE	36, 144, 145, 146, 147, 148
Julian	Gaviria	University of Bayreuth	DE	151
Julia	Gawlik	Institute of Geography, FAU Erlangen	DE	57
Antje	Gensing	Freie Universität Berlin	DE	113, 160
Anne	Gérard	Universität Hamburg	DE	148
Friederike	Gerschlauer	Karlsruhe Institute of Technology, IMK-IFU	DE	73
Andreas	Gettkant	GIZ	DE	132
Jaboury	Ghazoul	ETH Zurich	CH	55, 56, 61, 121
Julian	Glos	University of Hamburg	DE	42, 119
Ingo	Graß	Philipps-Universität Marburg	DE	
Ingeborg	Haug	University of Tübingen, Evolutionary Ecology of Plants	DE	114
Barbara	Haurez	University of Liège	BE	44
Antje	Heideroth	University Marburg (Lahn)	DE	155
Maria	Helbig-Bonitz	University Ulm, Institute of Experimental Ecology	DE	80, 158
Andreas	Hemp	University of Bayreuth	DE	71, 74, 75, 77, 78, 154, 165
Claudia	Hemp	University of Würzburg	DE	71, 165
Eduardo L.	Hettwer Giehl	Uni-Göttingen	DE	122
Eckhard W.	Heymann	Deutsches Primatenzentrum	DE	65, 66, 128
Patrick	Hildebrandt	Institute of Silviculture	DE	59, 88
Gabriele	Höbart	Red Frog Tours	AT	185
Walter	Hödl	Dep. of Integrative Zoology, Univ. Vienna	AT	31, 129, 137

First name	Family name	Organisation		Reference Page
Florian	Hofhansl	University of Vienna	AT	49
Stefan	Hohnwald	Dept. of Landscape Ecology	DE	38, 53
Monique	Hölting	Senckenberg	DE	120
Jürgen	Homeier	University of Göttingen	DE	88, 91, 93, 97, 104, 113, 160
Werner	Huber	Univ. Wien	AT	159, 177, 182
Andreas	Huth	Helmholtz Center for Environmental Research -UFZ	DE	48, 51, 76, 172, 173
Sascha	Ismail	ETH Zurich	CH	55, 56
Nele	Jantz	Göttingen University	DE	84
Lucas	Jurkschat	Universität Göttingen	DE	127
Samantha	Karunarathna	World Agroforestry Centre, Kunming, China	CN	111
Martin	Kazmierczak	UFZ Leipzig	DE	50
Michael	Kessler	Systematic Botany, University of Zurich	CH	26
Chris	Kettle	ETH Zurich	CH	55, 56, 121
Nikolai	Knapp	HNE Eberswalde	DE	152
Susanne	Kobbe	University of Hamburg	DE	36, 147
Daniel	Kübler	Institute of Silviculture, TU München	DE	59, 88, 90
Denis	Kupsch	Göttingen University, Germany	DE	34, 39, 66
Holger	Kurz	BfBB	DE	
Daniel	Lewanzik	IZW Berlin	DE	43
Ana	Luz	Universitat Autònoma de Barcelona / Institut de Ciència i Tecnologia Ambientals (ICTA)	ES	37
Bea	Maas	University of Göttingen, Agroecology	DE	64
Sandro	Makowski Giannoni	Philipps-Universität Marburg	DE	94

First name	Family name	Organisation		Reference Page
Alexandra	Mangold	University of Vienna	AT	
Asyraf	Mansor	Universiti Sains Malaysia	MY	134, 135, 136
Sylwia	Marcek	Universität Hamburg	DE	36, 146
Franca	Marian	Universität Göttingen	DE	99
Amanda	Matson	Georg-August University of Goettingen	DE	96
Antonia	Mayr	Universtity of Würzburg, Department of Animal Ecology and Tropical Biology	DE	79
Amir Shah Ruddin	Md Sah	Universiti Sains Malaysia	MY	
Dirk	Mezger	University of Ulm	DE	125
Julio	Mora	Institute of Silviculture TUM	DE	59
Reinhard	Mosandl	Institute of Silviculture TU München	DE	58, 59, 88
Anke Katrin	Müller	Georg-August-University Göttingen	DE	98
Christina	Mumm	University of Ulm	DE	166
Maximilian	Nepel	University of Vienna	AT	116
Eike Lena	Neuschulz	Biodiversity and Climate Research Centre	DE	25, 60
Manfred	Niekisch	Zoologischer Garten Frankfurt	DE	
Vojtech	Novotny	Czech Academy of Sciences	CZ	27
Clive	Nuttman	Tropical Biology Association	UK	
Nirmal	Ojha	Karlsruhe University of Applied Sciences	DE	163
Marti	Orta-Martinez	Universitat Autònoma de Barcelona	ES	37, 131
Pia	Parolin	INRA and Univ. Hamburg	FR	170, 186
Isabel	Pérez Postigo	Philipps Universität Marburg	DE	
Jana	Petermann	Freie Universität Berlin	DE	161

First name	Family name	Organisation		Reference Page
Marcell	Peters	Zoologie 3 / Uni Würzburg	DE	70, 71, 79
Meike	Piepenbring	Universität Frankfurt am Main	DE	108, 109
Anastasia	Poliakova	Georg-August-University, Göttingen	DE	171
Flavius	Popa	University Marburg	DE	112
Pablo Daniel	Ramirez Castillo	Universität Göttingen	DE	
Agnes	Rehmus	Universität Bern Geographisches Institut	CH	92
Jana Carina	Riemann	Universität Hamburg	DE	42
Max	Ringler	University of Vienna	AT	129, 137
Eva	Ringler	University of Vienna	AT	129, 137
Simon	Ripperger	Museum für Naturkunde, Berlin	DE	41
Kristin	Roos	Dept. of Plant Physiology, University of Bayreuth	DE	102
Gemma	Rutten	Insitute of Plant Sciences, Univ. Bern	CH	78
Ulrich	Saint-Paul	Leibniz Center for Tropical Marine Ecology	DE	
Dorothee	Sandmann	Georg-August-Universität Göttingen	DE	100
Gertrud	Schaab	Karlsruhe University of Applied Sciences	DE	69, 163
David	Schellenberger Costa	University of Oldenburg	DE	74
Marco	Schmitt	Ulm University	DE	175
Christine	Schmitt	Landscape Management, University of Freiburg	DE	47
Karin	Schneeberger	Leibniz Institute for Zoo and Wildlife Research	DE	167
Marie-Luise	Schnetter	Bot. Institut Gießen	DE	181
Nina	Schnetzer	Institute of Botany, BOKU	AT	183

First name	Family name	Organisation		Reference Page
Alexander	Scholz	Universität Ulm, Institut für Systematische Botanik und Ökologie	DE	52
Bernhard	Schuldt	Georg-August-University	DE	91, 169
Lisa	Schüler	Department of Palynology and Climate Dynamics, Göttingen University	DE	75, 154
Christian H.	Schulze	University of Vienna	AT	33, 40, 143, 159
Bruno	Simmen	CNRS/Muséum National Histoire Naturelle Paris	FR	141
Susanne	Spannl	Institute of Geography - University of Erlangen-Nürnberg	DE	89
Bernd	Stimm	Institute of Silviculture, TU Muenchen	DE	58, 59, 88
María Fernanda	Tapia Armijos	Göttingen University	DE	104
Franziska	Taubert	Helmholtz Centre for Environmental Research - UFZ	DE	51, 172
Theresa	Thiele	University of Kaiserslautern	DE	164
Alexander	Tischer	TU Dresden	DE	101, 102
Claire	Tito de Morais	ETH Zurich	CH	121
Helena Maura	Torezan-Silingardi	Universidade Federal de Uberlândia	BR	149
Katja	Trachte	Philipps-University Marburg	DE	156
Franck	Trolliet	Université de Liège	BE	150
Martin	Unterseher	Institute of Botany and Landscape Ecology, Ernst-Moritz-Arndt University Greifswald	DE	109, 115
Cristina	Urrutia	Hochschule für Nachhaltige Entwicklung Eberswalde	DE	166
Andre	Velescu	Universität Bern	CH	
Andrea	Villota	Georg-August University Göttingen	DE	157

First name	Family name	Organisation		Reference Page
Christian	Voigt	Leibniz Institute for Zoo and Wildlife Research	DE	43, 158, 167, 181
Alejandro	von Bertrab	GIZ, GmbH	MX	132
Matthias	Waltert	Georg-August-Universität Göttingen	DE	34, 39, 66, 142
Michael	Weber	Institute of Silviculture, TUM	DE	59, 88, 90
Martin	Wiehle	University of Kassel	DE	162
Arno	Wielgoss	Argoecology- University Göttingen	DE	63
Andreas	Wilting	Leibniz Institute for Zoo and Wildlife Research	DE	35
Wan Fatma	Zuharah	Universiti Sains Malaysia	MY	135, 136

INFORMATION FOR PARTICIPANTS

Wireless LAN and Computers
During the conference, wireless LAN internet access is available at the conference location free of charge. Please use the code on the Voucher you received at the registration point.

Participants not bringing their own computer may have access to a university computer. Please ask our staff at the registration desk how to use these computers.

Meals
Several restaurants are located within a 5-minute walk of the conference venue.
Locations of different restaurants are indicated on the map in the back of this abstract volume.

Public Transport
How to get from the conference venue to ...
Vienna International Airport:
Take the U4 from station "Spittelau" to "Landstraße Hauptstraße" afterwards use the CAT (City Airport Train), which drives directly to the Airport.

Connections can be found under:
- http://www.wienerlinien.at/
- http://www.cityairporttrain.com/

Phone number of registration desk
+4368183157921

Taxi transport
You can hail a passing taxi or call "Taxi Vienna" under +43 (01) 40 100, +43 (01) 31 300, +43 (0) 664/310 33 14 (spezial Airport Taxi), +43 (0) 699/150 845 22 (spezial Airport Taxi).

Free entrance to the botanical garden of the University of Vienna
http://www.botanik.univie.ac.at/
Opening Hours 10:00–18:00

MAP OF CONFERENCE VENUE