

# STATUS AND FUTURE OF TROPICAL BIODIVERSITY

Conference of the Society for Tropical Ecology  
21 – 24 February 2011, Frankfurt a. M.



## PROGRAMME & ABSTRACTS



## MONDAY, 21 FEBRUARY

Registration from 9:00  
University Building *Hauptgebäude* (Jügelhaus), 2nd floor, foyer

**11:30 Welcome coffee | 2<sup>nd</sup> floor foyer**

12:00 Welcome & Keynote  
H III

**13.00 Lunch break**

13:00 Press conference

14:25 Plenary: Keynote H III

15:15 Parallel sessions

H III

H IV

16:00 Coffee break

H III

H IV

18:00 End of sessions

**18:30 Welcome reception at Frankfurt's City Hall „Römer“**

## TUESDAY, 22 FEBRUARY

9:10 Plenary: Keynote H III

10:00 Parallel sessions

H III

H IV

10:45 Coffee break

11:15 Parallel sessions

H III

H IV

**13.00 Lunch break**

14:25 Plenary: Keynote H III

15:15 Parallel Sessions

H III

H IV

16:00 Coffee break

H III

H IV

18:00 End of sessions

**18:30 Public talk (in German)**

**Hall H VI**

## WEDNESDAY, 23 FEBRUARY

9:10 Plenary: Keynote H III

10:00 Parallel Sessions

H III

H IV

11:00 Coffee break  
11:30 Parallel Sessions

H III

H IV

**12.30 Lunch break**  
Time to visit the Zoo Frankfurt, the Palmen garten, or the Sen ckenberg Museum

14:25 Plenary: Keynote H III

15:15 Parallel Sessions

H III

H IV

16:15 Coffee break  
16:30 Scientific poster session | Foyer

18:00 End of sessions

**18:30 For gtö members only: 34th Assembly**

**Hall H III**

## THURSDAY, 24 FEBRUARY

9:10 Plenary: Keynote H III

10:00 Parallel Sessions

H III

H IV

11:00 Coffee break

11:30 Parallel Sessions

H III

H IV

**13.00 Lunch break**

14:25 Plenary: Keynote H III

15:15 Parallel Sessions

H III

H IV

16:00 Coffee break  
15:30 Parallel Sessions cont.

H III

H IV

18:00 End of sessions

**19:30 Dinner & Awards**  
**Café Sturm & Drang; Cam-pus Westend**

FRIDAY: 9:00 - 13:00 FOR816 Working Group Meeting | Hall H III



## STATUS AND FUTURE OF TROPICAL BIODIVERSITY

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

Goethe University  
21 - 24 February 2011, Frankfurt a. M.

### Impressum

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Photo: Manfred Niekisch

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## Welcome



to all participants of the Conference of the Society for Tropical Ecology - gtö to the city of Frankfurt. This conference is hosted by the Johann Wolfgang Goethe University and brings together students and renowned scientists to share recent knowledge on the status and future of tropical biodiversity. Frankfurt is the most international city in Germany, the largest financial centre on the continent, the historical city of coronations, the city of Goethe and the Frankfurt School – in brief, the smallest metropolis in the world. Located along the Main river, between the extensive Stadtwald, the City forest, and the Taunus mountains, Frankfurt is a green city with a modern, highly attractive skyline. Almost one in three of the people living in Frankfurt do not hold a German passport. No matter where visitors come from, they will always meet people in Frankfurt who speak their language and a restaurant that serves their favorite food. The open and hospitable atmosphere in Frankfurt stems from its centuries-old role as a trading centre. This liberal and democratic tradition of the city may be one reason for the fact that people from very diverse cultures have lived here in peace with one another for a long time.

Frankfurt is also home to institutions with international reputation which have a long tradition in the conservation and research of biodiversity worldwide, such as the Palmengarten, the Senckenberg Research Institute and Museum, the University, Frankfurt Zoological Society and last not least Frankfurt Zoo. Frankfurt also hosts the only institute of its kind, the Institute for Biodiversity and Climate (BiK-F), and has the unique network BioFrankfurt which is formed by a wide range of organisations concerned with biodiversity and its conservation from the local to global level. So we are proud that the Society for Tropical Ecology-gtö under its President Manfred Niekisch, our Zoo Director, has recently chosen Frankfurt as its seat and furthermore decided to hold this 2011 annual conference here.

I wish all participants an exciting conference and a stay with fruitful discussions in the pleasant atmosphere of the city of Frankfurt! I hope that you will have the chance to explore the variety of Frankfurt. Our visitors and the people living here, coming from all over the world, have all contributed to making this city shine slightly differently from every angle, like a jewel shines slightly differently when you look at it from different sides.

Petra Roth  
Lord Mayor of the City of Frankfurt

Dear participants, dear colleagues,

it is a great pleasure for me to welcome you to the Annual Conference of the Society for Tropical Ecology (gtö) at Goethe University Frankfurt. The title of the Conference is "Status and Future of Tropical Biodiversity" and promises to provide fundamental new insights in crucial aspects of global biodiversity. It takes place right at the beginning of the UN Decade on Biodiversity 2011-2020, as declared by the UN General Assembly on December 22, 2010.

We as Host University are pleased about the decision of the gtö board to hold this 2011 annual conference here, because the Goethe University makes a significant contribution to biodiversity research in Germany and world-wide. A special highlight was the establishment of the Biodiversity and Climate Research Centre (BiK-F), founded as a cooperation centre between the University and Senckenberg in 2008 as part of the Hessian initiative for scientific and economic excellence (LOEWE).

Another focus of Goethe University lies in its interdisciplinary Research Centre for African Studies. It promotes interdisciplinary collaboration between the humanities and the natural sciences, develops institutional partnerships, and is engaged in knowledge transfer.

The university adopts the issue of biodiversity not only in research, but also, together with non-university partners in the BioFrankfurt network, in educational and public activities. The network brings together reputable institutions to further strengthen the research of global biodiversity, its protection and conservation, and to increase public awareness for the importance of our biological richness.

I express my thanks to the organization team from the group of Bruno Streit, which have realized this important meeting.

I wish you a successful conference with stimulating discussions and informative talks and I hope you will enjoy the time at Goethe University Frankfurt.

Manfred Schubert-Zsilavecz  
Vice President Goethe University Frankfurt





## Foreword



Distinguished participants, dear friends and colleagues,

the more we study tropical biodiversity the more we discover how little we still know. No matter if we look at orchids in Panama, frogs in Madagascar, chameleons in Cameroon and skinks in Vietnam, to mention just a few examples, there are still lots of surprises and species numbers turn out to be much higher than expected. Ecological studies are revealing every day more how rich the world of biodiversity is, how complex the interactions between different species of animals and plants are and, as a consequence, how complex tropical ecosystems are. At the same time economists are trying to assess the financial and economic value of species and ecosystem services. Not everybody does like the “economisation” of biodiversity, but it certainly translates the importance of the elements and systems of life – as we ecologists see it - into a language which is better understood by decision makers from politics, economics, and industry than our scientific, ecological arguments.

But wherever we look, trends of biological diversity are negative. The discovery of so many new species is paralleled by an unprecedented loss of biological diversity due to anthropogenic reasons. The more new species are described, the more we understand how many forms of life we may have lost already without even knowing about their existence, not to talk about their role in the ecosystems and their – potential – benefit for human beings.

The United Nations Year of Biodiversity just ended, and the “Target 2010” to significantly reduce or stop the loss of biodiversity has been missed. The Global Biodiversity Outlook 3, published less than a year ago, shows that none of the 21 sub-targets set for 2010 by the parties to the Convention on Biological Diversity in 2002 has been achieved.

The 2011 Conference of our Society for Tropical Ecology – gtö will address the status of tropical biodiversity and try to put a light on its future which seems to be dull. What unites us is the interest and – why not - enthusiasm for the tropical regions and so we may not give up to engage ourselves in the research on and conservation of our study areas, both in the geographical and taxonomic meaning.

Therefore, we need to strengthen also our organisation, the gtö. We need more members, we need to be active as an organisation also between our conferences. I’m convinced that this conference here in Frankfurt, to which I have the pleasure and honour of welcoming you all, will be one more important step stone towards a better understanding of the multiple aspects of tropical diversity and towards finding solutions for their conservation.

I would like to express the thanks of gtö and my very personal thanks to our supporters and sponsors, to all who helped to prepare the conference, especially my local team, and last but not least to all the participants who contribute to making this meeting interesting and productive.

I wish us all a successful conference.  
Thank you for coming!

Manfred Niekisch  
President gtö



Photos: Manfred Niekisch



Foyer

**REGISTRATION**

Registration can be done  
from 9:00  
in the foyer of the Goethe University  
Jügelhaus, 2<sup>nd</sup> floor

By invitation only:  
10:00 - 11:30  
joint meeting of the organizing committee  
and scientific board of gtö

11:30 Welcome coffee

Hall H III

12:00 Plenary: Opening & Keynote

**WELCOME**

**Manfred Schubert-Zsilavecz**, Vice President Goethe University  
**Manfred Niekisch**, President of gtö  
**Felix Semmelroth**, Frankfurt City Councillor, Deputy Mayor for Culture  
and Science

**KEYNOTE SPEECH**

**Anne Magurran** | Challenges and opportunities in tropical biodiversity  
Assessment

**Chair: Bruno Streit**

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13:15 Lunch break

Press conference

14:25 Plenary: Keynote

**Konrad Fiedler** | Dissecting insect megadiversity: evidence from a tropical montane  
hotspot region; **Chair: Pia Parolin**

p23

15:15 Parallel sessions

**Andean Biodiversity**  
**Chair: Jörg Bendix, Erwin Beck**

p24

15:15 Biodiversity & ecosystem services  
under environmental change in the  
Andes of southern Ecuador;  
**Jörg Bendix**

15:30 Investigating & predicting land use/  
land cover changes in a tropical  
mountain forest of southern Ecu-  
ador; **Boris Thies**

15:45 Vascular plant diversity of natural &  
anthropogenic ecosystems in the  
Andes of southern Ecuador - Stu-  
dies from the Rio-San-Francisco Val-  
ley; **Thorsten Peters**

16:00 Coffee break

16:30 Accessibility predicts the degree of  
degradation of Andean polylepis  
forest; **Johanna Toivonen**

16:45 Response of a tropical montane for-  
est at the rim of the Amazon basin  
in South Ecuador to low-level N, P,  
and Ca amendments;  
**Wolfgang Wilcke**

17:00 Nutrient availability & below-  
ground carbon allocation of tropi-  
cal montane rain forests in sou-  
thern Ecuador; **Katrin Wolf**

17:15 Responses of arbuscular mycorri-  
zal fungi to nutrient additions in a  
tropical montane forest;  
**Tessa Camenzind**

17:30 Decomposition rates & microar-  
thropod colonization of leaves &  
roots in tropical montane rain fo-  
rests along an altitudinal gradient  
in southern Ecuador;  
**Franca Marian**

17:45 Density & community structure of  
soil- & bark-living microarthropods  
along an altitudinal gradient in a  
tropical montane rainforest;  
**Mark Maraun**

**African Savannas Biodiversity**  
**Chair: Karen Hahn, Marco Schmidt**

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15:15 The Mystery of recent global dry-  
land greening;  
**Thomas Hickler**

15:30 Abrupt shifts in savanna tree cover  
along a precipitation gradient;  
**Charly Favier**

15:45 The Interplay of climate change &  
human pressure in predictive vege-  
tation Modeling, West Africa; **Jona-  
than Heubes**

16:30 Termite mound vegetation long  
a climatic gradient in West Africa  
**Arne Erpenbach**

16:45 Insights in savanna ecosystem  
ecology obtained from a former  
ranch in Tanzania;  
**Harry Olde Venterink**

17:00 Green, green grass of home: how  
ungulates select feeding sites in a  
nutrient poor tall grass savanna in  
coastal Tanzania;  
**Annette Stähli**

17:15 Grass-grazer interactions in Afri-  
can savanna ecosystems: where  
does ,the paradigm' stand & whe-  
re do we go from there?  
**Britta Kunz**

17:30 An integrative approach to spe-  
cies discovery - cryptic speciat-  
ion in the African Odonate Genus  
Trithemis; **Sandra Damm**

**18:30 Welcome reception at Frankfurt City Hall Römer by Frankfurt City Councillor  
Manuela Rottmann, Deputy Mayor for Health and Environment  
Public transport: U4 („Dom/Römer“)**

Hall H III	9:10 Plenary: Keynote <b>Alison Cameron</b>   Biodiversity data mining and modelling: prospects for biodiversity in Madagascar, a tropical biodiversity hotspot; <b>Chair: Eduard Linsenmair</b> p 43	

## 10:00 Parallel sessions

Hall H III	<b>Biodiversity &amp; Economy</b> p 44	Hall H IV	<b>Climate Change &amp; Seasonality</b> p 47
	<b>Chair: Manfred Niekisch</b>		<b>Chair: Ulrich Saint-Paul</b>
	10:00 The economics of ecosystems and biodiversity: insights into the relationship of environment & economy; <b>Carsten Nesshöver</b>		10:00 The impact of pleistocene climate change on speciation in Central Africa - the case of haumania; <b>Alexandra Ley</b>
	10:15 Enhancing biodiversity within palm oil: butterflies, stakeholders and the consumer; <b>Ellie Lindsay</b>		10:15 Modeling the dynamics of rainforests. How strong is the impact of drought on tropical rainforests in Madagascar? <b>Rico Fischer</b>
	10:30 Balancing society's priorities: reconciling conflicting land uses in Indonesia; <b>Jaboury Ghazoul</b>		10:30 Influence of climatic seasonality on the diversity & assemblage composition of hummingbirds & their food plant(...); <b>Stefan Abrahamczyk</b>

## 10:45 Coffee break

Hall H III	<b>Tropical Aquatic Ecosystems</b> p 50 <b>Chair: Pia Parolin, Matthias Wantzen</b>	
	11:15	How do rivers work? Tropical limnology provides new insights; <b>Karl Matthias Wantzen</b>
	11:30	Conservation of endemic extemophile livebearing fishes from sulfic habitats in southern Mexico; <b>David Bierbach</b>
	11:45	Helminthes infestation of <i>clarias batrachus</i> & <i>clarias macrophalus</i> : comparison of the small rivers & Mekong delta habitats (...); <b>Elena Mishina</b>
	12:00	Flora of centric diatoms from seven reservoirs in Central Vietnam; <b>Evgeniy Gusev</b>
	12:15	Estimating carbon stock sizes & distribution of methane sources for upper Amazon palm swamp ecosystems (...); <b>Viviana Horna</b>
	12:30	Leaf functional traits of Amazonian floodplain trees in relation to flooding; <b>Pia Parolin</b>
Hall H IV	<b>Rainforest Structure &amp; Dynamics</b> p 58 <b>Chair: Jürgen Homeier</b>	
	11:15	The structure of tropical rainforests: what can we learn from tree size distributions? <b>Franziska Taubert</b>
	11:30	The tropical lowland cloud forest: a lowland forest with montane epiphyte richness; <b>Christine Gehrig-Downie</b>
	11:45	The role of fog in the spatial distribution of a new tropical lowland forest type; <b>Andre Obregon</b>
	12:00	Long term dynamics of an epiphyte community in a lowland rainforest in Panama; <b>Glenda Mendieta-Leiva</b>
	12:15	Tree-level fecundity & dispersal of masting co-dominant rain forest trees in Central Africa; <b>Julian Norghauer</b>
	12:30	Spatial distribution of pine forest in Cusco National Park, Honduras, Central America; <b>Cordula Lennkh</b>
	12:45	Specialization or generalization? Functionality of woody & palm regeneration in a montane Guayanan rainforest, Sierra de Lema, Venezuela; <b>Cristabel Durán-Rangel</b>

## 13:00 Lunch break

Hall H III	14:25 Plenary: Keynote <b>Miguel Vences</b>   Diversity assessment of Madagascar's amphibians & reptiles: micro-endemism of species & phylogeographic lineages & perspectives for their conservation; <b>Chair: Eckhard Heymann</b> p 65	Hall H III

## 15:15 Parallel sessions

Hall H III	<b>East African Mountain Forests</b> p 66	Hall H IV	<b>Tropical Island Biodiversity</b> p 76
	<b>Chair: Georg Guggenberger, Reinhard Mosandl</b>		<b>Chair: Holger Kreft, Yann Clough</b>
	15:15 Coexistence of 3 different functional types of indigenous trees in a tropical montane forest in Ethiopia; <b>Erwin Beck</b>		15:15 The Patterns of fern diversity in the Southeast Asian Archipelago; <b>Dirk Nikolaus Karger</b>
	15:30 Growth strategies of evergreen & deciduous species in a tropical montane forest in Ethiopia; <b>Julia Krepkowski</b>		15:30 Historical & contemporary drivers of biogeographical modules & island roles: a cross comparison of Wallacea & West Indies; <b>Daniel Wisbech Carstensen</b>
	15:45 Temporal resolution of recently assimilated carbon allocation from tree canopy to soil CO <sub>2</sub> efflux in two contrasting tree species of an Afromontane forest; <b>Olga Shibistova</b>		15:45 Equilibrium or non-equilibrium process shapes ground spider diversity? A comparative study between tropical & temperate ecosystems; <b>Samuel Yu-Lung Hsieh</b>

## 16:00 Coffee break

Hall H III	16:30 Using stable isotope labelling to trace SOM decomposition & transformation by microbes under different silvicultural management in the Munessa forest, Ethiopia; <b>Marianne Benesch</b> 16:45 Soil CO <sub>2</sub> efflux in an afromontane forest of Ethiopia as driven by seasonality & tree species; <b>Yonas Yohannes</b> 17:00 Human impact on vascular plants diversity, population structure & natural regeneration of South Nandi Forest, Kenya; <b>Adane Girma Gebreselasse</b> 17:15 Strategies to conserve a lower-montane forest in East Africa using native tree specie; <b>Robert Gliniars</b> 17:30 Acclimation of two afromontane tree species to different irradiance levels determined by thinning of a <i>Pinus patula</i> plantation in southern Ethiopia; <b>Andreas Nenninger</b> 17:45 Effects of silvicultural management practices on the soil & foliar nutrient status of tree species in the Munessa Forest, Ethiopia; <b>Wolfgang Zech</b>	Hall H III	Hall H IV	
	16:30 Ant communities on small tropical islands: effects of island size & isolation are obscured by habitat disturbance & 'tramp' ant species; <b>Akhmad Rizali</b> 16:45 Can key food resources explain the presence & absence of two mouse lemurs in north-western Madagascar? <b>Sandra Thorén</b> 17:00 Ecology & social organisation of Farasan Gazelles on the Farasan Archipelago in the Red Sea; <b>Torsten Wronski</b> 17:15 Island invasion by threatened tree species: evidence for natural enemy release of Mahogany on Dominica, Lesser Antilles; <b>Julian Norghauer</b> 17:30 The yellow crazy ant <i>Anoplolepis gracilipes</i> on Christmas Island: Is successful invasion the end of the story? <b>Heike Feldhaar</b> 17:45 Conservation genetics of the Jellyfish tree, a Seychelles flagship species; <b>Aline Finger</b>			

18:30 Public talk (in German) | Hall H VI  
Walter Jetz | Die Biodiversität der Landwirbeltiere in einer Welt des Wandels;  
**Chair: Manfred Niekisch**

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Hall H VI



**Hall H III** 9:10 Plenary: Keynote  
**Susanne Renner** | Progress in collecting, identifying, and describing tropical species - the latest statistics;  
**Chair: Elisabeth Kalko** p 88

10:00 Parallel sessions

**Hall H III** **Ecological Networks & ecosystem functioning** p 89  
**Chair: Marco Mello, Elisabeth Kalko**  
 10:00 So close, no matter how far: the importance of different species in mutualistic networks; **Marco Mello**  
 10:15 Specialisation in tropical & temperate plant-herbivore networks; **Nico Blüthgen**  
 10:30 Complementary specialization of mutualistic interaction networks decreases towards tropical latitudes; **Matthias Schleuning**  
 10:45 The spatio-temporal behavior of networks crossing habitat borders; **Melanie Hagen**

**Hall H IV** **Animal Plant Interaction** p 101  
**Chair: Georg Zizka**  
 10:00 Delayed induction of plant defences by leaf-cutting ants: Unveiling the secrets of a key herbivore? **Rainer Wirth**  
 10:15 Nutritional aspects of fruit consumption in the Common fruit bat, *Artibeus jamaicensis*; **Larissa Albrecht**  
 10:30 Two species, two ecological strategies - a case study of the reproductive biology of understory herbs in south-eastern Brazil; **Katharina Stein**  
 10:45 The spatial genetic structure of bat-dispersed neotropical fig species; **Katrin Heer**

11:00 Coffee break

**Hall H III** **session continued**  
 11:30 Cheating on the mutualistic contract: seed-predation in the (frugivorous) bat *Chiroderma villosus*; **Insa Wagner**  
 11:45 Long-distance seed dispersal by Trumpeter Hornbills in a fragmented landscape; **Johanna Lenz**  
 12:00 Coronaviral zoonoses in tropical bats: interactions between hosts and the environment; **Stefan Klose**  
 12:15 A functional perspective on cross-continental community convergence: predicting diversity patterns and community composition in tropical anuran amphibian assemblages based on trait-environment relationships; **Raffael Ernst**

**Hall H IV** **Plant Physiology** p 105  
**Chair: Michael Lakatos**  
 11:30 From herbarium specimen to conservation recommendation – the example of bromeliads (Bromeliaceae) in Panama; **Daniel Caceres**  
 11:45 Effects of an experimental soil desiccation on the above- and belowground biomass production in a perhumid primary forest in Sulawesi, Indonesia; **Gerald Moser**  
 12:00 Size-dependent changes in leaf physiology and non-structural carbohydrate content in two Caribbean tree species; **Adam R. Martin**  
 12:15 Change in hydraulic properties and leaf traits of a tall rainforest tree species subjected to long-term throughfall exclusion in the perhumid tropics; **Bernhard Schuldt**

12:30 Lunch break

Time to take a walk through the Zoo, the Palmengarten or Senckenberg Museum! Entrance is free for all conference participants from 21 - 25 February 2011: just show your name batch to get in.

14:25 Plenary: Keynote  
**Meike Piepenbring** | Tropical Mycology - in an infinite pioneer state?  
**Chair: Gerhard Kost** p 109 **Hall H III**

15:15 Parallel sessions

**Hall H III** **Biodiversity Science & Biodiversity Policy - Chances for Cooperation** p110  
**Chair: Carsten Nesshöver, Axel Paulsch**  
 15:15 Biodiversity policy beyond 2010 - lessons from CBD COP10; **Carsten Nesshöver**  
 15:30 Intergovernmental platform on biodiversity & ecosystem services IPBES - status & Challenges; **Axel Paulsch**  
 16:00 Bushmeat harvest at the nexus of socio-economics & habitat; **Stefanie Jacob**

**Hall H IV** **Tropical Vertebrates** p115  
**Chair: Eckhard Heymann**  
 15:15 Movement pattern, habitat use & diet of tropical rainforest frogs: a comparison between pioneer & native anurans in Borneo; **Oliver Konopik**  
 15:30 Convergent evolution in nectar-feeding phyllostomid bats: nectar lapping vs. nectar pumping; **Marco Tschapka**  
 15:45 Echo location strategies for object recognition in dense rainforest for two gleaner bats; **Inga Geipel**  
 16:00 The Sabah rhino project; **Petra Kretzschmar**

16:15 Coffee break

16:30 Scientific Poster Session

for details see next page  
 for abstracts in alphabetical order see page 171.

18:30 For members only: 24<sup>th</sup> Annual General Assembly of the gto**Hall H III**

**SCIENTIFIC POSTER SESSION WEDNESDAY 16:00 FOYER**

Abstracts in alphabetical order p 1171-240

**Topic 1: African Savannas Biodiversity - Past, Present, Future:**

1.1	Modelling spatial patterns of savannas in Central African Republic; Julie Aleman	173
1.2	Demographic performance of woody plants in semi-arid savannas under human impact in Northern Benin; Katrin Jurisch	201
1.3	How strong is the West African savanna vegetation affected by human land-use? A comparison between a protected and a communal area; Katharina Schumann	230
1.4	The evolution of Savanna grasses: A case study on the evolutionary history of Andropogoneae; Gaelle Bocksberger	181
1.5	Phylogenetic and phylogeographic analyses of African and Arabian Dorcas gazelles ( <i>Gazella dorcas</i> ); Hannes Lerp	211
1.6	The West African Vegetation Database; Marco Schmidt	227

**Topic 2: The Andean Biodiversity Hotspot and its Future:**

2.1	A Holocene pollen-record reflecting vegetation, climate, and fire variability in a high-altitudinal ecosystem of the south Ecuadorian Andes; Nele Jantz	200
2.2	Rainfall distribution in the Andes of southern Ecuador derived from blending weather radar data and meteorological field observations; Rütger Rollenbeck	225
2.3	Climate change in the central Andes of southern Ecuador – a modelling perspective; Jörg Bendix	180
2.4	Tree growth dynamics of Poylepis forests during the dry season along a humidity gradient in the Peuvian Andes; Sabine Remmele	224
2.5	The variation of wood specific gravity and aboveground biomass along gradients of topography and elevation in the Andes of southern Ecuador; Jürgen Homeier	226
2.6	Influence of climatic conditions on the nutrient status of trees in a humid forest in southern Ecuador; Darwin Pucha Cofrep	221
2.7	Data handling and analysis of new emission databases for matter deposition in the tropical mountain forest; Sandro Makowski	213
2.8	Characterisation of some native arbuscular mycorrhizal (AM) fungi forming symbioses with trees native to South Ecuador; Claudia Krüger	209
2.9	Competition-growth-relationship of <i>Cedrela montana</i> (Meliaceae) in southern Ecuador in a natural forest management experiment; Susanne Spann	234
2.10	Arbuscular mycorrhizal communities of <i>Cedrela</i> seedlings and trees in reforestation plots and pristine forest; Ingeborg Haug	197
2.11	The Importance of nitrogen for tree seedling Nutrition along an elevational transect of Andean forests in South Ecuador; Bärbel Wittich	239
2.12	Cultural Key Species for biocultural conservation in the Bolivian Andes; Regine Brandt	182

2.13	Collection and use of field spectral data for land cover change detection in a tropical mountain forest; Giulia Curatola	183
2.14	Balloon aerial photography applied to the investigation of the southern bracken; Brenner Silva	232
2.15	Deriving spatial Leaf Area Index-data for a tropical research area in the Ecuadorian Andes as input for a SVAT-Model, Results and future prospects; Boris Thies	237

**Topic 3: Biodiversity & Economy:**

3.1	For free, still available - but threatened: The economic contribution of savanna woodlands to rural livelihoods in northern Benin; Katja Heubach	198
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**Topic 4: East African Mountain Forests: Functional Ecology and Sustainable Management**

4.1	Diversity of stem epiphytes in montane rainforests of Rwanda – The influence of altitude and anthropogenic disturbance; Carolin Thiel	236
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**Hall H III** 9:10 Plenary: Keynote  
**Doyle McKey** | Agroecology, resilience and tropical biodiversity: what do past and present Amazonian farmers tell us?  
 Chair: **Karl Wantzen** p 120

## 10:00 Parallel sessions

**Hall H III** **Hotspot Wallacea** p 121  
 Chair: **Stefan Merker, Sebastian Klaus**  
 10:00 Hotspot Sulawesi: tarsier diversity mirrors Wallacea's troubled past; **Stefan Merker**  
 10:15 The biogeography of Sulawesi - is there evidence for a vicariant origin of taxa on the island? **Björn Stelbrink**  
 10:30 Diversity & endemism of Sulawesi water monitors: implication for conservation efforts of a highly exploited CITES (...); **Andre Koch**  
 10:45 Past, present & future of Bornean carnivores; **Andreas Wilting**

**Hall H IV** **Free Contributions** p 128  
 Chair: **Meike Piepenbring**  
 10:00 Ecological impact of *Prosopis* species invasion in Turkwel Riverine Forest, Kenya; **Gabriel Muturi**  
 10:30 Tree-grass competition in savanna depending on organic & mineral nutrients; **Judith Sitters**  
 10:45 Biogeography & cenozoic climate change: on the occurrence of tropical forms in Grube Messel & other mid-latitude fossil sites; **Kristen T. Smith**

## 11:00 Coffee break

**Hall H III** **Tropical Ecologists at Work** p 133  
 Chair: **Manfred Niekisch**  
 11:30 KfW Development Bank - opportunities for tropical ecologists; **Peter Hilliges**  
 11:45 IUCN - the International Union for Conservation of Nature; **Hans Friederich**  
 12:00 OroVerde - Tropical Forest Foundation - opportunities and challenges of small NGOs; **Elke Mannigel**  
 12:15 Examples from the Frankfurt Institute: Biodiversity and Climate Research Centre (BiK-F); **Georg Zizka**  
 12:30 Consulting firms - opportunities for working in the field of development cooperation; **Wolfgang Scharm, GOPA**  
 12:45 Broad-based expertise for sustainable development - under one roof GIZ - Gesellschaft für Internationale Zusammenarbeit; **Harald Lossack**

**Hall H IV** **Anthropogenic Influences** p 144  
 Chair: **Doyle McKey**  
 11:30 Resilience of ecological services in human modified types in South Africa; **Eike Lena Neuschulz**  
 11:45 Forest regeneration dynamics in differently modified South African scarp forests; **Alexandra Botzat**  
 12:00 Disentangling small-scale variability in tree growth, herbivore distribution & herbivore-antagonist interactions in reforestation plantations on former tropical pasture; **Karsten Mody**  
 12:15 Ant diversity vs. single species dominance in Indonesian cocoa plantations; **Arno Wielgoss**  
 12:30 Bird diversity & feeding guild composition along a tropical forest-farmland gradient in western Kenya; **Ronald Mulwa**  
 12:45 Impact of anthropogenic pressure on the population structure of *Anogeissus leiocarpa* within Wari-Marô Forest Reserve in Benin; **Achille Ephrem Assogbadjo**

## 13:00 Lunch break

14:25 Plenary: Keynote  
**Michael Bruford** | Genetic diversity and tropical biodiversity conservation: neglected component or needless distraction?  
 Chair: **Heribert Hofer** p 150 **Hall H III**

## 15:15 Parallel sessions

**Hall H III** **Andean Biodiversity Hotspot II** p 151  
 Chair: **Jörg Bendix, Erwin Beck**  
 15:15 Functional soil-landscape modelling - estimating slope stability in a steep Andean mountain forest region; **Mareike Liess**  
 15:30 Influence of shallow landslides on forest dynamics in a South Ecuadorian tropical montane forest; **Claudia Dislich**  
 15:45 Implications of land-use change & pasture-fertilization on soil microbial activities & communities in a mountain rainforest region of S. Ecuador; **Karen Potthast**

**Hall H IV** **Link for Survival** p 161  
 Chair: **Christof Schenck, Antje Müllner**  
 15:15 The great green Macaw: Conservation biology for the implementation of a transboundary biological corridor in the lower watershed of the San Juan River (Costa Rica/Nicaragua); **Monika Melisch**  
 15:30 Adding a distribution modelling tool for conservationists to the African Odonata database; **Nirmal Ojha**  
 15:45 How to estimate the conservation status of vascular plants in a small scale area? A case study in East African rain forests; **Katja Rembold**

## 16:00 Coffee break

**Hall H III**  
 16:30 Regeneration of abandoned pastures in South Ecuador; **Kristin Roos**  
 16:45 Simulation of net photosynthesis of two competing species, the southern bracken & the pasture grass *Setaria sphacelata*, in tropical mountain ecosystem; **Brenner Silva**  
 17:00 Neotropical C3/C4 grass distribution - present, past & future; **Laurent Bremond**  
 17:15 Effects of grass competition & fertilization on root length & biomass allocation of native tree species from Ecuador; **Paula Loaiza**  
 17:30 Application of native arbuscular mycorrhizal fungi for reforestation with native tree species in South Ecuador; **Claudia Krüger**  
 17:45 Growth performance of six native tree species planted at three successional sites in the Andes of South Ecuador; **Ximena Palomeque**

**Hall H IV**  
 16:30 The cutting edge of sustainability: explorations of Amphibian functional diversity in selectively logged silvicultural systems of the Guiana Shield; **Monique Hölting**  
 16:45 Spider species richness in cacao agroforestry systems, comparing vertical strata, local management & distance to forest; **Kathrin Stenchly**  
 17:00 Understanding impacts of fragmentation & human disturbance on tree species community in tropical forest fragments; **Sandro Pütz**  
 17:15 Habitat threshold effects on genetic diversity & differentiation: empirical evidence from specialist species in three Atlantic forest landscapes; **Niko Balkenhol**  
 17:30 Economic incentives for mitigating fragmentation & edge-effects in the Brazilian Atlantic forest; **Florian Hartig**  
 17:45 Behavioural Ecology and Conservation of grey-shanked douc monkeys (*Pygathrix cinerea*) in the Central of Vietnam; **Long Ha Thang**

19:30 **Dinner & awards | Café „Sturm und Drang“ at Campus Westend**  
 Public transport: U1, U2, U3 (Stop: „Holzhausenstraße“); Bus 75/36 from Bockenheimer Warte (Stop: „Uni Campus Westend“)



Hall H III	9:00 - 13:00 Assembly of the DFG-Research Unit 816 AG members only
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### FOR gtö MEMBERS ONLY

#### Invitation to the 24<sup>th</sup> annual general assembly of the gtö in Frankfurt 2011

The Executive Board of the gtö invites all gtö members to the 24th annual general assembly on **Wednesday, 23 February 2011, 18.30 h** in Frankfurt, Goethe University of Frankfurt, Campus Bockenheimer, Hall H III.

The assembly will be held in German.

#### TAGESORDNUNG gtö MITGLIEDERDERSAMMLUNG

1. Eröffnung der MV and Annahme der Tagesordnung
2. Genehmigung des Protokolls der 23. MV
3. Bericht des Präsidiums über das Geschäftsjahr 2010
4. Bericht des Sprechers des Wissenschaftlichen Beirats
5. Bericht des Schatzmeisters
6. Bericht der Kassenprüfer
7. Entlastung des Präsidiums
8. Information Sachstand  
Satzungsänderung wegen Sitzverlagerung (Tübingen - Frankfurt)
9. Ecotropica
10. Vorbereitung der Tagung 2012 in Erlangen
11. Tagungsorte 2013 und 2014
12. Einrichtung von Internetauftritten
13. Verschiedenes

**Montag 21 February 2011**

- 12:00 Keynote speech: Anne Magurran p 22
- 14:25 Keynote speech: Konrad Fiedler p 23
- 15:15 Parallel Sessions  
 Andean Hall H III p 24  
 African Savannas Hall IV p 34
- 18:00 End of sessions
- 18:30 Welcome reception at City Hall „Römer“

MONDAY



**Keynote speaker: Anne Magurran**

**Chair: Bruno Streit**

### CHALLENGES AND OPPORTUNITIES IN TROPICAL BIODIVERSITY ASSESSMENT

Anne Magurran, University of St Andrews, St Andrews, UK,  
aem1@st-and.ac.uk

Ever since Bates, Wallace and Darwin it has been clear that tropical systems support immense biological diversity. However quantifying and understanding that biological diversity can be daunting. Here, with particular emphasis on freshwater fish communities, I attempt to identify tractable questions in tropical biodiversity and consider how these approaches might shed light on both the processes that underpin this diversity and effective conservation policies that will help conserve it.

**Keynote speaker: Konrad Fiedler**

**Chair: Pia Parolin**

### DISSECTING INSECT MEGADIVERSITY: EVIDENCE FROM A TROPICAL MONTANE HOTSPOT REGION

Konrad Fiedler, Department of Animal Biodiversity, University of Vienna, Vienna, Austria

Tropical rainforest communities harbour insect communities that, by all standards, deserve to be termed mega-diverse. During the past decade, tropical mountains have been recognized to often give home to more species-rich faunas than lowland forests. Much of this mega-diversity is found in herbivorous insects and their parasitoids, and these groups of organisms play key roles as paradigms to extrapolate global terrestrial species numbers. I here use data on nocturnal Lepidoptera, a basically herbivorous insect clade, from a global biodiversity hotspot, the eastern equatorial Andes, to examine their diversity along various ecological and evolutionary dimensions. High species richness at very local scales is one key component. Strong species turnover along elevational, topographical and succession gradients contributes significantly to the large diversity at landscape levels. High host plant specificity and co-evolutionary dynamics are important, as are extensions in feeding habits beyond classical herbivory. Quantitative inventories aided by DNA barcoding, morphological studies and niche characterizations of species continue to extend documented richness even in cases where recent studies had suggested an asymptotic coverage of the fauna. As a result, regional and global estimates of species numbers will have to be substantially revised. Molecular phylogenetic analyses reveal, however, that in evolutionary terms much of this diversity is older than expected. This points to the prominent role of tectonic and/or climatic events and the accumulation of biotic interaction partners, whereas the importance of glacial climate oscillations may need to be critically re-visited.



**Parallel session Hall H III:****THE ANDEAN BIODIVERSITY HOTSPOT AND ITS FUTURE: BIODIVERSITY, ECOSYSTEM FUNCTIONING AND ECOSYSTEM SERVICES UNDER ENVIRONMENTAL CHANGE**

Chairs: Jörg Bendix, Erwin Beck

Contact: bendix@staff.uni-marburg.de

Globally, biodiversity and ecosystem services are threatened by global and local environmental change. According to global analyses, main drivers for tropical alpine hotspots like the tropical Andes seem to be land use and climate change, as well as increasing atmospheric nutrient deposition to the frequently nutrient-limited hotspot ecosystems. However, the knowledge on ecosystem functioning and the relations between changes in the biogeochemical cycles, the human sphere and biodiversity is still poor. We therefore encourage papers which have conducted ecological (field) experiments, comparative field surveys along land use and climatic gradients or numerical model simulations to unveil the impacts of environmental change on biodiversity and ecosystem functioning / services for the tropical Andean biodiversity hotspot.

Second part of this session: Thursday, 15:15 - 18:00; abstracts talks p151

**BIODIVERSITY AND ECOSYSTEM SERVICES UNDER ENVIRONMENTAL CHANGE IN THE ANDES OF SOUTHERN ECUADOR**Jörg Bendix<sup>1</sup><sup>1</sup>LCRS, University of Marburg, Marburg, DE, bendix@staff.uni-marburg.de

At least it is proven since the millenium ecosystem assessment report that biodiversity and ecosystem services are threatened by global and local environmental changes. Main drivers for Alpine ecosystems seems to be climate change, land use change and remote fertilization (e.g. nitrogene). This also seems to hold for the Andean biodiversity hotspot and particularly, a specific area in the Andes of south-eastern Ecuador where a multidisciplinary research team investigates biodiversity and ecosystem functioning since more than 10 years. In the valley of the Rio San Francisco, the impact of climate and landuse changes on biodiversity, ecosystem functions and biotic-anbiotic-anthropogenic interactions are studied with field surveys, ecological experiments and numerical model scenarios. Impacts on ecosystem services are particularly analysed by comparing two manifestations of the ecosystem, the natural mountain rain forest and pastures as the prevailing anthropogenic replacement system.

The oral presentation firstly introduces to the study area and the overall research design. Then, extend and development of climate and land use change are presented. Based on that the talk will summarise the respective results gathered over the last ten years of ecosystem research. For instance, it will be shown that some but not all species groups reacts on local land cover change with a decline of diversity. Potential effects of climate change on diversity and ecosystem functioning will be addressed by means of investigations along an altitudinal gradient. Furthermore, the reason for and impact of remote fertilization on ecosystem functioning will be emphasized. Finally, the current knowledge on changes of ecosystem services as e.g. climatic and hydrologic regulation functions will be stressed.





## INVESTIGATING AND PREDICTING LAND USE/LAND COVER CHANGES IN A TROPICAL MOUNTAIN FOREST OF SOUTHERN ECUADOR

Boris Thies<sup>1</sup>, Hanna Meyer<sup>1</sup>, Jörg Bendix<sup>1</sup>

<sup>1</sup>Faculty of Geography, Marburg, DE, [thies@staff.uni-marburg.de](mailto:thies@staff.uni-marburg.de)

Land use and land cover (LUC) of the tropics affects climate on local and global scales. Nevertheless, especially tropical mountain forests are few studied. However, many interactions in these systems are still unknown. The understanding of the dynamics in tropical mountain forests is the objective of the geoeological research unit 816 of the German Research Council (DFG).

One essential aim of the research unit is the analysis of the soil vegetation atmosphere transfer (SVAT) in order to detect energy and water fluxes in the system. These fluxes predominantly depend on LUC. The Community Land Model (CLM) used in the research unit requires detailed information about the LUC as lower boundary conditions. These can be investigated by using satellite data with respect to the different radiances. However, LUC is subjected to spatiotemporal dynamics, which do not only consist of natural dynamics but are, by now, predominantly affected by human interference. In this context, deforestation is a common phenomenon in the tropics, especially in Ecuador. In consideration of the ongoing deforestation, a land use/land cover change (LUCC) model is needed to estimate future SVAT for different climate scenarios.

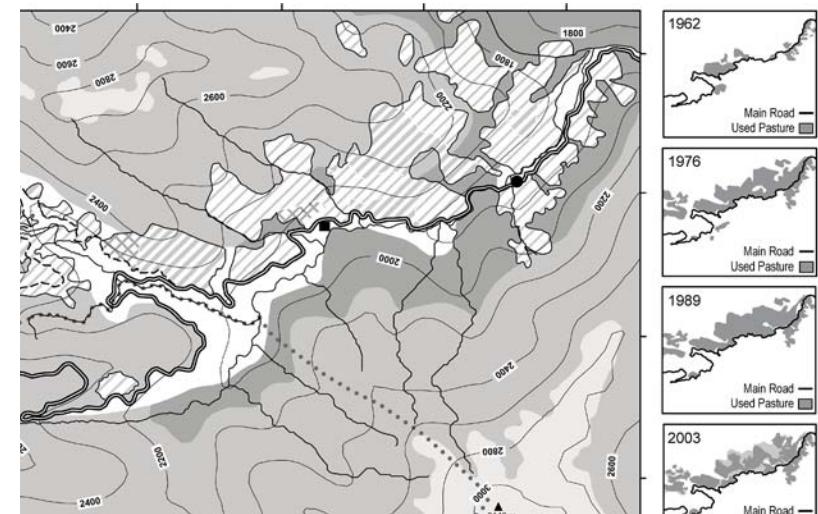
In the current study a model of LUCC was built for the central research area in southern Ecuador, which was chosen as the model domain for the CLM. The LUCC model was constructed using information of past changes derived by remote sensing data. Special focus was on forest development patterns. A training period of 14 years between 1987 and 2001 was chosen. Two LUC classifications were accomplished from Landsat data of the start and end date of this period. A change detection of the training period provided the basis for predictive LUCC modeling. Potential drivers for LUCC were applied to the model as GIS layers. The modeling procedure consisted of a combination of Markov chain analysis (MCA) for quantitative modeling and multi-layer perceptron (MLP) for revealing potential locations of change. A multi-objective land allocation (MOLA) served as final integration step. The model results were maps of LUC for 2006, 2010 and afterwards for every 10 years up to 2100. An internal validation was performed with the training data. The results of the prediction were validated by comparing the model output of 2006 to an ASTER LUC classification of the same time.

## VASCULAR PLANT DIVERSITY OF NATURAL AND ANTHROPOGENIC ECOSYSTEMS IN THE ANDES OF SOUTHERN ECUADOR – STUDIES FROM THE RIO-SAN-FRANCISCO VALLEY

Thorsten Peters<sup>1</sup>

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According to Barthlott et al (2007) the Andes of Ecuador constitute one of the world's five megadiversity hotspots of vascular plants. These hotspot characteristics apply particularly to the study site in the northernmost part of the Podocarpus National Park (3°58'S, 79°04'W). Here, family and species numbers vary considerably between primary mountain forest stands and anthropogenic sites at similar altitudes. During the past fifty years the magnitude of land use has grown at the upper parts of the south Ecuadorian valleys. Although climate change is intensely debated as a cause of future species extinctions, human land use is currently the most important threat to biodiversity (Köster et al 2009). Otherwise, an additional contribution to biodiversity by intentionally introduced and collateral invasive taxa by human impact is mostly ignored. The presentation focuses on the latter topic by comparing the local vascular plant diversity on natural and anthropogenic study sites to estimate the human influences on vascular plant diversity on the local scale of the Rio San Francisco valley.



## ACCESSIBILITY PREDICTS THE DEGREE OF DEGRADATION OF ANDEAN POLYLEPIS FORESTS

Johanna Toivonen<sup>1</sup>

<sup>1</sup>*University of Turku, Turku, FI, jomito@utu.fi*

High mountain forests of the central Andes are formed almost purely by trees of the genus *Polylepis*. These forests occur nowadays as scattered remnant patches of a more continuous past distribution. Apparently, the destruction of *Polylepis* forests has mainly been caused by millennia of human disturbance, although forest distribution may also have fluctuated according to prevailing climatic conditions. Nowadays, the remaining *Polylepis* forest stands are still threatened by

anthropogenic disturbance, which gradually degrades the forests. The aim of our study was to examine *Polylepis* forest structure and regeneration in relation to elevation in dry and humid climates and to

test the relationship of human accessibility on the forest structure and regeneration in the Cordilleras Vilcanota and Vilcabamba, Cuzco, Peru. We found relations of forest structural parameters and regeneration with elevation opposite to those expected in dry areas, whereas in humid areas the parameters mostly followed general elevational patterns. We also found that accessibility - quantified as geographical distance to the nearest village, to the nearest paved road or railway station, or to the nearest regional market centre - was closely related to forest structure and regeneration in both dry and humid areas, but that the relationships of these variables differed between the areas. These findings presumably reflect regional differences in human occupation between dry and humid areas. Our results also indicate that simple geographical predictors can be used for rapid spatial estimation of the degree of *Polylepis* forest degradation. These estimations are advantageous in the identification of the areas, where *Polylepis* forests are potentially the most degraded and conservation activities are urgently needed.

## RESPONSE OF A TROPICAL MONTANE FOREST AT THE RIM OF THE AMAZON BASIN IN SOUTH ECUADOR TO LOW-LEVEL N, P, AND CA AMENDMENTS

Wolfgang Wilcke<sup>1</sup>, Hans Wullaert<sup>2</sup>, Judith Minker<sup>3</sup>, Carlos Valarezo<sup>4</sup>, Jürgen Homeier<sup>5</sup>

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For the near future increasing deposition of nutrients including N, P, and base metals is expected in the tropics because of the economic development and climate change.

In a multidisciplinary effort, we conducted a field experiment in undisturbed tropical montane forest at ca. 2100 m a.s.l. in south Ecuador which is exposed to the Amazon basin to explore the effect of increasing nutrient deposition. In 2007, we started to amend low amounts of N (50 kg ha<sup>-1</sup>), P (10 kg ha<sup>-1</sup>), N+P (50+10 kg ha<sup>-1</sup>), and Ca (10 kg ha<sup>-1</sup>) split between two annual fertilizing dates to soil in a fourfold replicated randomized block design that also included unfertilized control plots. In the soil scientific subproject we focused on element fluxes with throughfall, litterfall, and soil water at different depths in soil (below the organic layer and at the 0.15 and 0.30 m mineral soil depths).

There was little leaching of the added nutrients into the mineral soil (1-10% of the fertilized amount) indicating that the elements were taken up by the vegetation or microbially immobilized in the soil solution. The latter was further supported by the fact that part of the fertilized elements appeared in litterfall soon after nutrient application (2-2.5%). Furthermore, the fertilizer application reduced the net retention of N, P, and Ca in the canopy based on a canopy budget approach suggesting a reduced demand of the vegetation for these nutrients.

Overall, the element cycling in the forest responded quickly to all added nutrients in a similar way.



## NUTRIENT AVAILABILITY AND BELOWGROUND CARBON ALLOCATION OF TROPICAL MONTANE RAIN FORESTS IN SOUTHERN ECUADOR

Katrin Wolf<sup>1</sup>, Edzo Veldkamp<sup>1</sup>

<sup>1</sup>Universty Goettingen, Goettingen, DE, [kwolf@gwdg.de](mailto:kwolf@gwdg.de)

Although total belowground carbon allocation (TBCA) accounts for the major fraction of carbon assimilated by forest ecosystems, large uncertainties remain about how environmental conditions control the rate of TBCA and the ratio between TBCA and aboveground carbon allocation. The carbon cycle of tropical montane forests has marginally been explored even though montane forests cover about 9% of the tropical forest area and provide a great opportunity to study TBCA along nutrient, soil moisture and temperature gradients. Here we investigate the influence of nutrient availability and elevation on TBCA in tropical montane forests in southern Ecuador. We estimated TBCA from year-round soil respiration and aboveground litterfall measurements along an elevation gradient from 1000 m to 3000 m and from lower slope to ridge positions. Aboveground litter production appeared to be limited by nitrogen (N), potassium (K), and phosphorus (P) and was related mainly to available nutrient stocks of the organic layer, although stocks of K and P were larger in the mineral soil. We could not confirm our hypothesis that total and relative TBCA increase when nutrient supply declines. TBCA decreased with elevation and from lower slope toward the ridges and was controlled more by soil moisture and temperatures than available nutrients. The decline in TBCA with increasing elevation corresponded with an increment in fine root biomass which we explain with higher root longevity. Together with slow decomposition rates in the organic layers, this may contribute to the large carbon storage in organic layers of tropical montane forest soils.

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

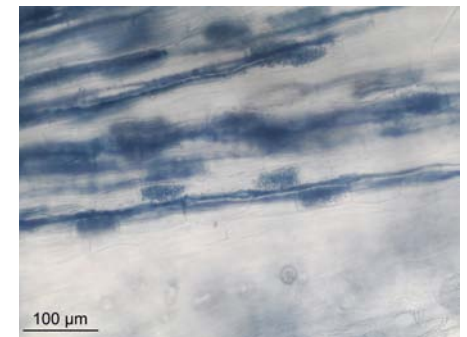
Tessa Camenzind<sup>1</sup>, Dietrich Hertel<sup>2</sup>, Bärbel Wittich<sup>2</sup>, Matthias C. Rillig<sup>1</sup>

<sup>1</sup>FU Berlin, AG Plant Ecology, Berlin, DE, [tessac@zedat.fu-berlin.de](mailto:tessac@zedat.fu-berlin.de), <sup>2</sup>University of Göttingen, Plant Ecology, Göttingen, DE

Human activities will lead to increased nutrient deposition with potentially strong impacts on ecosystems. Here we experimentally test the effects of increased nutrient availability in the soil on an ecologically important group of soil biota – arbuscular mycorrhizal fungi (AMF). This field experiment is embedded in a multidisciplinary study in a megadiverse tropical mountain forest in southern Ecuador. As part of this experiment several other ecological parameters (nutrient cycles, tree growth, microbial biomass) are monitored continuously.

AMF form mycorrhizae with 80% of land plants and have been shown to be the dominant root symbionts in this area. Their main function is to improve nutrient uptake for their host plants – especially of phosphorus. It is indeed a well-known phenomenon that increased nutrient availability in the soil decreases AMF abundance according with the functional equilibrium model, though evidence is mainly available from field studies conducted in temperate regions. Thus we present one of the first experimental field studies on this topic in the tropics. Nutrient additions (phosphorus and nitrogen) started in 2008 and replicated blocks are established at three elevational levels. As response variable for AMF abundance the percentage of root colonization and hyphal length in the soil are recorded. Fungal community analyses are in progress. Fertilization treatments have significant effects on tree growth parameters after only one year, though mycorrhizal responses are partly hidden by spatial effects.

We hope to achieve a comprehensive understanding of future reactions of these keystone symbionts and consequences for the whole ecosystem.



## DECOMPOSITION RATES AND MICROARTHROPOD COLONIZATION OF LEAVES AND ROOTS IN TROPICAL MONTANE RAIN FORESTS ALONG AN ALTITUDINAL GRADIENT IN SOUTHERN ECUADOR

Franca Marian<sup>1</sup>

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The effect of altitude and litter type on decomposition rates and microarthropod colonisation in a tropical montane rain forest in southern Ecuador was investigated. Leaf litter from three tree species and roots of different diameters were collected from three sites along an altitudinal gradient (1000, 2000, 3000 m). Litter and roots were placed in litterbags in the field, and after six and twelve months the C/N ratio, microbial biomass, colonisation by microarthropods and remaining dry mass were determined. Microbial parameters were correlated with litter quality which declined with the altitude of its origin. The density of microarthropods correlated poorly with litter origin and quality. This was also true for the relationship between microarthropods and microorganisms. The density of microarthropods declined with altitude, suggesting that they were driven by site-specific conditions. Altitude was the main factor modifying decomposition rates. Processes related to decomposition were faster at lower altitudes. The origin of the litter and therefore its quality did not significantly affect decomposition processes, and microbial biomass correlated poorly with decomposition rates.

## DENSITY AND COMMUNITY STRUCTURE OF SOIL- AND BARK-LIVING MICROARTHROPODS ALONG AN ALTITUDINAL GRADIENT IN A TROPICAL MONTANE RAINFOREST

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Microarthropod communities in the soil and on the bark of trees were investigated along an elevation gradient (1850, 2000, 2150, 2300 m) in a tropical montane rain forest in southern Ecuador. We hypothesised that the density of microarthropods declines with depth in soil and increases with increasing altitude mainly due to the availability of resources, i.e. organic matter. In addition, we expected bark and soil communities to differ strongly, since the bark of trees is more exposed to harsher factors. In contrast to our hypothesis, the density of major microarthropod groups (*Collembola*, *Oribatida*, *Gamasina*, *Uropodina*) was generally low and decreased with altitude. However, as we predicted the density of each of the groups decreased with soil depth. Density of microarthropods on tree bark was lower than in soil. Overall, 43 species of oribatid mites were found, with the most abundant higher taxa being *Poronota*, pycnonotic *Apherodermata*, Mixonomata and Eupherodermata. The oribatid mite community on bark did not differ significantly from that in soil. The number of oribatid mite species declined with altitude (24, 23, 17 and 13 species at 1850, 2000, 2150 and 2300 m, respectively). Rarefaction curves indicate that overall about 50 oribatid mite species are to be expected along the studied altitudinal gradient. Results of this study indicate (1) that microarthropods may be limited by the quality of resources at high altitudes and by the amount of resources at deeper soil layers, and (2) that the bark of trees and the soil are habitats of similar quality for oribatid mites.





Monday, 21 February, 15:15, Hall H IV

## AFRICAN SAVANNAS BIODIVERSITY - PAST, PRESENT, FUTURE

Chairs: Karen Hahn, Marco Schmidt  
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Biodiversity of the widespread African savanna regions is most vulnerable due to climate change, high population growth and increasing land use. The most important issue is to better predict the interaction of human impact, climate change and biodiversity, and the potential to adapt to these changes. So far, different climate models and predictions, sometimes even contradictory, hamper conclusions for decision makers. Future research needs on one hand improvement of prediction tools, but on the other hand also an improved data base from the fields. Contributions of this session shall deal with biodiversity dynamics, drivers of change and modelling as well as molecular approaches for reconstructing past and predicting future biodiversity changes.

## THE MYSTERY OF RECENT GLOBAL DRYLAND GREENING

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Greenness trends derived from satellite images are a proxy of recent vegetation changes. We present time series analyses of the GIMMS Normalized Difference Vegetation Index (NDVI) that show that most global drylands, including savannas, have been greening up since the early 1980s. Global precipitation data and a Dynamic Global Vegetation Model (DGVM) that only accounts for natural vegetation dynamics were used to identify potential drivers of the greenness changes.

In areas such as the African Sahel and southern Africa, the greening trend strongly coincides with positive trends in precipitation and modelled Net Primary Productivity (NPP), suggesting that changes in climate have been the main driver. In other areas, such as western U.S., inner Mongolia and most of Australia, however, both the DGVM results and the precipitation data indicate that a climatically driven trend should have been negative. A deviation between climatically driven trends and real trends was expected in areas with intensive land use, but, surprisingly, these areas coincide with low-intensity land use, mainly by grazing. As livestock numbers have increased in most areas, a change in land use seems unlikely as an explanation of increased greenness. We have no straight-forward explanation for the observed pattern. Poorly understood changes in community structure may be one contributing factor.



## ABRUPT SHIFTS IN SAVANNA TREE COVER ALONG A PRECIPITATION GRADIENT

Charly Favier<sup>1</sup>, Laurent Bremond<sup>2</sup>, Julie Aleman<sup>2</sup>, Marc A. Dubois<sup>3</sup>, Jean-Michel Yangakola<sup>4</sup>, Charly Favier<sup>1</sup>

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How savanna tree covers are determined by natural and man-induced forcings remains under debate. Small-scale studies have led to conflicting models and large-scale studies are ambiguous on the link between tree covers and climate. Along a climatic North-South transect in Central Africa, this study aims to answer three debated questions: is there identifiable mean savanna structure under given climate? Does tree cover always increase with water availability or is there a depression in tree cover in the most humid sites? Is there a continuous trend or a stepwise trend? An original analysis of coarse scale satellite data allowed us to show that the vegetation pattern along the transect is made of a succession of stable states, each of them consisting of patches asynchronously exploring a wide range of configurations around the average one. The transitions between them are discontinuous transitions, resulting in regions of mosaics of alternative stable states, in contrast with continuous evolution of climate and species pools. The observed large-scale predictability of savanna structures is significant for savanna modeling, resilience studies and paleoenvironmental studies.

## THE INTERPLAY OF CLIMATE CHANGE AND HUMAN PRESSURE IN PREDICTIVE VEGETATION MODELLING, WEST AFRICA

Jonathan Heubes<sup>1</sup>, Rüdiger Wittig<sup>1</sup>, Georg Zizka<sup>1</sup>, Karen Hahn<sup>1</sup>

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Climate and land use change are the most influential factors for future biodiversity. Especially in African savannas, land use change is expected to have a high impact. Thus, our objectives are (1) to quantify the importance of land use and climate on plant species distributions across Burkina Faso, West Africa and (2) to project future species richness (2050) considering climate and land use changes. To evaluate the importance of land use we ran stepwise generalized additive models for each plant species with climatic parameters, only. In a second step, we regressed the residuals of the climate-driven models against the land use variables to extract relevant land use parameters. Finally, we derived future (2050) richness patterns, considering both climate and land use variables. We used the climate model MIROC-medres while land use simulations were generated by LandSHIFT. Our results partly show an improvement of the explanatory and predictive power of the models in consideration of land use. Strongly modified plant species richness patterns emerge by 2050, accounting for land use impact. We conclude to consider land use as an important factor when projecting future species richness patterns for African savanna ecosystems.



## TERMITE MOUND VEGETATION LONG A CLIMATIC GRADIENT IN WEST AFRICA

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The impact of termites as ecosystem engineers in Africa has been acknowledged since W. Troll coined the term "termite savannas" for some East African landscapes. Abandoned termite mounds build by *Macrotermes* species have been described as conspicuous microhabitats, supporting distinct vegetation. This vegetation is supposed to be rather homogenous among mounds, which leads to the impression of azonality of termite mound vegetation. However, there is a lack of comparative studies between different vegetation zones, and termite mounds are sometimes even actively excluded from vegetation sampling and analysis since their vegetation is considered to be particular.

Therefore, we sampled mound vegetation and surrounding savanna matrix from the South Soudanian vegetation zone to the Sahel zone in West Africa along a bioclimatic gradient. Several plant species are characteristically confined to mounds throughout our study area. However, multivariate analysis of termite mound vegetation shows a gradual variation of mound vegetation along our transect.

We suggest that termite mounds harbor some specific species along the whole climatic gradient and enlarge the range of several other species in the respective vegetation zones, but are nevertheless subject to a climatic influence, and thus can not be considered as azonal.

This might also imply a need for adapted conservation planning, and further research considering both resilience and vulnerability of those microhabitats to climatic shifts.



Figure:  
Approximate location of termite mound vegetation sampling in protected areas across a climatic gradient in West Africa (Burkina Faso and Benin). From South to North: Pendjari National Park, W National Park, Gonsé Classified Forest, Niouma Classified Forest, Sahel Partial Faunal Reserve.

## INSIGHTS IN SAVANNAH ECOSYSTEM ECOLOGY OBTAINED FROM A FORMER RANCH IN TANZANIA

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Mkwaja Ranch in Tanzania is an example of a large cattle enterprise that failed within the savannah environment. It was closed in 2000 after 48 years. Our studies and detailed ranch records made it possible to reconstruct how ranching activities affected the savannah ecosystem. We show how grazing by cattle led to shrub encroachment. We also compare the influence of cattle and wild herbivores upon N and P cycling in several vegetation types on the former ranch and a neighbouring game reserve. Cattle ranching led to considerable re-distribution of N and P, with depletion in grazing areas and accumulation in areas where animals congregated at night. In dense *Acacia* stands N<sub>2</sub>-fixation enhanced N availability and caused a net annual N input. Fire was the major cause for nutrient losses from tallgrass savannah. N inputs from deposition and N<sub>2</sub>-fixation were not sufficient to compensate for these losses; our results therefore call into question the common assumption that N budgets in annually burned savannah are balanced. The results help us to understand why intensive livestock ranching as practised on Mkwaja Ranch was unsustainable, and give us insight in savanna ecosystem functioning.



## GREEN, GREEN GRASS OF HOME: HOW UNGULATES SELECT FEEDING SITES IN A NUTRIENT POOR TALL GRASS SAVANNAH IN COASTAL TANZANIA

Annette Stähli<sup>1</sup>

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Unlike the well-studied short grass savannas on fertile soils, tall grass savannas in more humid climates and poorer soils may be difficult habitats to graze for ungulate herbivores. Grazing patterns in such environments tend to be patchy but repeated grazing of the same sites over several (dry) seasons might help to improve forage quality. These sites (termed "grazing lawns" in some circumstances) may eventually become a crucial resource for several herbivore species especially bulk grazers. Studying herbivore-vegetation interactions in northern coastal Tanzania, we compared grass forage quality and quantity, species composition and grazing intensity on grazed patches and in surrounding apparently ungrazed tall grass vegetation over two dry seasons (short dry season Jan.-Feb. 2010, long dry season July-Sept. 2009). Results of a multivariate analysis of 204 vegetation plots, recorded during the short dry season revealed significant differences in species composition of grazed patches and nearby tall grass vegetation. Grazed patches were characterized by significantly higher abundance of two main fodder species (*Panicum infestum* and *Digitaria milanjiana*). *Sporobolus pyramidalis* and *Bothriochloa bladhii*, two grass species highly avoided by herbivores, were significantly more abundant in the tall grass vegetation. In both study seasons, grazing intensity on grazed patches was more than two times higher than in surrounding tall grass vegetation, and mean vegetation height was thus significantly lower. In both dry seasons, green vegetation (grasses mixed with some forbs) sampled from grazed patches had significantly higher nitrogen and thus crude protein contents compared to samples from the nearby tall grass savannah. The same was found in a separate analysis of four grass species known to be preferred by selective grazers. However, N contents of these grass species tended to be slightly lower than N contents of the total vegetation on grazed patches, presumably because of the presence of N rich leguminous forbs. Overall grazing intensity was positively correlated with nitrogen contents in green vegetation (pooled data of grazed patches and surrounding tall grass).

Our findings indicate that in a tall grass savannah, herbivores focus on areas with particular species compositions offering elevated nutritional value, and by maintaining grazing over extended periods, are able to boost nitrogen contents even more.

## GRASS-GRAZER INTERACTIONS IN AFRICAN SAVANNA ECOSYSTEMS: WHERE DOES 'THE PARADIGM' STAND AND WHERE DO WE GO FROM THERE?

Britta K Kunz<sup>1</sup>, Gaelle Bocksberger, Thomas Hovestadt, Ottmar Kullmer, Christine Römermann, Friedemann Schrenk, Georg Zizka, Oliver Tackenberg

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African savannas and grass-eating ungulates are considered inextricably linked to each other at least since the Plio-Pleistocene, when a massive radiation of ungulates occurred, corresponding to a rapid speciation in grasses. Today, African savannas still harbour the highest diversity and biomass of ungulates worldwide which daily consume large amounts of the aboveground foliage. From the grass' point of view, grazing represents loss of photosynthetically active material. Consequently, the interaction between grasses and grazers generally is considered an antagonistic one in which both plants and ungulates have evolved co-adapted traits and strategies in an „arms-race“. However, empirical field studies regularly prove that ungulates can play a major role in dispersal of inconspicuous seeds of grassland species, including grass seeds. Though this often is interpreted as 'dispersal by chance' it might indicate a more mutualistic relationship than commonly assumed. While a good theoretical framework exists on the evolutionary and ecological interactions related to seed dispersal of attractive, nutrient rich fruits or seeds, many basic aspects of the interaction between plants with inconspicuous fruits and their seed dispersers are not well understood. Identification of the relevant traits in grass-grazer interactions and a better understanding of the underlying mechanisms thus would further improve the general theory of seed dispersal by animals. Moreover, it would help to understand past and current species distribution patterns and to better predict future distribution patterns under different scenarios of climatic change. Last but not least a thorough understanding of factors that structure grassland communities will help guiding management efforts.

We will review the state of the art of grass-grazer interactions, consider open questions and suggest future research directions to fill the gaps in our knowledge concerning this matter.





## AN INTEGRATIVE APPROACH TO SPECIES DISCOVERY - CRYPTIC SPECIATION IN THE AFRICAN ODONATE GENUS TRITHEMIS

Sandra Damm<sup>1</sup>, Heike Hadrys<sup>1</sup>

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Since molecular genetics has entered taxonomy many new species have been discovered solely based on genetic data. Discovering these, often cryptic, species is of crucial importance for biodiversity research, but it is also error-prone, because a delineation of species via genetic distances alone is not a straightforward approach. Therefore modern taxonomy should not rely on a single data set alone – particularly not genes only. The recently proposed taxonomic circle describes a way to test a species discovery hypothesis by the integration of different disciplines. In a case study on odonates (dragonflies and damselflies) we apply the scheme of the taxonomic circle to detect the first two cryptic dragonfly species in Africa. In the genus *Trithemis* a genetic study using four different sequence markers (ND1, COI, 16S and ITS I-II) unravelled three genetically distinct but morphological cryptic clades within a single species, *T. stictica*. We complement our genetically based new species hypothesis with ecological, geographical and morphological data. With the new species hypothesis in hand we identified significant morphological differences between *T. stictica* and the two new species, *T. morrisoni* and *T. palustris*. The latter two stay morphologically cryptic. They coexist in the same regional restricted area, while *T. stictica* is distributed throughout sub-Saharan Africa. Despite of their clear geographical overlap and morphological similarity, molecular clock analysis dates back the time of divergence ca. 2.4- 0.7 million years ago. We discuss the speciation events in a historical habitat shift and phylogenetic framework. Most likely drastic climatic fluctuations in the past resulting in aridification and forest fragmentation forced allopatric speciation events. The understanding of such events as well as correct estimates of biodiversity in the *Trithemis* group would not have been possible without genetic data and a clear defined taxonomic circle approach to species discovery.

**Keynote speaker Alison Cameron**

Chair: Eduard Linsenmair

Tuesday, 22 February, 9:10 | Hall H III

## BIODIVERSITY DATA MINING AND MODELLING: PROSPECTS FOR BIODIVERSITY IN MADAGASCAR, A TROPICAL BIODIVERSITY HOTSPOT

Alison Cameron, Queen's University Belfast, [noremacosila@gmail.com](mailto:noremacosila@gmail.com)

Conservation biologists must aim to create efficient conservation strategies for rare and threatened species. A common concept of efficient conservation is to create a protected area network that conserves the most species in the least space. This ideal is difficult to achieve across multiple taxa because species richness, endemism and turnover patterns rarely align well; although minimum complementary sets often can represent a relatively high proportion of other taxa. I will present a series of collaborative analyses, modeling species distributions from diverse data sets, and then applying conservation planning optimizations. A serious, but less-studied, trade-off, is that prioritizing persistence of selected species may reduce representation of other species in the network, soon resulting in these species joining the rank of the threatened. The effects of weighting species in conservation planning, and the representation of very rare species by solutions optimized for more common species are discussed.



PARALLEL SESSION HALL III , TUESDAY, 10:00:

BIODIVERSITY AND ECONOMY

Chair: Manfred Niekisch

## THE ECONOMICS OF ECOSYSTEMS AND BIODIVERSITY - INSIGHTS INTO THE RELATIONSHIP OF ENVIRONMENT AND ECONOMY

Carsten Nesshöver<sup>1</sup>

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The Economics of Ecosystems and Biodiversity (TEEB) study is a major international initiative to draw attention to the global economic benefits of biodiversity, to highlight the growing costs of biodiversity loss and ecosystem degradation, and to draw together expertise from the fields of science, economics and policy to enable practical actions moving forward. The study consists of a series of reports, addressing policy makers at local and national levels, businesses, complemented by a scientific report which summarizes the state of the art in the valuation of ecosystem services – its chances and its restrictions.

The talk will give a short insight into the results from TEEB, but also into the discussions that it reinforced: How can we account for the value of nature and its services, while at the same time ensuring that this approach is not misused in putting the anthropocentric idea of valuation of ecosystem services on the top of a general appreciation of the value of nature per se? TEEB tries to approach this challenge, but also tries to identify concrete action points for governments, local policy makers and businesses in order to better mainstream the economics of nature (TEEB 2010).

Reference:

TEEB (2010) – Mainstreaming the Economics of Nature: A synthesis of the approach, conclusions and recommendations of TEEB.- available online at [www.teebweb.org](http://www.teebweb.org)

## ENHANCING BIODIVERSITY WITHIN PALM OIL: BUTTERFLIES, STAKEHOLDERS AND THE CONSUMER

Ellie Lindsay<sup>1</sup>

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This interdisciplinary study examines biodiversity management approaches for oil palm plantations. Within the oil palm plantation sites were sampled in riparian habitat, forest fragment, oil palm where grazing is used, and oil palm where chemicals are used. A significant difference in abundance and species richness was found between all sites. However, when paired sites were compared abundance in the forest and the riparian was not significantly different. A series of interviews were conducted in order to assess stakeholder opinion of conservation strategies within oil palm plantations. Connectivity between forest fragments was the most frequently cited conservation strategy amongst stakeholders. There are clear ecological drivers for this change in environmental awareness, however it is apparent that there must be clear economic drivers in order for plantation managers to remain engaged in conservation strategies. The final part of this research looks at consumer willingness to pay for certified palm oil including manufacturers, distributors, and members of the public. This has been achieved through online questionnaires and is currently ongoing.



## BALANCING SOCIETY'S PRIORITIES: RECONCILING CONFLICTING LAND USES IN INDONESIA

Jaboury Ghazoul<sup>1</sup>, Lian Pin Koh<sup>1</sup>

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Tropical land use is beset with tensions over the assignment of land to food production, biofuels expansion, biodiversity conservation, carbon sequestration among others. Growing populations giving rise to increasing resource demands must be set against the need to mitigate climate change and protect biodiversity. Yet assigning land use to one of these objectives incurs trade-offs in others. Such trade-offs might be minimised through spatially explicit trade-off analyses. We develop and apply such a model to Indonesia, which is set to double its production of oil palm over the coming decade. We conclude that the impacts of oil palm expansion on other land uses (e.g. food production, forest cover and biodiversity conservation) can be greatly reduced compared to business as usual scenarios. As the model is spatially explicit, we can also identify areas where oil palm expansion should be focused, and where it should be avoided. Such scenario analyses may form the basis for informed decision making, although such tools need further refinement and verification before implementation.

PARALLEL SESSION TUESDAY 10:00 HALL H IV

CLIMATE CHANGE AND SEASONALITY

Chair: Ulrich Saint-Paul

## THE IMPACT OF PLEISTOCENE CLIMATE CHANGE ON SPECIATION IN CENTRAL AFRICA – THE CASE OF HAUMANIA (MARANTACEAE)

Alexandra Ley<sup>1</sup>, Olivier Hardy<sup>1</sup>

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The role played by historical processes in the origin of biodiversity and its distribution in Central Africa is still unclear. A frequently discussed hypothesis postulates that rainforest was fragmented and retracted into refuge areas during recurrent dry periods of the Pleistocene leading to geographic isolation of populations followed by speciation. This hypothesis has been established based on current patterns of diversity and endemism and is now being tested via phylogeographic analysis. Here we report on the genetic structure of two closely related lianescent *Haumania* species which show currently parapatric distribution ranges with overlap in Gabon. Thereby each species' range overlaps with different postulated refuge areas. The comparison of cp-haplotype distributions between the two species suggests allopatric speciation with one species originating in the Lower Guinean and one in the Congolian region and subsequent range expansion and overlap in Gabon. In the sympatric area several cp haplotypes are shared between species and their concordant spatial distribution indicates recent interspecific gene flow - a hint towards a young speciation possibly during the Pleistocene.

Merian Award Winner 2011



## MODELLING THE DYNAMICS OF RAINFORESTS. HOW STRONG IS THE IMPACT OF DROUGHT ON TROPICAL RAINFORESTS IN MADAGASCAR?

Rico Fischer<sup>1</sup>, Hans-Jürgen Dobner<sup>2</sup>, Andreas Huth<sup>1</sup>

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The rainforests in Madagascar with their high degree of endemism belong to the hot spots of biodiversity. Since up to 90% of forests are destroyed, many scientists believe that they should be considered among the highest conservation priorities on Earth.

The long-term responses of forests on droughts cannot be easily measured. Therefore and for extrapolations of short-term field measurements we need vegetation models. In this study we use the process-based, individual-oriented simulation model FORMIX3. The main processes of this model are tree growth, mortality, regeneration and competition. Tree growth is calculated on a carbon balance. The parameters of the model have been estimated based on field data of a rainforest in the south of Madagascar. This data has also been used to develop stem diameter increment functions by statistical methods.

The objective of this study is to understand how drought modifies biomass, species composition, productivity and carbon flux of a rainforest as a function of annual rainfall. The impact of drought on plants is modeled by calculating stress factors. Depending on the scenarios we observed a reduction of 30% in biomass and 40% in production.

## INFLUENCE OF CLIMATIC SEASONALITY ON THE DIVERSITY AND ASSEMBLAGE COMPOSITION OF HUMMINGBIRDS AND THEIR FOOD PLANTS: WHAT CAN WE DEDUCE FOR CLIMATE CHANGE?

Stefan Abrahamczyk<sup>1</sup>, Michael Kessler<sup>2</sup>

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Hummingbirds mainly feed on nectar and are thus strongly linked to their food plants. We conducted a survey of hummingbirds and their food plants along a latitudinal gradient in six Bolivian lowland forests. The latitudinal gradient also represents a gradient in temperature and precipitation seasonality. At each locality, species numbers of hummingbirds and their food plants as well as hummingbird abundance and numbers of flowers were registered once in both the rainy and dry seasons. We found that climatic seasonality had a strong impact on the diversity of food plant species, which in turn determines the number of flowers and hence nectar availability. Species number and abundance of hummingbirds was related to the number of flowers but not to the diversity of food plants. Focussing on changes in species richness and assemblage composition between seasons, climatic seasonality was the most important factor. Therefore, we predict that climate change will mainly directly affect the hummingbird food plants. These in turn will have an influence on the diversity and assemblage composition of hummingbirds. However, because the abundance of single food plants has far-reaching impacts on the hummingbird assemblages, specific responses of hummingbird assemblages to climate change are impossible to predict.



**Session: Tropical aquatic ecosystems: Diversity, ecophysiological processes and conservation****Tuesday, 24 February, 11:15, Hall H III****TROPICAL AQUATIC ECOSYSTEMS: DIVERSITY, ECOPHYSIOLOGICAL PROCESSES AND CONSERVATION**

Chair: Pia Parolin, Matthias Wantzen

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In spite of their ecological importance, wetlands belong to the most threatened ecosystems worldwide as they underlie a severe use conflict by human demands on water supply, timber, agriculture and pasture area, fish and wildlife, wastewater disposal and leisure activities. Biodiversity is especially affected in wetlands, among other reasons because of the recently drastic reduced area of undisturbed sites. The present session aims at highlighting the status quo of organismic and functional diversity research, understanding traits of species composition and diversity, ecophysiological processes and adaptation strategies of plant and animal species, and discuss the possibilities of implementation of scientific results into sustainable management and conservation schemes in wetlands.

## HOW DO RIVERS WORK?

### TROPICAL LIMNIOLOGY PROVIDES NEW INSIGHTS

Matthias Wantzen<sup>1</sup><sup>1</sup>Université Francois Rabelais, Tours, FR

Ecological concepts are derived from the most-studied ecosystems, which are often situated in the temperate zones of Europe and North America. This bias may hamper insights into the understanding of tropical ecosystems. A classical example for this is the River Continuum Concept, which has dominated river ecology for decades in spite the fact that it was formulated based on a data background from a limited set of low-order streams in the US. Research in tropical rivers in the past years has provided a number of insights, which complete, change or even overturn our picture of aquatic ecosystem functioning, including the importance of algal productivity in low-order streams, the very variable importance of leaf litter contribution, and the flood-pulse in the entire river system. Comparative studies between tropical and temperate countries are therefore very important to improve our view on the functioning of ecosystems.





## CONSERVATION OF ENDEMIC EXTREMOPHILE LIVEBEARING FISHES FROM SULFIDIC HABITATS IN SOUTHERN MEXICO

David Bierbach<sup>1</sup>, Martin Plath<sup>1</sup>

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Local adaptation to divergent environmental conditions can promote population genetic differentiation even in the absence of geographic barriers and hence, lead to (ecological) speciation. In southern Mexico (Tabasco and Chiapas), various populations of livebearing fishes occur endemically in small habitat patches with high concentrations of hydrogen sulfide, which is of volcanic origin. While some forms are phylogenetically old and represent distinct species (like *Gambusia eurystoma* or *Poecilia sulphuraria*), other populations are en route to speciation (i.e., have not yet achieved full reproductive isolation from related populations in adjacent non-toxic environments). We exemplify the diversity of unique adaptations in different sulfide-adapted ecotypes and highlight problems related to the conservation of the various evolutionarily significant units ('ESUs'), especially phylogenetically young forms. Specifically, we will use the genus *Poecilia* (mollies) as an example and show convergent morphological and behavioural adaptations to life in sulfidic habitats, provide a phylogenetic framework to reconstruct their independent evolution in different river drainages, and specify whether and how different populations are nowadays threatened by human activities.

Merian Award Winner 2011

## HELMINTHES INFESTATION OF *CLARIAS BATRACHUS* (LINNAEUS, 1758) AND *CLARIAS MACROCEPHALUS* (GUNTER, 1864): COMPARISON OF THE SMALL RIVER AND MEKONG DELTA HABITATS

Elena Mishina<sup>1</sup>, Nguyễn Thị Hải Thanh<sup>2</sup>, Alexander Zhokhov<sup>1</sup>

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River Cai is situated in Khanh Hoa Province in the Central Vietnam. Its drainage area is about 1450 km<sup>2</sup>, and its length is about 70 km. Fish's helminthes of river Cai have been studied from January to May 2008 -2009. Fishes were collected at the upper and lower reaches of river Cai. Another river, river Hau, that has been investigated for helminth fauna is one of the channels of the Mekong river localised in its delta. 111 specimens of *Clarias batrachus* were studied in the river Cai and 49 fishes were investigated in the river Hau. 54 fishes of *Clarias macrocephalus* were collected in the river Hau. A total number of 15 species of helminthes were identified: Cestoda – 7 species, Trematoda – 4, Nematoda – 3, Acanthocephala – 1. Six species of helminthes (*Lytocestus assamensis*, *Lytocestus sp.*, *Macroderoides sp.1*, *Phyllodistomum sp.*, *Procammallanus clarius* and *Pallisentis sp.*) were found in all fishes. *Djombangia penetrans* was observed in both catfishes from the Hau river. *Markewitschia sp.* and *Masenia sp.* were found in *Cl. batrachus* from the Hau river only. 2 species of nematodes (*Cammalanus cf. lacustris* and *Contracaecum sp. larva*) were found in *Cl. macrocephalus* only. *Monobotrium sp.*, *Bovienia sp.*, *Macroderoides sp.2* were identified in *Cl. batrachus* from the river Cai. The maximum intensity of helminthes for all fishes was found in intestines. The Caryophyllidea prevailed in all studied fishes in number of species, intensity and infestation (%). Maximal number of taxa of helminthes were revealed in *Cl. batrachus* from the river Hau. Minimal species richness of parasites was observed in *Cl. macrocephalus*.



Tuesday 12:00 | Parallel session: Tropical aquatic ecosystems; Hall H III

## FLORA OF CENTRIC DIATOMS FROM SEVEN RESERVOIRS IN CENTRAL VIETNAM (KHANH HOA AND QUANG NAM PROVINCES)

Evgeniy Gusev<sup>1</sup>, Elena Mishina<sup>1</sup>, Nguyen Thi Hai Thanh<sup>2</sup>

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Flora and ecology of centric diatoms from seven tropical reservoirs in Vietnam have been studied from January 2008 to June 2009. The use of electron microscopy technique allowed for the discovery of 16 species in seven reservoirs: *Aulacoseira* (4); *Cyclotella* (1); *Discostella* (2); *Melosira* (1); *Orthoseira* (1); *Puncticulata* (1); *Spicaticribra* (1); *Stephanodiscus* (2); *Thalassiosira* (1), *Urosolenia* (2). Nine species are new records for Vietnam flora and one from the genus *Urosolenia* is a new taxa to the science. Biovolume of diatoms reached up to 1.4 mm<sup>3</sup> l<sup>-1</sup>. Most abundant species with substantial biovolume and highest frequency of occurrence were *Aulacoseira granulata* (Ehrenberg) Simonsen, *Aulacoseira subarctica* (O.Müller) Haworth emend Genkal, *Discostella stelligera* (Cleve & Grunow) Houk & Klee and *Urosolenia* sp. The species *Aulacoseira granulata* and *Urosolenia* sp. reached the highest abundance and biovolume in eutrophic reservoirs. The diatoms *Aulacoseira subarctica* and *Discostella stelligera* preferred mesotrophic waters. The work was supported by project MK-5872.2010.4.

## ESTIMATING CARBON STOCK SIZES AND DISTRIBUTION OF METHANE SOURCES FOR UPPER AMAZON PALM SWAMP ECOSYSTEMS USING IN SITU MEASUREMENTS, OPTICAL IMAGERY AND AND MULTI-TEMPORAL MAPPING WITH PASSIVE AND ACTIVE MICROWAVES

Viviana Horna<sup>1</sup>, Reiner Zimmermann<sup>2</sup>, Kyle MacDonald<sup>3</sup>, Ronny Schröder<sup>3</sup>, Erika Podest<sup>3</sup>, Hermann Behling<sup>1</sup>, Pedro Vasquez<sup>5</sup>, Johannes Dietz<sup>6</sup>, Heinz Flessa<sup>4</sup>, Matthias Heckmann<sup>7</sup>, Annett Börner<sup>8</sup>

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Large areas of western Amazonia are covered by *Mauritia flexuosa* palm swamps (Aguajales). These occur in areas with stagnant water and may contain enormous amounts of carbon, which accumulated during the Holocene. Current remote sensing and atmospheric studies show high methane concentrations in this region. suspect the *Mauritia* palm swamps to dominate this source. This study intends to understand the role of palm swamps as carbon sink or source of greenhouse gases. Our study area is the upper Amazon watershed in Peru. Peat coring shows a high variability of peat accumulation from more than 7m to less than 1m. *Mauritia* stands have apical growth rates comparable to temperate forest trees. Tree growth measurements and tree apical growth estimates by leaf scar counts indicate that primary productivity, tissue respiration and mortality of palm swamp trees are higher than in adjacent upland forests. Assimilation rates in *Mauritia* plants under good light conditions reach values expected in non flooded plants. We measured maximum apparent assimilation rates of 6μmol CO<sub>2</sub> m<sup>-2</sup> s<sup>-1</sup> in mature *Mauritia* leaves at around 1000μmol Photons m<sup>-2</sup> s<sup>-1</sup>. Leaf dark respiration rates were moderate at 0.4μmol CO<sub>2</sub> m<sup>-2</sup> s<sup>-1</sup> indicating a high primary productivity. Aboveground biomasses of palm swamps are in the lower range for tropical lowland and montane forests. Physical and chemical soil parameters showed a clear distinction between the soils of the inundation forests and soils on well-drained upland forests.

We investigate the relationship between forest floor flooding and overlaying vegetation to determine sub-pixel inundation fraction by using a linear mixture model. Analysis of historic aerial photography from 1962 on, Landsat and ASTER imagery allowed the identification of palm swamp vegetation units. SAR imagery (wet season/dry season temporal change analysis) showed a good correlation between the distribution of Aguajales and other wetlands and the extent of flooding.



Our first measurements of enhanced methane concentrations of 2 to 4  $\mu\text{L L}^{-1}$  in air samples collected 10cm above the soil surface indicate a significant methane emission from the swamp area. They also indicated a high spatial variability of methane emission. The current knowledge suggest that palm swamps in western Amazonia are a tropical hotspot for soil C sequestration and they may also be a significant methane source at the local, regional and global perspective.

## LEAF FUNCTIONAL TRAITS OF AMAZONIAN FLOODPLAIN TREES IN RELATION TO FLOODING

Pia Parolin<sup>1</sup>

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1000 highly flooding tolerant tree species grow in Amazonian floodplain forests. Growth, productivity and morphological adaptations are adjusted to gradients of flooding intensity and nutrient availability. Plant physiology and morphology are adapted to conditions in specific sites, and thus tree species are not equally distributed, but form a clear zonation along the flooding gradient. The main hypothesis of this talk is that leaves, which are among the most important organs of a plant, reflect the differences in their morphoanatomical structures and show different adaptations and functional traits depending on the environment the plant typically occurs in. However, results show that the relationship of leaf functional traits with flooding intensity and nutrient availability are neglectable and – contrary to the expectations – no patterns could be detected. There are equal leaf adaptations in high and low positions along the flooding gradient, and in nutrient-poor and –rich environments. The differences can be explained almost exclusively by the morphoanatomical characteristics of pioneer trees which occur only in várzea.



PARALLEL SESSION TUESDAY, HALL H IV:

RAINFOREST STRUCTURE &amp; DYNAMICS

Chair: Jürgen Homeier

**THE STRUCTURE OF TROPICAL RAINFORESTS: WHAT CAN WE LEARN FROM TREE SIZE DISTRIBUTIONS?**Franziska Taubert<sup>1</sup>, Hans-Jürgen Dobner<sup>2</sup>, Andreas Huth<sup>1</sup><sup>1</sup>*Helmholtz-Centre UFZ, Leipzig, DE, [franziska.taubert@ufz.de](mailto:franziska.taubert@ufz.de), <sup>2</sup>HTWK Leipzig - University of Applied Science, Leipzig, DE*

In the global discussion on climate change and environmental protection tropical rainforests take up an important position. Their high biomass and biodiversity is closely related to their structure and dynamics. Tropical rainforests show a high variety in canopy structure. Local variations in forest biomass can be traced back to variations in tree sizes. Investigations on the stem size distribution of tropical rainforests are important for the estimation of forest biomass and thus, the role of these forests in the carbon cycle.

Here, we use statistical and geometrical methods for analysing the stem size distributions of tropical rainforests, particularly maximum likelihood methods for statistical reconstruction of the stem size distribution and the concept of sphere packing. We use field data from tropical forests of different sites in Panama and Malaysia (in total 61 ha).

The applications of the abovementioned methods on these field data indicate that the widely-spread assumption of a power-law for the stem size distribution can not be substantiated.

**THE TROPICAL LOWLAND CLOUD FOREST: A LOWLAND FOREST WITH MONTANE EPIPHYTE RICHNESS**Christine Gehrig-Downie<sup>1</sup>, Andre Obregon<sup>2</sup>, Jörg Bendix<sup>2</sup>, S. Robbert Gradstein<sup>3</sup><sup>1</sup>*University of Göttingen, Goettingen, DE, [cgehrig@gwdg.de](mailto:cgehrig@gwdg.de), <sup>2</sup>University of Marburg, Marburg, DE, <sup>3</sup>Muséum National d'Histoire Naturelle, Paris, FR*

The novel forest type "Tropical lowland cloud forest" (LCF) has recently been described in moist river valleys in French Guiana below 300 m. This forest resembles mixed lowland rain forest, but the frequent occurrence of fog and the greater richness of epiphytes sets this forest type apart.

Integrating climatic and botanical research, a four year interdisciplinary project investigating differences between LCF and tropical lowland rainforest (LRF) was initiated in 2007 supported by the German Research Foundation.

Diversity of epiphytic bryophytes and pteridophytes, microclimate and epiphytic biomass and cover on canopy trees in Central French Guiana were compared between LCF and LRF. Analyses of these characteristics indicate that LCF resembles moist montane cloud forests more than LRF, albeit at a far lower altitude. This similarity with montane cloud forests can be explained by the increased humidity due to high fog frequencies observed in LCF, leading to greater epiphytic biodiversity.





## THE ROLE OF FOG IN THE SPATIAL DISTRIBUTION OF A NEW TROPICAL LOWLAND FOREST TYPE

Andre Obregon<sup>1</sup>, Christine Gehrig-Downie<sup>2</sup>, S. Robbert Gradstein<sup>3</sup>, Jörg Bendix<sup>1</sup>

<sup>1</sup>University of Marburg, Marburg, DE, obregon@staff.uni-marburg.de, <sup>2</sup>University of Göttingen, Göttingen, DE, <sup>3</sup>Muséum National d'Histoire Naturelle, Paris, FR

Fog occurrence is extensively studied in the outer Tropics and in tropical montane cloud forests, but investigations of the spatio-temporal distribution of fog in tropical lowland forests are virtually lacking. We studied the meteorological processes leading to fog formation in central French Guiana by installing a climate station directly above the forest canopy (45 m above ground). Horizontal visibility (and thus fog occurrence) was observed by using a visibility sensor. Our studies provide detailed evidence of frequent occurrence of radiation fog in lowland valleys. Comparable high fog frequencies are only reported from tropical montane cloud forests. The main trigger of fog development in the lowland forest seemed to be precipitation, leading to higher soil moisture, greater evapotranspiration and, thus, higher water content of air.

The frequent occurrence of fog in the valleys correlated with significantly higher epiphyte diversities in valley forests as compared to hill forests, and supported the occurrence of the hitherto undescribed, epiphyte-rich "tropical lowland cloud forest" (LCF) in the valleys. The higher epiphyte diversity in LCF coincided with significantly higher relative air humidity than in hill forest. The ecological benefits of fog for the epiphytes in LCF are surplus of moisture and delayed onset of the stress period, particularly in the dry season.

The spatial extent of fog, and hence the propable distribution of LCF, was analyzed by means of night-time AVHRR and MODIS satellite data using an algorithm relying on brightness temperature differences between the long-wave and medium infrared bands. The output of the fog detection scheme was validated against horizontal visibility data from the ground station. The results indicate a widespread distribution of night and morning fog in river valleys throughout French Guiana. It must be assumed that fog is not an azonal phenomenon but could be widely distributed throughout the lowland tropics, with significant consequences for vegetation.

## LONG TERM DYNAMICS OF AN EPIPHYTE COMMUNITY IN A LOWLAND RAINFOREST IN PANAMA

Glenda Mendieta-Leiva<sup>1</sup>, G. Wagner<sup>1</sup>, K & G. Zotz<sup>1</sup>

<sup>1</sup>University of Oldenburg, Department of Functional Ecology, Oldenburg, DE, glendamendieta@gmail.com

Epiphyte community dynamics differs greatly from that of trees, but is associated and influenced in turn by the growth and mortality of the latter. The nature of this interaction changes with scale from individual tree, to the local population of a tree species to all trees in a local patch of forest. Here, we follow the structure and dynamics of all epiphytes on all trees of a particular host tree species, the palm *Socratea exorrhiza*, in ca. 1 ha of lowland rainforest in Panama over a period of 10 years.

The first census in 1999 yielded 99 palm trees, of which 59% held epiphytes. This percentage increased to 74% in 2010, although the total number of palms decreased to 89 trees. Both the number of epiphyte species and individuals increased with time; from 59 to 64 and 756 to 1839, respectively. These numbers conceal considerable fluctuation: on average, only about 50% of the species present in one census were also found during the subsequent census. Such variation could be linked to the changes in relative abundance, while rare species were comparably the same and occurred with a similarly low frequency in time; some of the most abundant species gradually switched their abundance rank.

Overall diversity was maintained, with a rather high rate of replacement, especially of fast growing species; whereas overall abundance increased by more than twofold. In conclusion, whilst there is variation in the relative abundance of individuals and diversity in time, the structure of the entirely epiphyte community remains rather stable. A future expansion of the study, through inclusion of different host tree species, will enable the possibility of further analysis at a larger spatial scale.



of different host tree species, will enable the possibility of further analysis at a larger spatial scale.





## TREE-LEVEL FECUNDITY AND DISPERSAL OF MASTING CO-DOMINANT RAIN FOREST TREES IN CENTRAL AFRICA

Julian Norghauer<sup>1</sup>, David Newbery<sup>1</sup>

<sup>1</sup>University of Bern, Bern, CH, [julian.norghauer@ips.unibe.ch](mailto:julian.norghauer@ips.unibe.ch)

Tree-level seed production within populations is poorly documented for species in tropical forests, especially those with supra-annual fruiting or masting behavior. Here we report on surveys made of pod and seed production of adults of two dominant species, *Microberlinia bisulcata* and *Tetraberlinia bifuliolata*, that masted in 2007 and 2010, and a third co-dominant canopy tree, *Tetraberlinia korupensis*, that masted in 2008, in 25 ha of primary lowland forest in Korup National Park (Cameroon). Preliminary analyses indicated highly variable patterns in tree-level fecundity between and within species, which did not scale up neatly with individual stem diameter or basal area. These results may have important implications for the inverse modeling of ballistic seed dispersal in these species at Korup, and possibly elsewhere too for other tree species also characterized by overlapping seed shadows.

## SPATIAL DISTRIBUTION OF PINE FORESTS IN CUSUCO NATIONAL PARK, HONDURAS, CENTRAL AMERICA

Cordula Lennkh<sup>1</sup>

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Monitoring of vegetation using remotely sensed data proved to be a cost-effective and time-efficient tool for forest surveys, detection of change and forest management. Current attempts at classifying vegetation in the area of Central America used the UNESCO system (Mueller-Dombois & Ellenberg, 1974) which is a species independent hierarchical vegetation classification system based on vegetation physiognomy.

This study was carried out for the area of Cuscuo National Park, which is situated within the Merendón Mountain mountain range in the vicinity of the city San Pedro Sula, Honduras. The ecosystem of main interest for this study was seasonal submontane pine forest. This is the most common type of ecosystem in Honduras, which is, however, reported not to be present in significant amounts within the borders of the Honduran National Park System (House et.al., 2002).

In this study Landsat TM remotely sensed data was used as a tool for forest vegetation classification combined with physiognomic data gathered during a three year extensive ground survey to evaluate the spatial distribution of seasonal submontane pine forest within Cusuco National Park. The vegetation classification carried out was based on the UNESCO system and compared previous large scale classifications performed during the mapping of Central American Ecosystems (Vreugdenhill et al., 2002) with the small scale classification of Landsat TM images for the core zone of Cusuco National Park from 2003, with additional re-classification of the extend of pine forests in 2009.



## SPECIALIZATION OR GENERALIZATION? FUNCTIONALITY OF WOODY AND PALM REGENERATION IN A MONTANE GUAYANAN RAIN-FOREST, SIERRA DE LEMA, VENEZUELA

Cristabel Durán-Rangel<sup>1</sup>, Stefanie Stefanie Gaertner<sup>3</sup>, Albert Reif<sup>1</sup>, Lionel Hernández<sup>2</sup>, José Ayala<sup>2</sup>

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In forests light constitutes a gradient which plant species partition. The resource partitioning is one of the explanation for species coexistence in the tropics. Species have been classified depending on their tolerance to shadow in functional groups (FG) and are thought to be specialized to an certain range of the light gradient.

We hypothesize that if species are specialists, they are found in a limited range of the light gradient. On the contrary if species are generalists, they are able to germinate, survive and grow under all light conditions and being similarly abundant along the light gradient.

We ask how varies the abundance of FG along the light gradient and which are the species regenerating only in gaps.

The light gradient was stratified in gap, gap border and closed-canopy forest with 39, 23 and 16 plots of 20m<sup>2</sup> respectively. Presence of trees, shrubs, palms and fern-trees was recorded and individuals identified to family, genera or species level when possible. Species were classified in FG (pioneers, long-lived pioneers, partial shade tolerant and shade tolerant) based on their wood density (WD). WD is a strong tool for categorizing species in FG since it provides an indicative trait of their shade tolerance. Palms were classified in partial shade tolerant and shade tolerant based on their maximal heights at adult stage.

Shade tolerant species (including palms) where the most abundant FG (range: 54-74% of all species) in all the light gradient followed by partial shade tolerant species (also palms) (range: 17-31% of all species). Pioneers and long-lived pioneers represented below 10% of the species even in gaps. Gap, border and forest do not differ on abundance of long lived pioneers, shade tolerant species (also palms). They do differ in abundance of pioneers and partial shade tolerant species (also palms), specifically gap and border differed in relation to forest. The majority of species growing only in gaps were shade tolerant or partial shade tolerant. The floristic composition of gap and border is similar and differ to the forest.

We conclude that forest regeneration is generalist prevailing shade tolerant and partial shade tolerant species. Even though the floristic composition of forest regeneration changes along the light gradient, the majority of the species are generalists having competence to germinate, survive and grow under a wide range of light conditions.

**Keynote: Tuesday, 22 February, 14:25 | Hall H III**

**Keynote speaker: Miguel Vences**

**Chair: Eckhard Heymann**

## DIVERSITY ASSESSMENT OF MADAGASCAR'S AMPHIBIANS AND REPTILES: MICROENDEMISM OF SPECIES AND PHYLOGEOGRAPHIC LINEAGES, AND PERSPECTIVES FOR THEIR CONSERVATION

Miguel Vences, TU Braunschweig, Braunschweig, DE, [m.vences@tu-bs.de](mailto:m.vences@tu-bs.de)

Madagascar harbors a unique fauna of amphibians and reptiles, characterized especially by an extreme degree of endemism of 100% among the ca. 275 amphibian and >90% in the ca. 360 reptile species. Intensive application of integrative taxonomy have revealed an astonishing amount of undescribed candidate species - especially in amphibians where an additional 200—300 candidate species were discovered by combining DNA barcoding, bioacoustic analyses and morphology. While DNA barcoding alone should not be used as sole argument for erecting new species it provides an extremely valuable tool to accelerate the erection of candidate species hypotheses that subsequently can be substantiated or rejected by other data sets. Many of the newly discovered species appear to be geographically very restricted whereas others are widespread over most of Madagascar. Species diversity and microendemism appear to be related, on one hand, to extrinsic factors like elevational heterogeneity in northern Madagascar, and on the other hand to intrinsic factors such as life history and body size. Given that the true bottleneck at present is not species discovery but taxonomic species description of Malagasy amphibians and reptiles, and considering the extreme rate of ongoing habitat destruction in Madagascar, it will be crucial to include undescribed candidate species and phylogeographic lineages to develop objective recommendations for spatial conservation priority assessments.



TUESDAY 15:15 Hall H III

**Tuesday, 22 February, 15:15, Hall H III**

**EAST AFRICAN MOUNTAIN FORESTS:  
FUNCTIONAL ECOLOGY AND SUSTAINABLE MANAGEMENT**

Chairs: Georg Guggenberger, Reinhard Mosandl  
Contact: [guggenberger@ifbk.uni-hannover.de](mailto:guggenberger@ifbk.uni-hannover.de)

Despite the precious services provided by east African mountain forests, they are increasingly endangered by anthropogenic impact. This calls for sustainable forestry concepts based on profound understanding of the ecophysiological traits of important native and exotic tree species. We, therefore, invite papers dealing with all aspects of functional ecology of intact and disturbed east African mountain forests and strategies for conservation and sustainable management.

**COEXISTENCE OF 3 DIFFERENT FUNCTIONAL TYPES OF  
INDIGENOUS TREES IN A TROPICAL MONTANE FOREST IN ETHIOPIA**

Erwin Beck<sup>1</sup>, W. Simone Strobl<sup>1</sup>, Masresha Fetene<sup>2</sup>, Yigremachew S. Lemma<sup>2</sup>, Solomon Zewdie<sup>3</sup>

<sup>1</sup>University of Bayreuth, Dept. of Plant Physiology, Bayreuth, DE, <sup>2</sup>Addis Ababa University, Biology Dept., Addis Ababa, Ethiopia, <sup>3</sup>Wondogenet Forestry College, Wondogenet, Ethiopia

*Podocarpus falcatus* (Pf), *Prunus africa* (Pa) and *Croton macrostachyus* (Cm) share the same site in a montane Munessa forest in Ethiopia. Pf and Pa are evergreen, while Cm is facultative deciduous, shedding its leaves at the end of the dry season. Photosynthesis, transpiration, daily sap flow, growth, and leaf characteristics were compared to assess the coexistence of the 3 different functional types. While water use efficiency of carbon assimilation was identical in the rainy season, substantial differences were observed between the 3 species in the dry months, when WUE of Pf was more than twice as much as that of Cm and 40% higher than of Pa. The daily course of xylem sap flow was season-independent in Pf. In Pa sap flow during the morning was almost similar in both seasons, but greatly reduced during the dry season's afternoons. In the leaf-on status sap flow of Cm was almost three-times that of Pa, but after leaf shedding it was in the range of Pf. The data, as well as other parameters identify Cm as pioneer species while the other two species are representatives of the mature forest state. The 2 evergreens differ in growth rates: Pa (broad leaf) grows faster than Pf (gymnosperm)

TUESDAY 15:15 Hall H III



## GROWTH STRATEGIES OF EVERGREEN AND DECIDUOUS SPECIES IN A TROPICAL MONTANE FOREST IN ETHIOPIA

Achim Bräuning<sup>1</sup>

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Speaker: Julia Krepkowski

The growth dynamics of seven tree species belonging to different life forms (evergreen conifer, evergreen broadleaved, deciduous broadleaved) was studied in the montane forest of Munessa (2.300 m a.s.l.; Ethiopia) using high-resolution dendrometers. Measurements of stem diameter variations were collected in 30 minute intervals over two calendar years. In addition, wood anatomical samples were collected in monthly intervals to study cambial activity with the help of wood anatomical micro-sections. Cambial phenology and length of the growing season varied considerably between years and life forms. Precipitation and the length of the dry period are the most important climate factors determining growth activity and the amplitudes of daily stem swelling and shrinkage resulting from transpiration. Wood anatomical micro-sections revealed the formation of growth boundaries. By the help of dendrometer data, the amount of annually formed wood and of the time of formation of growth boundaries could be determined for each species. The different tree life forms show different growth strategies of cambial phenology during the year: evergreen species are able to initiate cambial activity earlier and to interrupt growth during the short dry season (April-May), if conditions get too dry. In contrast, deciduous species showed a delayed start of cambial activity which was compensated by higher growth rates during the rainy season.

## TEMPORAL RESOLUTION OF RECENTLY ASSIMILATED CARBON ALLOCATION FROM TREE CANOPY TO SOIL CO<sub>2</sub> EFFLUX IN TWO CONTRASTING TREE SPECIES OF AN AFROMONTANE FOREST

Olga Shibistova<sup>1</sup>, Yonas Yohannes<sup>1</sup>, Masresha Fetene<sup>2</sup>, Birgit Wild<sup>3</sup>, Margarethe Watzka<sup>3</sup>, Andreas Richter<sup>3</sup>, Georg Guggenberger<sup>1</sup>

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Using a canopy <sup>13</sup>C pulse-labeling approach, we studied the temporal resolution of recently assimilated carbon allocation from tree canopy to soil CO<sub>2</sub> efflux for the gymnosperm coniferous *Podocarpus falcatus* and the angiosperm deciduous *Croton macrostachyus* (a climax and pioneer tree species, respectively) in an Ethiopian Afromontane forest. The current anthropogenic disturbances of the forest lead to shift in trees abundance to the favor of the pioneer. We hypothesized that the allocation of recently assimilated carbon is faster and the contribution of that to soil CO<sub>2</sub> efflux is greater for *C. macrostachyus* than for *P. falcatus*. During the labeling, *C. macrostachyus* assimilated 5.9 g <sup>13</sup>C and *P. falcatus* 6.9 g <sup>13</sup>C, corresponding to a tracer uptake efficiency of 61% and 59%. <sup>13</sup>C excess in leaves declined rapidly following a double exponential function with a larger size of the fast pool (64% vs. 50% of the assimilated carbon) having a shorter MRT (14h vs. 55h) for *C. macrostachyus* than for *P. falcatus*. Phloem sap velocity was about 4 times larger for the former. Consequently, in the soil CO<sub>2</sub> efflux the label was recorded earlier under *C. macrostachyus* (after 24h) then under *P. falcatus* (after 72h). Within a one year chasing period, 32% of the assimilated <sup>13</sup>C appeared in soil CO<sub>2</sub> efflux under the pioneer angiosperm, whereas it was only 15% in case of the late-successional gymnosperm.

That different behavior may be related to larger proportion of recently assimilated carbon being allocated belowground to enable the water and nutrient uptake by roots mycorrhiza in case of *C. macrostachyus*. *P. falcatus* seems to store more of this carbon in structural components. Continuing degradation of Afromontane forests will probably accelerate the temporal resolution of carbon cycling due to an increasing abundance of pioneers.



## USING STABLE ISOTOPE LABELING TO TRACE SOM DECOMPOSITION AND TRANSFORMATION BY MICROBES UNDER DIFFERENT SILVICULTURAL MANAGEMENT IN THE MUNESSA FOREST, ETHIOPIA

Marianne Benesch<sup>1</sup>

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During the last decades natural forests in Ethiopia with *Prunus africana*, *Croton macrostachy* and *Podocarpus falcatus* were frequently replaced by exotic tree species like *Cupressus lusitanica*, *Eucalyptus globules*, *Eucalyptus saligna*, *Pinus radiata* and *Pinus patula*. But less is known about their sustainability. In tropical ecosystems soil organic matter (SOM) is an important factor for soil sustainability. SOM depend on organic matter (OM) input by above- and below-ground biomass, and on OM output e.g. by carbon mineralization and dissolved OM leaching. To study litter decomposition and OM turnover a labeling experiment was installed with <sup>13</sup>C and <sup>15</sup>N labeling of different tree species (*Prunus africana*, *Croton macrostachys*, *Podocarpus falcatus*, *Cupressus lusitanica*) simultaneously via photosynthesis by tree gassing with <sup>13</sup>CO<sub>2</sub> and by stem injection of <sup>15</sup>NH<sub>4</sub><sup>15</sup>NO<sub>3</sub>. Our results demonstrate that simulating natural litter fall conditions, enough labeled plant material can be produced in situ for a long-term litter turnover experiment. The intra-plant label uptake is heterogeneous so that only leaves (litter) should be used for the turnover study. The original litter was removed from the experimental plots (1 m<sup>2</sup>) and replaced by labeled litter. After 2, 8 and 12 months soil samples were taken in threefold repetition from 0-2 cm, 2-5 cm and 5-10 cm depth under different management strategies (conversion and intense promotion).

Kruskal Wallis ANOVA showed that management strategies, tree species, soil depth and tree age significantly influenced bulk soil <sup>15</sup>N enrichment, while <sup>13</sup>C enrichment was only influenced by depth. To extract the microbial biomass and measure <sup>13</sup>C and <sup>15</sup>N enrichment a chloroform fumigation extraction was used. Here, Kruskal Wallis ANOVA showed that the <sup>15</sup>N enrichment of the microbial biomass depends mainly on the incubation time of the labeled litter, tree age and depth, while <sup>13</sup>C enrichment is only significantly influenced by tree age.

## IMPACT OF HUMAN UTILIZATION ON A TROPICAL FOREST ECOSYSTEM IN WESTERN KENYA

Dana Berens<sup>1</sup>, Julia S. Brennecke<sup>2</sup>, Verena Schuldenzucker<sup>3</sup>, Katrin Böhning-Gaese<sup>4</sup>

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Tropical forest ecosystems are hotspots for biodiversity and are thus a worldwide conservation priority. Growing human populations in the tropics increase the pressure on these unique ecosystems and their biodiversity. The local population living adjacent to tropical forests is largely depending on forest products, e.g. firewood, timber, or medicine, as important sources of domestic goods and income. Thus, assessing the threat status of tropical forests caused by human disturbances and the sustainability of human activities is a major concern for the conservation of these ecosystems. In Kakamega Forest, western Kenya, we investigated anthropogenic disturbances, e.g., logging or charcoal burning, under different management regimes and along a distance gradient from the forest edge up to 2 km inside the forest. We furthermore assessed the impact of distance and disturbance on the abundance, species richness and regeneration of pioneer- and climax tree and shrub species utilized by the local people. Our results showed that stricter management led to overall lower levels of anthropogenic disturbance. Smaller-scale disturbances, e.g., debarking of trees or selective logging, decreased with increasing distance from the forest edge into the forest. In contrast, larger-scale and more conspicuous disturbances, such as charcoal burning, predominantly occurred at farther distances from the forest edge. Analyses of pioneer and climax tree and shrub species revealed that, in general, abundance and species richness were hardly affected by anthropogenic utilization. The same was true for abundance and species richness of saplings and seedlings of these species, and, thus, for their regeneration potential. To conclude, our study showed that small-scale levels of human disturbance and utilization of forest products can be maintained at an apparently sustainable level. However, human activities have to be managed effectively to guarantee the long-term sustainable use and persistence of this valuable ecosystem.





## HUMAN IMPACT ON VASCULAR PLANTS DIVERSITY, POPULATION STRUCTURE AND NATURAL REGENERATION OF SOUTH NANDI FOREST, KENYA

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This study aims to investigate human impact on the plant species, community types and diversity of South Nandi forest. Two sites based on their disturbance status were selected for this study. Totally forty-nine 20 by 20 meter plots from both sites (27 plots from relatively less disturbed site (Kobujoi) and 22 plots from relatively highly disturbed site (Bonjoge)) were used to collect vegetation and environmental data. These plots were distributed 100 meters apart along transects of 1 km to 1.6 km length and the distance between adjacent transects was 500 m. All woody plants greater than two cm diameter at breast height (DBH) and taller than 2 m were measured using diameter tape and hypsometer respectively. Herbaceous plants and seedlings of all woody plants were recorded in five three by three meter plots within the bigger plot, at the four corners and the centre. Each plant was identified at species level when first encountered in the forest. For those plants which were difficult to identify at field, voucher specimens were collected, pressed and later identified at herbarium. Multivariate statistical analysis method was used to analyze the data. Cluster analysis and ordination were undertaken using PC-ORD and CANOCO respectively. In this study, including those found out of study plots, in both sites totally 253 plant species from 87 families and 200 genera were identified. Higher species richness per plot is recorded at Kobujoi (67.1) than that of Bonjoge (50.4). Both basal area and number of seedlings per hectare were significantly higher ( $p < 0.001$ ) at Kobujoi (38.36 m<sup>2</sup> and 66972 respectively) than that of Bonjoge (24.65 m<sup>2</sup> and 39661). At both sites higher proportion of woody plants was found at lower Dbh and height classes. In this study three different plant communities were identified. The species check-lists resulting from this research is the first of its kind for South Nandi forest. This study aims to contribute to the conservation and development endeavor of South Nandi Forest.

Keywords: basal area, cluster analysis, CANOCO, disturbance, diversity, human impact, ordination, PC-ORD, plant community, species richness, vascular plants, Kenya

## Session: East African mountain forests: functional ecology and STRATEGIES TO CONSERVE A LOWER-MONTANE FOREST IN EAST AFRICA USING NATIVE TREE SPECIES

Robert Gliniars<sup>1</sup>, Sebastian Becker<sup>1</sup>, Mathias Oesker<sup>1</sup>, Henning Todt<sup>1</sup>, Helmut Dalitz<sup>1</sup>, Winfred Musila<sup>2</sup>

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Kakamega Forest, Kenya (1600 m a.s.l.) is a lower-montane rainforest that has partially been highly disturbed by the surrounding dense population. This human disturbance poses in particular a threat to those native forest tree species that are most often harvested for timber and firewood. Our nine-year research project produced extensive knowledge on the common tree species in the forest. This was achieved by carrying out monthly stem growth measurements and phenology observations, tree sapling observation in the natural habitats and greenhouse experiments. Further the wood of most species was analyzed for wood density and carbon content. These findings were then put into practice by setting up on-farm-forestry and reforestation projects. The on-farm-forestry approach allowed farmers to contribute to satisfying their own wood demands by cultivating trees that they would otherwise have removed from the forest. According to the feedback from the farmers these trees did not have a negative effect on crop production. The first stage in the restoration work was to set up the infrastructure for tree nurseries, thus enabling the creation of jobs for the local communities e.g. the collecting of seeds, if not available, and then the cultivating of the target species. The next stage was to plant a mixture of pioneer, successional and climax tree saplings in the restoration areas. These saplings were planted under different light conditions in shade or in the open area. This approach required close cooperation with the local community in areas such as the creating of infrastructure, the negotiating of agreements with the local authorities and the use of guards. Both approaches help to conserve the forest by on the one hand offering an alternative wood supply as a substitute for forest trees and on the other hand by replanting trees to satisfy the specific needs of the communities. By reducing the human pressure these approaches help to implement sustainable forest management plans.



## ACCLIMATION OF TWO AFROMONTANE TREE SPECIES (PODOCARPUS FALCATUS AND CROTON MACROSTACHYS) TO DIFFERENT IRRADIANCE LEVELS DETERMINED BY THINNING OF A PINUS PATULA PLANTATION IN SOUTHERN ETHIOPIA.

Andreas Nenninger<sup>1</sup>, Thorsten Grams<sup>1</sup>, Andreas Wasner<sup>1</sup>, Yigremachew Seyoum<sup>2</sup>, Simone Strobl<sup>3</sup>, Hany El Kateb<sup>1</sup>, Reinhard Mosandl<sup>1</sup>

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The remaining forest resources of Ethiopia are declining dramatically due to deforestation and degradation. Although the important role of plantation forests to foster native tree species is very well documented, studies based on plantation management concepts focusing on how to enhance natural regeneration of native tree species are scarce in Africa. The main objective of this study was to assess, how two important afromontane tree species, *Croton macrostachys* (pioneer species) and *Podocarpus falcatus* (late-successional-species), naturally regenerated in a *Pinus patula* plantation respond to irradiance levels determined by four silvicultural treatments. Leaf traits, photosynthetic performance and growth were investigated under an irradiance gradient of 1.6 – 35.3 (mol / sq.m. and day) PPFD determined by the intensity of thinning. *P. falcatus* characterised as shade tolerant species could cope very well under high light levels. Systematic promotion by pronounced thinning treatments seems promising in order to establish the species on the long run and consequently convert the exotic plantation into a natural forest.

## EFFECTS OF SILVICULTURAL MANAGEMENT PRACTICES ON THE SOIL AND FOLIAR NUTRIENT STATUS OF TREE SPECIES IN THE MUNESSA FOREST, ETHIOPIA

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In Ethiopia, forest plantations with exotic tree species play an important role in the supply of the increasing human population with fire wood and building material. To sustain plantation productivity improved silvicultural management practices of these monocultures are necessary. Conversion (CV) is such a practice aiming by intensive thinning to improve water supply of the trees and soil nutrient turnover by stimulation mineralization and thus promoting increment and increasing timber quality. However, up to now sound knowledge about the effects of CV, carried out by Mosandl et al. end of 2007 and at the beginning of 2008, are lacking. Therefore the objectives of our studies are:

1. To investigate the effects of CV on SOM and nutrient pools in the ground vegetation, in the soil organic layers, and in the upper mineral soil.
2. To study the CV-effects on the mineral nutrition of tree species by foliar analysis.
3. Further we are studying the effects of mineral fertilizers on growth and survival rate of enrichment plantings, and in collaboration with Beck et al. on photosynthesis and transpiration of selected tree species.

About 15 months after CV mineral soil properties (SOC- and nutrient stocks, C/N-ratios, 0-5 cm) did not change. The expected C- and N-mineralization as a consequence of CV could not be shown in the surface mineral soil. But most properties of the organic layer changed significantly after CV, for instance the C-, N- and P-stocks increased and the C/N-ratios decreased indicating higher inputs of forest floor vegetation- and shrub-litter (with low C/N-ratios). The exploding forest floor vegetation seems to assimilate especially N, correlating with a decrease of N-levels in tree foliage after CV. Increased K-, Na-, Ca- and Al-levels in the organic soil layers may indicate higher dust inputs after opening the canopy by CV and thus increasing the filter capacity of the canopy.



Parallel session: Tuesday, 22 February, 15:15, Hall H IV

### **Tropical island biodiversity: magnitude, function and conservation**

Chairs: Holger Kreft, Yann Clough  
Contact: [hkreft@uni-goettingen.de](mailto:hkreft@uni-goettingen.de)

Tropical islands are in the focus of ecological and biogeographical research for more than 200 years and have sparked some of the most influential works in ecology and evolution. Given their small area size, tropical islands contribute disproportionately to global biodiversity, but the biodiversity inventorying of the thousands of islands is a Herculean task and its completion currently out of reach. At the same time, tropical island biodiversity and essential ecosystem functions are vanishing at an accelerating pace due to a multitude of drivers. This session aims at providing an overview about the recent progress in the documentation and understanding of biodiversity on tropical island. We welcome contributions that investigate ecological patterns and interactions, invasive species, or effects of habitat degradation on ecological to biogeographic scales.

### **PATTERNS OF FERN DIVERSITY IN THE SOUTHEAST ASIAN ARCHIPELAGO**

Dirk Nikolaus Karger<sup>1</sup>, Victor B. Amoroso<sup>3</sup>, Dedy Darnaedi<sup>2</sup>, Arief Hidayat<sup>2</sup>, Michael Kessler<sup>1</sup>

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Island systems have long played a crucial role in investigating patterns of biodiversity because they provide comparatively simple systems with clearly defined subunits of usually varying sizes and ecological conditions. Biodiversity, however, can be measured in different ways, representing different levels of diversity (alpha-, beta- and gamma-diversity), and all levels are influenced by different factors. Most studies focusing on island biodiversity use only one of these levels. To get an accurate measure of the status of biodiversity on islands it is important to investigate all levels of biodiversity as well as the influencing factors. We present first results from a study which investigates fern diversity on all these different levels of biodiversity in the Southeast Asian archipelago of Indonesia and the Philippines. The Southeast Asian archipelago provides us with a large number of island of varying sizes and environmental conditions which we used as a natural experiment to evaluate the role of different factors influencing the different levels of diversity.



## HISTORICAL AND CONTEMPORARY DRIVERS OF BIOGEOGRAPHICAL MODULES AND ISLAND ROLES: A CROSS COMPARISON OF WALLACEA AND WEST INDIES

Daniel Wisbech Carstensen<sup>1</sup>, Bo Dalsgaard<sup>2</sup>, Jens Christian Svenning<sup>1</sup>, Carsten Rahbek<sup>3</sup>, Jon Fjeldså<sup>3</sup>, William Sutherland<sup>2</sup>, Jens Mogens Olesen<sup>1</sup>

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To compare biogeographical patterns, we adopted a network approach to detect biogeographical modules (sub-regions of islands compartmentalized on the basis of a common avifauna) and island topological roles in Wallacea and West Indies. In both archipelagoes we could explain these biogeographical modules with a combination of historical and contemporary factors such as geological origin, past connections, current geographical position, and island area. Each island was given two coordinates, *l* (localized topological importance), and *r* (regionalized topological importance), placing it in a two dimensional *l-r* space. This designates the biogeographical function or role of an island and can be used as a way to characterize and compare its importance for the local and regional fauna. The relative influence of island characteristics and species richness were tested as predictors of *l* and *r*. In both Wallacea and West Indies, island area, maximum elevation, and species richness were strongly correlated with *l*, while two measures of isolation correlated positively, although not strongly, with *r*. Large, mountainous, and species-rich islands were thus highly connected within modules and responsible for the conglomeration of modules, while islands distant from the mainland and locally isolated could behave as sinks and stepping stones for dispersing species. We discuss islands in different positions in the *l-r* space and their significance for the regional avifauna, while comparing islands with similar roles in Wallacea and West Indies.

## EQUILIBRIUM OR NON-EQUILIBRIUM PROCESS SHAPES GROUND SPIDER DIVERSITY? A COMPARATIVE STUDY BETWEEN TROPICAL AND TEMPERATE ECOSYSTEM

Samuel Yu-Lung Hsieh<sup>1</sup>, Karl Eduard Linsenmair<sup>1</sup>

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The neutral theory and niche theory are still controversial and offer useful perspectives regarding fundamental questions of ecology. However, we lack even a basic understanding and universal model of how community organizations change within temporal and spatial resolution, even though this information is essential for suggesting that equilibrium or non-equilibrium process control biodiversity. Therefore we use the null model to test whether ground spider species in a tropical island (Taiwan) and a temperate area (Germany) have competitive interactions, while controlling for temperature (seasons) and habitat (forest/grassland) variables. The co-occurrence species in this tropical area shows high niche overlaps, and these ground spider communities are assembled deterministically and stochastically in different seasons. The spatial differentiation of species composition between habitats does not occur in the tropical area, thus it does not demonstrate niche segregation. Moreover, our data show that both equilibrium and non-equilibrium patterns control the biodiversity and shape the ground spider communities in the temperate area which support the predictions of the continuum hypothesis, which combine both neutral theory and niche theory. However, only equilibrium force works in this tropical research area.



## ANT COMMUNITIES ON SMALL TROPICAL ISLANDS: EFFECTS OF ISLAND SIZE AND ISOLATION ARE OBSCURED BY HABITAT DISTURBANCE AND 'TRAMP' ANT SPECIES

Akhmad Rizali<sup>1</sup>

<sup>1</sup>*Agroecology, Uni Göttingen, Göttingen, DE, arizali@gwdg.de*

Comparisons among islands offer an opportunity to study the effects of biotic and abiotic factors on small, replicated biological communities. Smaller population sizes on islands accelerate some ecological processes, which may decrease the time needed for perturbations to affect community composition. We surveyed ants on 18 small tropical islands in Thousand Islands Archipelago (Indonesian name: Kepulauan Seribu) off Jakarta, Indonesia, to determine the effects of island size, isolation from the mainland, and habitat disturbance on ant community composition. Ants were sampled from the soil surface, leaf litter and vegetation in all habitat types on each island. Island size, isolation from the mainland, and land use patterns were quantified using GIS software. The presence of settlements and of boat docks were used as indicators of anthropogenic disturbance. The richness of ant communities and non-tramp ant species on each island were analysed in relation to the islands' physical characteristics and indicators of human disturbance. Forty-eight ant species from 5 subfamilies and 28 genera were recorded from the archipelago, and approximately 20% of the ant species were well-known human-commensal 'tramp' species. Islands with boat docks or human settlements had significantly more tramp species than did islands lacking these indicators of anthropogenic disturbance, and the diversity of non-tramp species decreased with habitat disturbance. Human disturbance on islands in the Thousand Islands Archipelago promotes the introduction and/or establishment of tramp species. Tramp species affect the composition of insular ant communities, and expected biogeographical patterns of ant richness are masked. The island with the greatest estimated species richness and the greatest number of unique ant species, Rambut Island, is a forested bird sanctuary, highlighting the importance of protected areas in preserving the diversity of species-rich invertebrate faunas.



## CAN KEY FOOD RESOURCES EXPLAIN THE PRESENCE AND ABSENCE OF TWO MOUSE LEMURS (MICROCEBUS SPP.) IN NORTHWESTERN MADAGASCAR?

Sandra Thorén<sup>1</sup>, Sehen Lalandy<sup>3</sup>, Romule Rakotondravony<sup>4</sup>, Ute Radespiel<sup>1</sup>

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Since essential resources may influence the distribution pattern of species, we investigate whether the distribution of food plants explains varying abundances of *M. murinus* and *M. ravelobensis* in northwestern Madagascar. Therefore, we first identified potential key food plants for both species in three study sites and subsequently tested, if the distribution of these food plants could explain the presence/absence of the mouse lemurs in another set of 18 study sites. To identify key food plants we collected feeding data from 17 female *M. murinus* and 18 female *M. ravelobensis*, and botanical data from 9 plots and 36 50m-transects. We identified seven and four potential key food plant species for *M. murinus* and *M. ravelobensis*, respectively. However, the presence of these food plants could not be unambiguously linked to the presence/absence of the two mouse lemurs in the 18 further sites. However, whenever one of four food plants of *M. murinus* was present; this mouse lemur was also present. In conclusion, the distribution of food resources might influence distribution pattern of *M. murinus*, but not of *M. ravelobensis*. The evolutionary implications of these findings will be discussed.





### ECOLOGY AND SOCIAL ORGANISATION OF FARASAN GAZELLES (GAZELLA GAZELLA FARASANI) ON THE FARASAN ARCHIPELAGO IN THE RED SEA

Torsten Wronski<sup>1</sup>

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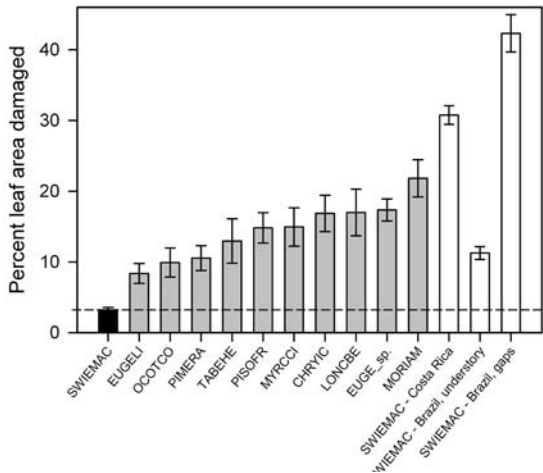
Once common throughout the entire Middle East, population sizes of Mountain Gazelles (*Gazella gazella*) are nowadays decreasing dramatically. The uncertain taxonomy of this species—with a variety of described subspecies without validated status—hampers conservation efforts. The last remaining stronghold of the species is the Farasan Archipelago in Saudi Arabia. Although, the origin of this island population remains obscure, the Farasan Gazelle is believed to have immigrated from the Arabian mainland and is isolated since the last glacial. Since then, the population has undergone a number of adaptations reaching from island dwarfism, via horn reduction in females, changed social structures, subdued reproduction to endemic parasites. The group of islands represents a “living” evolutionary laboratory, in which mechanisms of specification and adaptations to extreme aridity can be studied. This presentation gives an outline about gazelle research currently carried out on the islands and should encourage further studies within this unique habitat.

### ISLAND INVASION BY A THREATENED TREE SPECIES: EVIDENCE FOR NATURAL ENEMY RELEASE OF MAHOGANY (SWIETENIA MACROPHYLLA) ON DOMINICA, LESSER ANTILLES

Julian Norghauer<sup>1</sup>, Adam Martin<sup>2</sup>, Erin Mycroft<sup>2</sup>, Arlington James<sup>3</sup>, Sean Thomas<sup>2</sup>

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Despite its appeal to explain plant invasions, the enemy release hypothesis (ERH) remains largely unexplored for tropical forest trees. In Cabrits National Park, Dominica, we observed patterns consistent with enemy release of two mahogany species, *Swietenia macrophylla* and *S. mahagoni*, planted ~50 years ago. *Swietenia* populations at Cabrits have reproduced, with juveniles established in and out of plantation areas. *S. macrophylla* juveniles also had significantly lower leaf-level herbivory (~3.0%) than nine co-occurring species native to Dominica (8.4–21.8%), and far lower than conspecific herbivory in *Swietenia*’s native range. These results support ERH and confirm that *Swietenia* has naturalized at Cabrits. However, *Swietenia* abundance was positively correlated with native plant diversity at the seedling stage, and only marginally negatively correlated with native plant abundance for stems ≥1-cm dbh. We conclude that relaxed pressure from specialized enemies, specifically the defoliator *Steniscadia poliophaea* and shoot-borer *Hypsipyla grandella*, enhanced *Swietenia* recruitment at Cabrits. Lacking intervention, *Swietenia* will spread and may negatively impact native biodiversity.



TUESDAY 17:00 Hall H IV

TUESDAY 17:15 Hall H IV

## THE YELLOW CRAZY ANT *ANOPLOLEPIS GRACILIPES* ON CHRISTMAS ISLAND: IS SUCCESSFUL INVASION THE END OF THE STORY?

Heike Feldhaar<sup>1</sup>

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Invasive species are one of the main reasons for the ongoing global loss of biodiversity. *Anoplolepis gracilipes* is an invasive ant that has recently received significant attention due to its negative effect on the native fauna and flora of Christmas Island, Indian Ocean. This species has contributed to a drastic change in the structure of the Christmas Island rainforest through its negative impact on the island's endemic red land crab, the dominant consumer on the islands forest floor. Currently no natural enemy of this ant is known. Like other invasive ant species *A. gracilipes* forms large polygynous supercolonies. Population genetic analyses of *A. gracilipes* on Christmas Island suggest that the island has been colonized twice independently. Genetic differentiation in nuclear and mitochondrial markers between the two sympatric supercolonies suggests that geneflow between the colonies is absent. When supercolonies have a disjunct distribution, e.g. due to human mediated jump dispersal, lack of gene flow between parts of the same supercolony may lead to genetic differentiation among them over time. Thus supercolonies (or oarts of one) may diverge genetically and, thus, also in recognition cues (cuticular hydrocarbons, CHC's), resulting in an increase of aggressive encounters between parts of the supercolony upon secondary contact. Thus, I propose that ultimately fragmentation and differentiation of the supercolonies will lead to the breakdown of the supercolony structure.

## CONSERVATION GENETICS OF THE JELLYFISH TREE, A SEYCHELLES FLAGSHIP SPECIES

Aline Finger<sup>1</sup>

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*Medusagyne oppositifolia* (Medusagynaceae) is a critically endangered flagship species of the Seychelles. The species survives in only four populations, where the total number of reproductive adults is 90, of which 78 occur in a single population being the only showing natural regeneration.

We used field ecological approach (controlled pollination crosses) and molecular genetic techniques to determine the genetic and ecological factors that contribute to the declining individual plant fitness and population viability. Using 13 microsatellite loci we demonstrate that genetic diversity is similar within small and large populations. Furthermore, all populations contain unique alleles not present in the other populations indicating that they have been and still are isolated due to low historical and contemporary gene flow. Our controlled pollination experiments reveal that inter-population crosses from a big donor population to a small recipient population results in elevated fruit set and increased seed viability compared to within pollination experiments.

The results highlight that the protection of the small populations is of high priority to maintain their unique genetic diversity.



**Public Talk | Abendvortrag | Tuesday 18:30; Hall H VI**

**Chair: Manfred Niekisch**

## **DIE BIODIVERSITÄT DER LANDWIRBELTIERE IN EINER WELT DES WANDELS**

Walter Jetz<sup>1</sup>

<sup>1</sup>*Yale University, New Haven, CT, US, [walter.jetz@yale.edu](mailto:walter.jetz@yale.edu)*

Eine globale Evaluierung der intra und extra-tropischen Diversität und Biogeographie der Landwirbeltiere und ihrer Bedrohung durch Landnutzung und Klimawandel.



### Öffentlicher Abendvortrag

Die Biodiversität der Landwirbeltiere in einer Welt des Wandels, Vortrag von Walter Jetz (Yale University)

Termin: 22.02.2011, 18.30 Uhr. Eintritt frei.

Im Rahmen der Konferenz „Status and Future of Tropical Biodiversity“ der Gesellschaft für Tropenökologie e.V. - gtö hält Walter Jetz von der Universität Yale/ USA einen öffentlichen Abendvortrag in deutscher Sprache mit dem Titel „Die Biodiversität der Landwirbeltiere in einer Welt des Wandels“.

Wälder werden umgewandelt, Plantagen und andere landwirtschaftliche Nutzflächen breiten sich aus. Dies hat Folgen für die Biodiversität, die Vielfalt an Arten, Ökosystemen und die genetische Vielfalt innerhalb der Arten – und dies nicht nur in den Tropen.

Walter Jetz wird in seinem Vortrag darstellen, wie sich die Vielfalt der Landwirbeltiere, vor allem der Reptilien, Vögel und Säugetiere, sowie ihre Verbreitung über den Globus vor dem Hintergrund von menschengemachter Lebensraumzerstörung und Klimawandel verändert.

Nach seinem Studium der Biologie an den Universitäten Würzburg und Oxford (GB) lehrte Walter Jetz vier Jahre an der Universität San Diego (USA) und ist seit 2009 Dozent in der Abteilung Ökologie und Evolutionsbiologie der Universität Yale (USA).

Der öffentliche Abendvortrag bietet Frankfurter Bürgern Einblicke in die Arbeit der Tropenökologen und in die momentane Lage und die Zukunft der tropischen Biodiversität. Diese öffentliche Abendveranstaltung mit Diskussion wird geleitet vom Präsidenten der gtö und Frankfurter Zoodirektor Prof. Dr. Manfred Niekisch.

**Keynote speaker: Susanne Renner**

**Chair: Elisabeth Kalko**

**Wednesday, 23 February, 9:10 | Hall H III**

### **PROGRESS IN COLLECTING, IDENTIFYING, AND DESCRIBING TROPICAL SPECIES - THE LATEST STATISTICS**

Susanne S. Renner, Department of Biology, University of Munich, Munich, Germany

2010 saw the publication of several new approaches to estimating the number of living species. Examples, which I will discuss, are Hamilton et al. (American Naturalist 176, July 2010: Quantifying Uncertainty in Estimation of Tropical Arthropod Species Richness), Joppa et al. (Proc. Royal Soc. B, July 2010: How many species of flowering plants are there?), and Bebber et al. (PNAS, Dec 2010: Herbaria are a major frontier for species discovery). In December 2010, the Royal Botanic Garden Kew and the Missouri Botanical Garden placed online a list of the 298,900 currently accepted vascular plant names (plus 477,600 synonyms), and many institutions also publish the number of species described annually by their staff, providing local view of species increase. These data allow assessing our progress in collecting, identifying, and describing tropical species. The estimate for tropical arthropod species now is 3.7 to 2.5 million species globally (with large 90% confidence intervals) of which 855,000 have been described. The estimate for all species on Earth is 11 million. For flowering plants, the current best estimate is 352,000 species, with 10 to 20% still remaining to be described. The most encouraging data in this talk concern the continued increase in numbers of species being described every year. How do the few taxonomists do it? And does the more rapid recognition of new species via barcoding encourage their formal naming?

### **Parallel Session | Wednesday, 23 February, 10:00, Hall H III ECOLOGICAL NETWORKS AND ECOSYSTEM FUNCTIONING**

Chairs: Marco Mello, Elisabeth Kalko

Contact: marmello@gmail.com

Network theory is almost 300 years old, and it's a mature field in Mathematics. Biologists started using network theory to study food webs much later, only in the 1940's. Since the 2000's there has been a new boom of interest in networks, and with this approach it has been possible to make new exciting findings about the structure and dynamics of antagonistic and mutualistic systems. The knowledge accumulated so far is enough to start making predictions about the effects of disturbances on ecological networks and, ultimately, on ecosystem functioning. In this session, we want to gather people who are investigating the complexity of ecological interactions in the framework of network theory from different perspectives, focusing on different taxa and different kinds of interaction. We aim at sharing examples of how network theory can be used as a tool to understand the complexity of food webs and conserve ecosystem services.

WEDNESDAY 10:00 Hall H III



## SO CLOSE, NO MATTER HOW FAR: THE IMPORTANCE OF DIFFERENT SPECIES IN MUTUALISTIC NETWORKS

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Each species plays a functional role (*Eltonian niche*) and so contributes differently to the structure of ecological communities; some are considered as keystones. This is true for food webs, and probably also for mutualistic networks. As mutualisms generate vital ecosystem services, it is crucial to understand functional roles within those systems, and how they affect their maintenance. Traditionally, mutualisms have been studied in pairs of species, but ecosystem services are better understood at the community level. We investigated from a network perspective the functional role of different species in seed dispersal and pollination systems, as well as its biological basis. Although seed dispersal is a less specialized mutualism than pollination, dietary specialization was a good predictor of a species' functional role in bat-fruit and bird-fruit networks. Specialized frugivores made more interactions, occupied more central positions, and thus formed the backbone of those systems, whereas less specialized frugivores were more peripheral and played complementary roles. Regarding pollination, well-adapted mutualists with a longer coevolutionary history established more interactions and composed the backbone of those networks. However, in another pollination study, we observed that invasive species such as the Africanized honeybee, despite being less specialized and rendering low-quality services, can be also central and change profoundly the system's structure. In summary, our evidence point out that dietary specialization and coevolutionary adaptations play an important role in structuring mutualistic networks; therefore, species that are more specialized in each kind of mutualism tend to be network keystones. Nevertheless, each service depends also on less specialized mutualists, which represent complements or backups. We suggest more caution when defining and investigating specialization in network studies, as ecological and network concepts of specialization lead to diametrically different classifications of species in terms of functional role.

## SPECIALISATION IN TROPICAL AND TEMPERATE PLANT-HERBIVORE NETWORKS

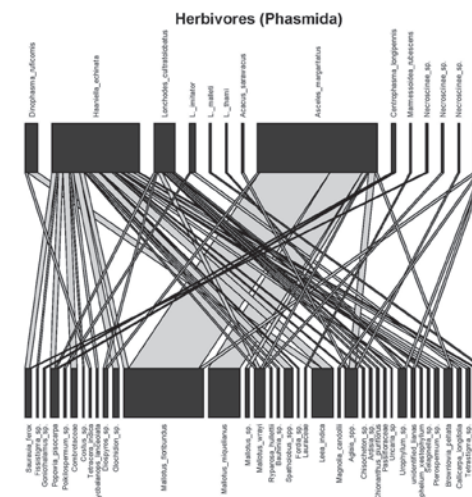
Nico Blüthgen<sup>1</sup>

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Ecological networks are commonly used to describe the association between consumers and their resources in a selected site. Such analyses are used to test evolutionary hypotheses or to predict consequences for community stability. Most examples studied to date involve mutualistic plant-pollinator, plant-frugivore and plant-ant relationships, while studies on plant-herbivore networks are scant. What are the main differences between these mutualistic and antagonistic plant-animal networks? The few examples of quantitative plant-herbivore networks show a particularly high degree of complementary specialisation (i.e., narrow niches and high niche partitioning). Even different species of relatively generalised folivores (phasmids) prefer a significantly different spectrum of host plants, as suggested by their distribution on hosts in the field and confirmed by experimental choice tests in the lab. Chemical plant defences are most likely the main trait responsible for the pronounced specialisation of herbivorous consumers, compared to the mutualistic interactions mentioned above.

Specialised consumers may have some advantages over generalists when exploiting their specific resources to which they are adapted. However, they are faced with an extinction risk when their resources (host plants) disappear. We use a simple thought experiment on herbivore communities to illustrate such a co-extinction scenario. Limitations of such approaches and the use of network metrics are briefly discussed.

(Network drawn from Blüthgen et al. 2006 J Trop Ecol 22: 35-40)





## COMPLEMENTARY SPECIALIZATION OF MUTUALISTIC INTERACTION NETWORKS DECREASES TOWARDS TROPICAL LATITUDES

Matthias Schleuning<sup>1</sup>, Jochen Fründ<sup>2</sup>, Alexandra-Maria Klein<sup>3</sup>, Stefan Abrahamczyk<sup>5</sup>, Ruben Alarcón<sup>6</sup>, Matthias Albrecht<sup>7</sup>, Georg Andersson<sup>8</sup>, Simone Bazarian<sup>9</sup>, Katrin Böhning-Gaese<sup>1</sup>, Ricardo Bommarco<sup>10</sup>, Bo Dalsgaard<sup>11</sup>, Matthias Dehling<sup>1</sup>, Ariella Gotlieb<sup>12</sup>, Melanie Hagen<sup>13</sup>, Thomas Hickler<sup>1</sup>, Andrea Holzschuh<sup>2</sup>, Christopher Kaiser-Bunbury<sup>14</sup>, Rebecca J Morris<sup>19</sup>, Brody Sandel<sup>14</sup>, William Sutherland<sup>11</sup>, Jens-Christian Svenning<sup>14</sup>, Mathias Templin<sup>1</sup>, Teja Tscharntke<sup>2</sup>, Stella Watts<sup>15</sup>, Christiane Weiner<sup>16</sup>, Michael Werner<sup>16</sup>, Neal Williams<sup>17</sup>, Camilla Winqvist<sup>10</sup>, Carsten Dormann<sup>18</sup>, Nico Blüthgen<sup>16</sup>

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Mutualistic relationships between plants and their pollinators and seed dispersers form the backbone of terrestrial ecosystems. While we know that patterns of biodiversity are strongly affected by latitudinal and bioclimatic gradients, we lack a deeper understanding of how the structure of mutualistic relationships between plants and their mutualistic partners changes along those gradients. In order to test whether the degree of specialization of mutualistic networks differs between temperate and tropical latitudes and climates, we compiled a dataset of more than 250 quantitative interaction networks of flower-visiting and frugivory interactions from more than 70 regions. We determined the degree of complementary specialization (H2') for each network and tested whether the variation in network specialization among regions could be explained by distance from the equator, mean annual temperature, and precipitation. Flower-visitor networks were more specialized than frugivory networks, while the response of both types of mutualistic interaction to latitudinal and bioclimatic gradients was very similar. Mutualistic relationships were less specialized at tropical than at temperate latitudes and in warmer than

in cooler climates. Annual precipitation did not affect network specialization. This is the first study reporting a global latitudinal and bioclimatic gradient in the structure of mutualistic interaction networks. The gradient in network specialization could be caused by stronger constraints against specialization in tropical ecosystems due to higher proportions of rare plant species and longer lifespans of pollinator and frugivore species. We conclude from these findings that mutualistic relationships of tropical plant species exhibit a higher redundancy and thus could be less prone to disruption than those of temperate plants.



## THE SPATIO-TEMPORAL BEHAVIOR OF NETWORKS CROSSING HABITAT BORDERS

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Habitat borders are a main feature of landscapes and separate habitats from each other. While some borders might be easy to cross for some species, they might be insuperable for others. Habitat borders may not only be species-specific, but dynamic on a temporal scale. While the border might be rather impenetrable in a certain season, it might be blurred during another season. In the case of flower visiting bees, these patterns might be due to seasonal changes or differences in the availability of foraging and nesting sites in neighboring habitats. In a tropical rainforest in Western Kenya we found obvious community differences between the forest and the surrounding farmland in terms of flowering plants and their pollinating bees. While large numbers of flowering plants and bee species were found in the farmland throughout the year, the pattern was highly dynamic within the forest, with very small numbers of flowering plants and bees in the rainy season, and larger numbers of both in the dry season. Here we wanted to demonstrate the dynamics of plant-pollinator interactions between neighboring habitats using a network approach and to investigate the seasonal variation in network composition, especially modularity across habitats. We will focus on the seasonal dynamics in the topological role of species within and among modules (hubs, connectors and peripherals) and in the habitat border visibility to different bee species. We expect seasonal variation in the 'visibility' and of the border to different bee species, and expect the border to be rather impenetrable and distinct during the dry season, in which bees and plants will interact within their modules (either within the farmland or within the forest). We furthermore expect the border to dissolve in the rainy season, as we expect the farmland to act as a source and the forest as a sink of pollinating bees during that period. Particularly, we expect eusocial and large bees to seasonally change their hierarchical position within the modular network.

## CHEATING ON THE MUTUALISTIC CONTRACT: SEED-PREDATION IN THE (FRUGIVOROUS) BAT *CHIRODERMA VILLOSUM* (PHYLLOSTOMIDAE)

Insa Wagner<sup>1</sup>, Elisabeth K. V. Kalko<sup>1</sup>

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Many plants and frugivores share a mutualistic relationship in which frugivores gain nutrients from fruits, whereas the plants profit from frugivores as seed dispersers. Frugivorous bats are well-known as effective seed-dispersers because they typically do not damage seeds and transport them over long distances. Among the more than 250 frugivorous bats worldwide, only *Chiroderma villosum* and *C. doriae* "cheat" on this mutualistic contract as they act more as seed-predators than as dispersers. Both species have evolved a unique technique of processing figs where seeds and pulp are separated in their mouth. The bats thoroughly chew the seeds, using their specialized molars as "seed traps". Finally, the chewed fragments of the seeds are ejected as a dry pellet. Due to their specialised feeding behaviour, processing time of figs is significantly longer in *C. villosum* than in other fig-eating bats such as *Artibeus jamaicensis*. We hypothesized that the chewing of the seeds enhances acquisition of nutrients, especially proteins and fats. This assumption is supported by our analysis of nutrients where we compared intact fig seeds with the ejecta and fecal samples from *C. villosum*.



## LONG-DISTANCE SEED DISPERSAL BY TRUMPETER HORNIBILLS IN A FRAGMENTED LANDSCAPE

Johanna Lenz<sup>1</sup>, Wolfgang Fiedler<sup>2</sup>, Tanja Caprano<sup>1</sup>, Wolfgang Friedrichs<sup>1</sup>, Bernhard H. Gaese<sup>3</sup>, Martin Wikelski<sup>2</sup>, Katrin Boehnig-Gaese<sup>1</sup>

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Long-distance seed dispersal plays an important role for the exchange of plant propagules and genes between populations especially in fragmented landscapes. Frugivorous birds and bats provide important ecosystem services by transporting the seeds of fleshy-fruited plants. So far, it has been assumed that the seed dispersal kernels generated by these highly mobile animals are leptokurtic, with a peak close to the seed source, followed by a rapid decline and a long tail, resulting in little dispersal between fragmented habitat patches. In our study we investigated the movement and seed dispersal patterns of Trumpeter Hornbills (*Bycanistes bucinator*) in a fragmented landscape at the East Coast of South Africa. GPS data loggers provide high quality location data without any bias against recording long distance movements. The data, stored in the tag, can be downloaded to a handheld base station through a radio link. We obtained for 22 individuals on average 19 days of movement data per individual, with the locations recorded every 15 min. Together with data of gut passage times we calculated distributions of seed dispersal distances. To evaluate whether seed dispersal distributions differed between habitat types, we calculated seed dispersal distributions over time periods when birds moved either only within large continuous forests or exclusive in the agricultural landscape. Seed dispersal distributions differed considerably between those habitat types. In continuous forests the seed dispersal distribution was unimodal, whereas for agricultural areas we found a bimodal pattern. Furthermore, maximum seed dispersal distances were much longer in agricultural areas than in forest. These results show that landscape structure strongly influences the movement behavior and thus the seed dispersal pattern of Trumpeter Hornbills. The high mobility, frequent long distance flights and the high abundance of these birds suggest that Trumpeter Hornbills play an essential role for long-distance seed dispersal among fragmented forests.

## CORONAVIRAL ZONOSSES IN TROPICAL BATS: INTERACTIONS BETWEEN HOSTS AND THE ENVIRONMENT

Stefan Klose<sup>1</sup>, Christian Drosten<sup>4</sup>, Heather Baldwin<sup>6</sup>, Heather Baldwin<sup>1</sup>, Samuel Oppong<sup>3</sup>, Yaw Adu-Sarkodie<sup>3</sup>, Augustina Annan<sup>5</sup>, Evans Nkrumah<sup>3</sup>, Michael Owusu<sup>3</sup>, Olivia Agbenyega<sup>3</sup>, Elisabeth Kalko<sup>1</sup>, Elisabeth Kalko<sup>2</sup>

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Coronaviruses (CoV) in bats (Chiroptera) have been identified in the aftermath of an epidemic in Asia as causal agent for the severe acute respiratory syndrome (SARS). First surveys implicate that bats are the likely origin and reservoir of the majority of coronaviruses. Overall, CoV are believed to cause a significant percentage of the common colds in humans. Currently, we understand little about the way and the frequency how transmission of bat-borne viruses including CoV to humans may occur. In particular, maintenance and amplification of viruses in bats has remained largely unexplored as well as our understanding of barriers (molecular, physiological, behavioural) against host switching and ecological factors that might influence virus prevalence. Recently, several German and Ghanaian institutions have formed a DFG-funded research cluster with the aim to better understand key aspects of virus biology, bat host ecology and human behaviour as determinants of coronaviral zoonoses in tropical ecosystems. In our presentation, we address ecological aspects of coronaviral zoonoses and ask how bats may serve as a source of epidemics for humans and livestock. Our approach to the species barrier comes from two sides: (1) the ecological entry barrier on the host side and (2) the less well-defined internal (cellular) replication barrier. At present, we know very little about how coronaviruses are maintained in their host populations, how host diversity and mobility environmental factors affect viruses and their ability to enter new host species. Understanding the link between emerging wildlife diseases and the ecology of their hosts is crucial for our ability to assess global risks arising from increasingly pressured ecosystems with decline in species diversity and changes in community composition. We assume that anthropogenic habitat modifications, i.e., degradation and fragmentation are likely to affect health of bat host populations with direct and indirect implications for virus mobility and entry pathways into hosts including dead-



end hosts such as humans. In a multidisciplinary approach we have set out to characterise the propensity of reservoir-borne CoV to switch hosts into humans and livestock by studying bat host interactions within ecosystems ranging from the potential role of arthropods as vectors to exposure of humans to vectors and hosts. In our presentation, we provide an overview of our approach, current consortium activities and first results

### **A functional perspective on cross-continental community convergence: predicting diversity patterns and community composition in tropical anuran amphibian assemblages based on trait-environment relationships**

Raffael Ernst<sup>1,2</sup>, Gwendolyn Landburg<sup>3</sup>, Alexander Keller<sup>4</sup>, Frank Dziock<sup>2</sup>

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The diversity within species assemblages does not necessarily represent a random sample with respect to species traits and habitat templates are thought to shape these trait communities. While phylogenetically driven patterns of convergent trait evolution have been investigated intensively in the past, large-scale patterns of trait-habitat relations and potential convergence or divergence in these relationships remain elusive. We investigated potential convergent species-trait-habitat relation patterns in a cross-continental comparison between tropical anuran assemblages from three important tropical eco-regions (Guiana Shield, South America; Upper Guinea Forest Block, West Africa; Borneo Montane Rain Forests, South-East Asia). We assessed the role of universal vs. unique habitat templates in shaping local or global trait assemblages when different assembly mechanisms are operating. Large (> 25.000 individuals of 84 different species, recorded on 549 independent sampling units, during > 850 hours of standardized acoustic and visual sampling) anuran amphibian data sets, at both the regional and cross-continental scale were analysed, applying a combination of established RLQ and novel permutation model based multivariate fourth corner statistics to test for trait-habitat relationships at both scales and to test a set of hypotheses developed to uncover potential convergent patterns across large geographic scales in assemblages with largely independent phylogenetic histories.

Species assemblages in the three global regions under comparison did not follow strictly neutral assembly rules with respect to species trait-environment relations. Rather we found distinct yet variable trait-habitat relations. Despite the existence of convergent trait patterns, we did not find evidence for the existence of a universal cross-continental trait-habitat relationship at the community



level and hence no clear sign for convergent species trait-habitat evolution at the global scale. Species trait-habitat relation patterns rather varied between continents, which highlights the importance of recent historical effects and local site filters in shaping trait-habitat relations and hence determining functional composition in local communities. These results highlight the importance of integrating trait-habitat links into analyses of biological communities as this would enhance predictive power and general usefulness of species assembly rules in community ecology and macro-ecology. Convergence studies can also yield general models for predicting fundamental community patterns and they provide essential tools for large scale species distribution models if trait-habitat link information is included.

**PARALLEL SESSION WEDNESDAY 10:00, Hall H IV:**  
**ANIMAL PLANT INTERACTION**  
**Chair: Georg Zizka**

**DELAYED INDUCTION OF PLANT DEFENCES BY LEAF-CUTTING ANTS: UNVEILING THE SECRETS OF A KEY HERBIVORE?**

Rainer Wirth<sup>1</sup>, Martin Tremmel<sup>2</sup>, Jörg Stephan<sup>1</sup>, Christian Kost<sup>3</sup>

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Leaf-cutting ants (LCAs) are omnipresent features of neotropical landscapes that drastically influence present-day forest structure and composition. These ants are known as polyphagous, yet highly selective herbivores. The factors that govern their selection of food plants, however, remain poorly understood. We hypothesized that the induction of anti-herbivore defences by attacked food plants, which are toxic to either ants or their mutualistic fungus, should affect food plant selection and elucidate a series of hitherto unresolved questions on the ants' foraging behavior. To test this 'induced defence hypothesis', we used lima bean (*Phaseolus lunatus*), a plant that - upon herbivore attack - emits many volatile organic compounds (VOCs) with known anti-fungal or ant-repellent effects. While a 20% removal of a plant's total leaf area by workers of the LCA *Atta colombica* did not influence its VOC emission rate after 24 h, extending the damage treatment to a total of 4 d significantly increased VOC emission levels in damaged plants relative to controls. In contrast, leaf loss due to a chewing herbivore of approximately 15% of a plant's total leaf area was already sufficient to significantly increase VOC emission levels within 24 h. In dual choice bioassays, foraging workers were strongly attracted to plants that have been damaged mechanically or by LCAs 24 h ago. On the other hand, strong induction levels of experimental plants after treatment with the plant hormone jasmonic acid or, alternatively, 4 d of LCA feeding strongly repelled LCA foragers relative to control plants. These findings offer two valuable insights in the foraging ecology of LCA. First, they support the 'induced defence hypothesis' that predicts a strong effect of inducible anti-herbivore defences on the foraging behaviour of LCAs. Second, the delayed activation of the plant's anti-herbivore defences observed after LCA damage is a novel mechanism used by an herbivore to quickly remove larger quantities of leaf material before being recognized by the plant. In this way, a LCA colony can maximize its intake of plant biomass suitable for the cultivation of its mutualistic fungus.





## NUTRITIONAL ASPECTS OF FRUIT CONSUMPTION IN THE COMMON FRUIT BAT, *ARTIBEUS JAMAICENSIS*

Larissa Albrecht<sup>1</sup>, Elisabeth Kalko<sup>1</sup>

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In tropical forests, interactions between fruit trees and frugivores play very important roles in maintaining biodiversity. In exchange for seed dispersal services, trees have to provide sufficient nutrients and minerals to attract and maintain frugivores. Frugivorous bats are among the most important seed dispersers in Neotropical forests. On Barro Colorado Island in Panamá, figs (*Ficus* sp.) form the main food resource for the very abundant Jamaican fruit-eating bat *Artibeus jamaicensis*, although other fruits are known to be consumed as well. Figs are often considered as low-quality fruits, which are only attractive because of their abundance and year-round availability. We analyzed the nutrient and mineral content of figs and other fruits eaten by *A. jamaicensis* to determine differences in pulp composition. Figs generally have a higher concentration of most minerals, particularly calcium, than non-fig fruits, although concentrations of other nutrients are mostly low to medium. Assimilation experiments indicate that *A. jamaicensis* is able to extract sufficient of most nutrients and minerals to cover their needs from figs, and often in higher amounts than from non-fig fruits.

## TWO SPECIES, TWO ECOLOGICAL STRATEGIES – A CASE STUDY OF THE REPRODUCTIVE BIOLOGY OF UNDERSTORY HERBS IN SOUTHEASTERN BRAZIL

Katharina Stein<sup>1</sup>, Isabell Hensen<sup>1</sup>

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Outcrossing and sexual reproduction of many plants depend on pollinators that provide an essential ecosystem service to maintain overall biological diversity of natural ecosystems.

Furthermore, the reproductive success of a plant species is crucial for maintaining vigorous populations, which might be especially important in tropical forests with their intensive pressure from competitors, predators and abiotic agents.

Aim of this study was to investigate the pollination ecology, breeding system, female reproductive output and germination of two understory herbs. The field study was performed in the Atlantic Rainforest of Brazil. Pollinators were recorded in natural populations. The breeding systems were studied through pollination experiments.

We found out that both species suffer from pollen limitation. They are partially self-compatible, which might compensate the insufficient natural outcrossing due to the lack of pollinators, typical for tropical species with a patchily distribution in forests. Nevertheless fruit set in general was low. The floral nectar is sucrose-dominant, typical for hummingbird pollinated plants.



## THE SPATIAL GENETIC STRUCTURE OF BAT-DISPERSED NEOTROPICAL FIG SPECIES (*FICUS* SPP., MORACEAE)

Katrin Heer<sup>1</sup>, Elisabeth K.V. Kalko<sup>1</sup>, Christopher W. Dick<sup>3</sup>

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Neotropical fruit-eating bats (*Phyllostomidae*, *Chiroptera*) are considered to be effective seed disperser of many fig species as they disperse large amounts of viable seeds. However, the dispersal distances of these seeds are still uncertain as actual seed deposition events are hard to observe in nocturnal flying mammals. Methodological advances in molecular genetics now allow indirect measurements of seed dispersal distances: highly polymorphic genetic markers, in particular microsatellites have become important tools to assess gene flow in tree populations. They are used increasingly to derive estimates of pollen and seed dispersal distances.

Despite the importance of figs as keystone resources for many frugivores in the (sub)tropics, spatial genetic structure (SGS) is virtually unknown. We studied SGS of several Neotropical fig species from Panama and Costa Rica and present preliminary results of our studies. We are interested in quantifying the strength of spatial genetic structure in figs considering pollen is transported over large distances by mutualistic fig wasps and evaluating the differences in SGS among fig species that are dispersed by bat species differing in mobility.

PARALLEL SESSION, WEDNESDAY 11:30, HALL H IV:  
PLANT PHYSIOLOGY  
Chair: Michael Lakatos

## FROM HERBARIUM SPECIMEN TO CONSERVATION RECOMMENDATION \_ THE EXAMPLE OF BOMELIADS (*BROMELIACEAE*) IN PANAMA

Daniel Cáceres<sup>1,2</sup>, Katharina Schulte<sup>1,3,4</sup>, Marco Schmidt<sup>1,2,3</sup>, Georg Zizka<sup>1,2,3</sup>

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Speaker: Daniel Cáceres

The Bromeliaceae comprise over 3,000 almost exclusively neotropical species. Known for their extraordinary ecological versatility, the members have radiated successfully in terrestrial and epiphytic habitats. The dependency of many of the tropical, especially epiphytic species on suitable habitats like lowland humid rainforest or cloud forest makes the bromeliads a plant group suitable for assessing the conservation potential of protected areas and the spotting of up to now not protected areas especially worth conservation.

The detailed study of the collections of relevant herbaria and extensive fieldwork in Western Panama (where diversity of vascular plants and the degree of endemism are especially high) led to an updated inventory for the Bromeliaceae of Panama, now comprising 16 genera and 206 species. 28 species of these are recorded for Panama for the first time. Over 8,000 distribution records (herbarium specimens and observation data) from Panama and adjacent Costa Rica were filed and potential distribution areas were calculated using ecological niche modelling. Maps of overall bromeliad distribution in Panama are provided based on these data.

To infer recommendations for conservation, abundance and ecological preferences were estimated for each of the bromeliad species in Western Panama and correlated to the distribution and diversity data.



## EFFECTS OF AN EXPERIMENTAL SOIL DESICCATION ON THE ABOVE- AND BELOWGROUND BIOMASS PRODUCTION IN A PERHUMID PRIMARY FOREST IN SULAWESI, INDONESIA.

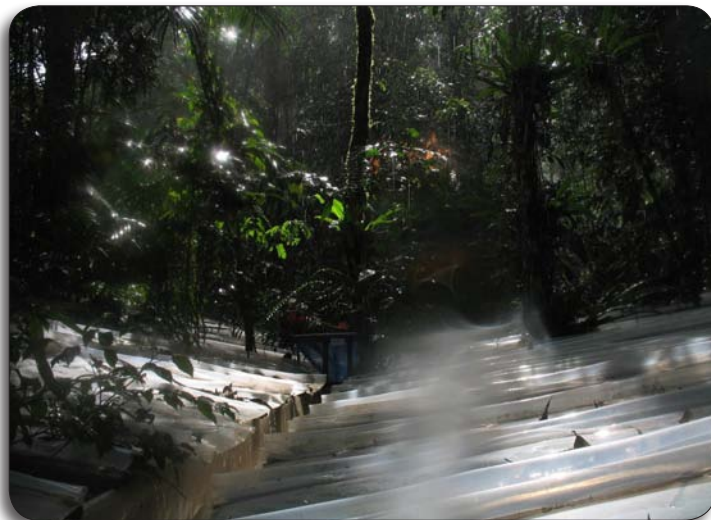
Gerald Moser<sup>1</sup>, Bernhard Schuldt<sup>2</sup>, Dietrich Hertel<sup>2</sup>, Christoph Leuschner<sup>2</sup>

<sup>1</sup>Giessen University, Gießen, DE, [Gerald.Moser@bio.uni-giessen.de](mailto:Gerald.Moser@bio.uni-giessen.de), <sup>2</sup>Göttingen University, Göttingen, de

In this ecosystem experiment we studied if primary forest trees in a perhumid region are vulnerable to ENSO droughts, which plant traits determine the drought sensitivity, and if forest stability may be affected.

To simulate an ENSO drought 3 throughfall displacement roofs and 3 control plots (each 40mx40m) were installed in a premontane rainforest in the Lore Lindu National Park, Central Sulawesi. The roofs were closed from May 2007 until May 2009. During the first year of desiccation roof cover was increased from 60 to 90% of the plot area.

After 2 years of desiccation we observed no significant changes in fine root biomass or production, in tree leaf litter fall, in stem diameter increment or tree mortality. During the 2nd year a significant decrease of stem wood production occurred, which was greatest in the predominant *Fagaceae Castanopsis acuminatissima*, forming the highest trees in the stand. This observed trend could provoke a shift in the dominance structure and stability of the studied premontane rainforest, if pre-dictions from climate change models for more often and sev-ere ENSO droughts in this region hold true.



## SIZE-DEPENDENT CHANGES IN LEAF PHYSIOLOGY AND NON-STRUCTURAL CARBOHYDRATE CONTENT IN TWO CARIBBEAN TREE SPECIES.

Adam R. Martin<sup>1</sup>, Sean C. Thomas<sup>1</sup>

<sup>1</sup>University of Toronto, Toronto, CA, [adam.martin@utoronto.ca](mailto:adam.martin@utoronto.ca)

In tropical trees, onset of reproduction is likely to induce changes in leaf physiological traits and non-structural carbohydrate (NSC) content in woody tissues. For example, as resources are increasingly allocated to reproductive structures, one may expect to observe commensurate declines in photosynthetic capacity, leaf nitrogen (N), and/or wood NSC content following reproductive onset. While several studies have detected such patterns in temperate tree species, currently no such comparable studies exist from tropical tree species. In this study, we sought to evaluate the influence of reproduction on size-dependent changes in leaf physiology and NSC content in stem-wood and branches, for two Dominican rainforest tree species (*Dacryodes excelsa* (Burseraceae) and *Miconia mirabilis* (Melastomataceae)). Using reproductive surveys, we estimated the relative size at onset of maturity (RSOM) to be 10.4 cm DBH in *M. mirabilis*, and 20.1 cm in *D. excelsa*. Preliminary results suggest that in both species leaf area and leaf N decline following reproductive onset, while leaf C:N ratio increases. Conversely, leaf mass per area (LMA) increased monotonically with tree size in both species. We observed subtle size-dependent declines in NSC pools in stem wood and branches following reproductive onset in both species, yet at no sizes were NSC pools completely depleted in any woody tissues. Our results thus indicate that size-dependent changes in a suite leaf traits (i.e. leaf area, leaf N, C:N ratio) are in response to resource allocation to reproduction, while other traits (i.e. LMA) change in response to vertical light gradients through the forest canopy. Additionally, declines in wood NSC content demonstrate size-dependent shifts in resource allocation from storage to reproduction. However, we suggest that because NSC pools were not completely depleted, it is ultimately unlikely that growth in tropical trees is carbon limited, even at later ontogenetic stages.



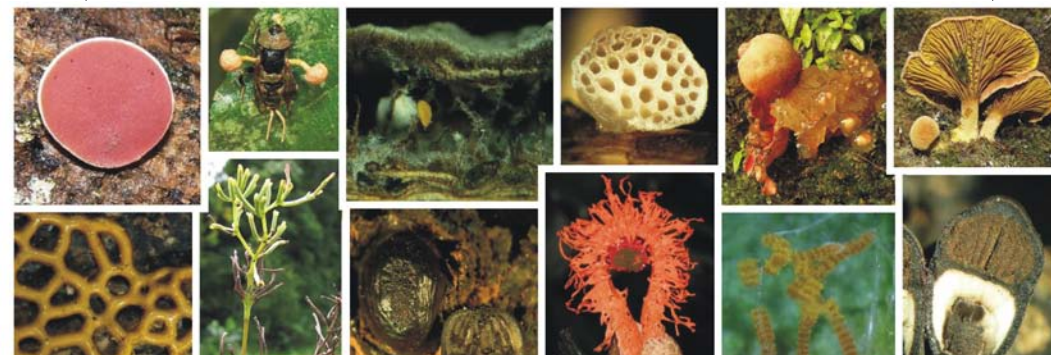
**Session: Plant Physiology****Wednesday, 23 February, 12:15, Hall H IV****CHANGE IN HYDRAULIC PROPERTIES AND LEAF TRAITS OF A TALL RAINFOREST TREE SPECIES SUBJECTED TO LONG-TERM THROUGHFALL EXCLUSION IN THE PERHUMID TROPICS**Bernhard Schuldt<sup>1</sup>, Christoph Leuschner<sup>1</sup>, Viviana Horna<sup>1</sup>, Gerald Moser<sup>2</sup>, Michael Köhler<sup>3</sup>, Henry Barus<sup>4</sup><sup>1</sup>University of Goettingen, Goettingen, DE, [info@plant-ecology.de](mailto:info@plant-ecology.de), <sup>2</sup>Plant Ecology, Gießen, DE, <sup>3</sup>Tropical Silviculture and Forest Ecology, Goettingen, DE, <sup>4</sup>Department of Agrotechnology, Palu, ID

In a throughfall displacement experiment on Sulawesi, Indonesia, three 0.16 ha stands of a premontane perhumid rainforest were exposed to a two-year soil desiccation period that reduced the soil moisture in the upper soil layers beyond the conventional wilting point. About 25 variables, including leaf morphological and chemical traits, stem diameter growth and hydraulic properties of the xylem in the trunk and terminal twigs, were investigated in trees of the tall-growing tree species *Castanopsis acuminatissima* (Fagaceae) by comparing desiccated roof plots with nearby control plots. We tested the hypotheses that this tall and productive species is particularly sensitive to drought, and the exposed upper sun canopy is more affected than the shade canopy. Hydraulic conductivity in the xylem of terminal twigs normalised to vessel lumen area was reduced by 25 %, leaf area-specific conductivity by 10-33 % during the desiccation treatment. Surprisingly, the leaves present at the end of the drought treatment were significantly larger, but not smaller in the roof plots, though reduced in number (about 30 % less leaves per unit of twig sapwood area), which points to a drought effect on the leaf bud formation while the remaining leaves may have profited from a surplus of water. Mean vessel diameter and axial conductivity in the outermost xylem of the trunk were significantly reduced and wood density increased, while annual stem diameter increment decreased by 26 %. In contradiction to our hypotheses, (i) we found no signs of major damage to the *C. acuminatissima* trees nor to any other drought sensitivity of tall trees, and (ii) the exposed upper canopy was not more drought susceptible than the shade canopy.

**Keynote speaker: Meike Piepenbring; Chair: Gerhard Kost****TROPICAL MYCOLOGY – IN AN INFINITE PIONEER STATE?**Meike Piepenbring, Universität Frankfurt aM, Frankfurt am Main, DE, [piepenbring@bio.uni-frankfurt.de](mailto:piepenbring@bio.uni-frankfurt.de)

Fungi are mostly microorganisms, omnipresent and indispensable in ecosystems as decomposers of organic material, mycorrhizal symbionts, food for animals, parasites contributing to the diversity of plants and animals, as well as lichenized pioneer organisms colonizing sterile substrates. We appreciate them as food and in food technology, as source of medicine, other active compounds, for bioremediation, biological control, and many other aspects. Fungi are feared as agents of diseases in humans, animals, and cultivated plants, as moulds in buildings and on other artefacts. We know about 100,000 species, i.e. about 6.7 % of 1.5 millions of species estimated to exist worldwide. For tropical countries, we probably know less than 5 % of the fungi existing there. Fungi are highly diverse morphologically, ecologically, and systematically, with species of numerous different phylogenetic lineages developing fruiting structures of any imaginable form and interacting with maybe any organism on earth. Especially for tropical fungi, however, we ignore host specificity of many groups of parasitic fungi, important aspects of life cycles, adaptations to tropical seasons, interactions with other organisms, and phylogenetic relationships especially of not cultivable microfungi.

We do not really know the status of tropical fungal diversity because tropical mycology is still in a pioneer phase due to historical reasons, tropical climate, and only a small number of fungal taxonomists working in the tropics. The identification of most tropical fungi is very difficult, because numerous species of tropical fungi are incompletely described, monographs are lacking, type specimens are inaccessible or incomplete, and because of administrative constraints. If classical mycological research continues with the current rate of descriptions of new species, we need more than 1,000 years to document all the missing fungal species. Sequence data taken from soil and plant organs indicate the presence of numerous, maybe unknown fungal species. Sequence data without the fungal organism, however, do not promote taxonomical knowledge because without morphology, it is not possible to formally describe new species, and comparative molecular data of morphologically described species are lacking for many groups of tropical fungi. Meanwhile, tropical primary vegetation is destroyed and species of fungi in specific ecological niches are threatened with extinction.





Wednesday, 23 February, 15:15, Hall H III

## **BIODIVERSITY SCIENCE AND BIODIVERSITY POLICY - CHANCES FOR COOPERATION**

Chairs: Carsten Nesshoever, Axel Paulsch

Contact: axel.paulsch@ufz.de

The International Year of Biodiversity (2010) can be seen as a milestone in biodiversity policy as it brought not only an overview over the status of global biodiversity, the Global Biodiversity Outlook 3, but also the formulation of new targets until 2020 in the Convention on Biological Diversity. Furthermore, the establishment of a new science-policy interface, the Intergovernmental Platform on Biodiversity and Ecosystem Services IPBES is in progress. All these processes have implications for biodiversity science, need scientific input and offer chances for an enhanced cooperation between biodiversity science and biodiversity policy. We welcome contributions that share experiences with science-policy interfaces at local, national, regional or global level.

## **BIODIVERSITY POLICY BEYOND 2010 - LESSONS FROM CBD COP10**

Carsten Nesshoever<sup>1</sup>

<sup>1</sup>NeFo & UFZ Leipzig, Leipzig, DE, carsten.nesshoever@ufz.de

In October 2010, the Convention on Biological Diversity (CBD) convened its 10th meeting of the parties (COP1) in Nagoya, Japan. Its 2010 target to significantly reduced the rate of loss of biodiversity across the globe wasn't met.

Thus the ambitions for COP10 were high: a regime for access and benefit sharing of genetic resources should be set up, and a new strategic plan with new targets for 2020 needed to be decided. Also, the interactions with other convention, namely the UN Climate Convention (UNFCCC) and the Convention to Combat Desertification (UNCCD) needed intensification, e.g. in the area of avoiding deforestation and degradation of forests.

The talk will analyse the results from COP10 from a scientific perspective and also tackle the question, how science can support the new decisions of CBD.





## INTERGOVERNMENTAL PLATFORM ON BIODIVERSITY AND ECOSYSTEM SERVICES IPBES - STATUS AND CHALLENGES

Axel Paulsch<sup>1</sup>

<sup>1</sup>Helmholtz Centre UFZ, Leipzig, DE, axel.paulsch@ufz.de

The Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) will serve as a new scientific advisory body for biodiversity related political decision making. The process of establishing took several years and is still ongoing. Three international meetings invited by UNEP were needed before in June 2010 the final meeting in Busan (Korea) came up with an agreed text, that is now handed over to the UN General Assembly (UNGA). The IPBES will have the main task to perform assessment on biodiversity related topics on global, regional and local scale, to formulate policy options and to inform about consequences of taking or missing these options. The scientific quality of these assessments shall be guaranteed by transparent methods, best available data and a peer review process. All UN member states will be part of the plenary of IPBES, other organisations will have access but no voting rights. A second task of IPBES will be to support capacity building for developing countries. The financing of IPBES will be based on voluntary contributions.

As the process of establishing is still ongoing (including formal acceptance by the UNGA, building up a secretariat, defining topics for first assessments) the presentation will report on the most recent status and the challenges to make IPBES really working.

## CHINA'S DEVELOPMENT: A COMPARISON BETWEEN A RISING ECONOMY AND ITS BIODIVERSITY IMPACT

Torsten Sprenger<sup>1</sup>

<sup>1</sup>University Göttingen, Göttingen, DE, torstensprenger@web.de

China fuels the actual global economic rise and buffered its last crisis with a comparatively strong and constant growth. This indicates that China will become a reliable economic part in future, with global relevance towards the political, ecological and economical development. But on the other hand as a new global player, its influence and pressure on social systems and ecosystems is predicted to become much more significant than known today. Consequently the international community gets more and more interested in China's responsibility e.g. in nature conservation, environmental policy or within the climate change discussion. Within this the protection of biodiversity has been identified as one major field where China can play a key role in future.

While China's economic success is mainly driven by the demand of foreign states, the domestic development and production is often not sustainable. E.g. inefficient agrarian and forestry production systems still damage intact nature with great impact on biodiversity. Moreover the exploitation of mineral and energy resources is often linked with huge impacts on related ecosystems. Information about these problems is often ambiguous. But it becomes a question for the future strategic development especially for neighbouring states and the rural development of China itself, if biodiversity as fundamental basis can not be efficiently sustained. Therefore sound information play a key role for policy within decision making processes.

This paper reviews China's economic development regarding biodiversity and economic indices, identifying contradictory information and key areas for further scientific research.



## BUSHMEAT HARVEST AT THE NEXUS OF SOCIO-ECONOMICS AND HABITAT

Stefan Ziegler<sup>1</sup>, Stefanie Jacob<sup>2</sup>, Roland Melisch<sup>3</sup>, Martin Wegmann<sup>2</sup>

<sup>1</sup>WWF Germany, Frankfurt, DE, stefan.ziegler@wwf.de, <sup>2</sup>University of Würzburg, DE, <sup>3</sup>TRAFFIC International, Frankfurt, DE

Understanding environmental change and socioeconomic development have rarely been considered simultaneously when evaluating the impacts on and benefits from the bushmeat resource. We analyse landscape patterns as well as socio-economic data sets in the Congo Basin and how these factors relate to recorded bushmeat trade data throughout the last 30 years. Bushmeat relevant data are derived from food balance sheets provided by the FAOSTAT database and a range of published and non-published sources. We define proxy indicators for hunting pressure and discuss their inter-relationships with habitat variables. Despite the overall trend of decreasing forest cover in Central Africa, the analysis leads to the conclusion that overall bushmeat extraction has increased in the Congo Basin, but the gradient of bushmeat harvest per forest area has been on the decline in certain countries since the turn of the millennium. The outcome of the study also shows a trend of bushmeat consumption increasing with personal wealth expressed as GDP per head throughout the Congo Basin States.

PARALLEL SESSION HALL H IV | 15:15 | WEDNESDAY:

## TROPICAL VERTEBRATES

Chair: Eckhard Heymann

### MOVEMENT PATTERN, HABITAT USE AND DIET OF TROPICAL RANID FROGS: A COMPARISON BETWEEN PIONEER AND NATIVE ANURANS IN BORNEO

Oliver Konopik<sup>1</sup>, Karl Eduard Linsenmair<sup>1</sup>, Ulmar Grafe<sup>2</sup>

<sup>1</sup>University of Würzburg, Würzburg, DE, oliverkonopik@gmx.de, <sup>2</sup>Universiti Brunei Darussalam, Bandar Seri Begawan, BN

In many parts of the world amphibians are among the most threatened taxonomical groups. Declines in Southeast Asia are mainly attributed to habitat loss caused by logging or land conversion. Here we provide a case study of the extent and possible impact of the immigration of alien pioneer anuran species into a primary rainforest in Brunei Darussalam (Borneo) facilitated by the construction of a road. We compared the movement pattern, habitat use and diet of two immigrant species (*Hylarana glandulosa* and *Limnonectes ingeri*) to those of a native close relative (*Limnonectes leporinus*). Over a period of four month we surveyed a forest stream, which was traversed by a recently constructed dirt road. Movement pattern was obtained by either individual marked specimens or by radio telemetry with implantable transmitters. The diet analysis was done by stomach flushing. We identified and measured the recovered prey items and classified them into certain taxonomical groups. In addition we took tissue samples to analyze stable nitrogen isotope ratios. This study revealed distinct differences in the habitat use of the native and the immigrant species and could proof that the invasion was clearly linked to the construction of the dirt road. Furthermore we could show that *Limnonectes ingeri*, one of the immigrant species, migrates more than 500 meters into the adjacent primary forest. The diet composition of the three species was similar, but there were also some important differences. Particularly *Limnonectes ingeri* preyed heavily on other anuran species, including the native relatives. This was further underlined by the results of the stable isotope analysis. Hence we suggest that the local amphibian assemblage is not only threatened by the shifting chemical and morphological features of the streams within the area of impact, but also by the direct influence of the immigrant species. These species could cause a further decline in native amphibian populations either via competition or predation. We also discuss if it is suitable to consider *Limnonectes ingeri* as an indicator species for human impact, particularly the influence of roads, in the hilly lowland forest of Borneo.



**Session: Tropical vertebrates**  
**Wednesday, 23 February, 15:30, Hall H IV**

### **CONVERGENT EVOLUTION IN NECTAR-FEEDING PHYLLOSTOMID BATS: NECTAR LAPPING VS. NECTAR PUMPING**

Marco Tschapka<sup>1</sup>, Tania P. Gonzalez-Terrazas<sup>1</sup>

<sup>1</sup>University of Ulm, Ulm, DE, marco.tschapka@uni-ulm.de

Characteristic for all species of neotropical nectar-feeding bats (Phyllostomidae: Glossophaginae) is a long, protrusible tongue that is used for drinking nectar from flowers. However, within the nectar-feeding Glossophaginae there are distinct morphological differences between the currently recognized tribes Glossophagini and Lonchophyllini. Tongues of Glossophagini (e.g. the genera *Glossophaga*, *Leptonycteris*, *Hylonycteris*) show filiform papillae near the tip of the tongue, while Lonchophyllini (e.g. *Lonchophylla*, *Lionycteris*, *Platalina*) tongues largely lack these hairs and show lateral grooves over the length of the tongue. We used highspeed video recordings to analyze tongue movement during nectar extraction of *Glossophaga soricina* and *Lonchophylla robusta* visiting artificial nectar feeders. *Glossophaga* repeatedly inserted its tongue into the nectar and retracted it again, while the tongue of *Lonchophylla* remained during the entire visit in contact with the fluid and was retracted only when the bat left the feeder. Large filiform papillae of *Glossophaga* were actively erected near maximum extension of the tongue and nectar could adhere between these hairs through capillary action. In contrast *Lonchophylla* used peristaltic movements of the tongue to pump the nectar upwards within the lateral grooves. Nectar extraction efficiency (mg nectar / msec hovering duration) varied little between the two species. The pronounced differences in tongue morphology and drinking behaviour (lapping vs. pumping) suggest an independent evolution of these adaptations to nectarivory and support alternative views of the current Glossophagine systematics.

**Session: Tropical vertebrates**  
**Wednesday, 23 February, 15:45, Hall H IV**

### **ECHOLOCATION STRATEGIES FOR OBJECT RECOGNITION IN DENSE RAINFOREST FOR TWO GLEANING BATS, MICRONYCTERIS MICROTIS AND THYROPTERA TRICOLOR**

Inga Geipel<sup>1</sup>, Elisabeth K. V. Kalko<sup>1</sup>

<sup>1</sup>University of Ulm, Ulm, DE, inga.geipel@uni-ulm.de

Bats that fly and forage in the dense understory of tropical rainforests face various sensorial tasks as they have to orient in space and detect, classify and localize targets (food, roost sites) within strong background clutter (vegetation). We studied two species of gleaning bats that employ echolocation as the main sensorial input for object recognition in dense vegetation. *MicroNycteris microtis* (Phyllostomidae) feeds on large, motionless insects from leaves whereas *Thyroptera tricolor* (Thyropteridae) uses unfurled Heliconia leaves as roosts. We exposed *M. microtis* to stationary, silent prey and presented unfurled leaves to *T. tricolor* to assess their echolocation strategies for finding specific objects in clutter. Both bats hovered briefly in front of the target (food, roost) and scanned it by continuously emitting short and steep frequency-modulated echolocation calls. Overall, calls of *T. tricolor* were much higher in frequency and broader in bandwidth than those of *M. microtis*. Furthermore, *M. microtis* generally emitted groups of 2-3 calls whereas *T. tricolor* produced long pulse trains at high repetition rates. Interestingly, both bat species performed extensive scanning and steered their sound beam along the edges of the respective object before closing in on it. We conclude that the bats sonar system provides detailed 3-D acoustic information about shape, size and texture of the targets.



**Session: Tropical vertebrates**  
**Wednesday, 23 February, 16:00, Hall H IV**

## THE SABAH RHINO PROJECT

Petra Kretzschmar<sup>1</sup>

<sup>1</sup>IZW Berlin, Berlin, DE, [kretzschmar@izw-berlin.de](mailto:kretzschmar@izw-berlin.de)

The Sabah rhino (*Dicerorhinus sumatrensis harrissonii*) is a subspecies of the Sumatra rhino. It once occurred all over Borneo but habitat destruction and poaching led to a drastic reduction of the population within the last 15 years. Currently less than 50 individuals of the subspecies still exist. These few individuals occur in the northern tip of Borneo, in the East Malaysian state Sabah. Sabah is characterised by a high diversity in flora and fauna. Its rainforests are among the oldest rainforest of the world. But the majority of the forest areas in Sabah, especially the lowland forests, have been selectively logged in the past. The increasing demand for palm oil on the international market, has led to a high pressure on the remaining forest areas. Forest areas with a very low protection status, such as secondary forest, are therefore at a high risk to be converted into agricultural land. These areas are however very important for the animals such as the rhino and the elephant. They are buffer zones between agricultural land and primary forest and they are corridors for large animals connecting the fragmented landscapes. The remaining Sabah rhinos are isolated from each other in small pockets of rainforest surrounded by plantations; here they are facing a high risk of inbreeding. Therefore breeding management of this highly endangered species becomes essential.

In July 2007 the government of Sabah together with local and international Non Governmental Organisations (NGO) decided to start a rescue and breeding project for isolated individuals. In the past, the captive breeding of the species has not been a story of success. Basic information from free ranging animals was lacking due to its elusive character, its rarity and the inhospitable nature of its habitat.

This resulted in management problems as its basic requirements in terms of food, health and breeding were unknown. In recent years more data has been collected and captive breeding methods have fast developed. Non-invasive hormone analysis, ultrasound techniques and assisted reproductive techniques have been successfully applied for the reproductive assessment in a number of

species, including the Sabah rhino.

The Leibniz Institute for Zoo and Wildlife Research (IZW) and the Zoo Leipzig support the local government and NGOs with its proven scientific and captive breeding expertise ensuring the preservation of the Sabah rhino.



**Keynote speaker: Doyle McKey**

**Chair: Karl Wantzen**

**Thursday, 24 February, 9:10 | Hall H III**

**AGROECOLOGY, RESILIENCE AND TROPICAL BIODIVERSITY: WHAT DO PAST AND PRESENT AMAZONIAN FARMERS TELL US?**

Doyle McKey, CEFE, CNRS, Montpellier, FR, [d\\_mckey@hotmail.com](mailto:d_mckey@hotmail.com)

The need to reconcile food production, ecosystem services and biodiversity conservation has spurred the search for more sustainable ways of farming. Successful agroecological solutions are likely to be strongly case-specific, so we must cast our net broadly in the hunt for ideas. The folk knowledge of smallholder farmers is one source of inspiration for the diverse solutions that will be needed. Of necessity, these farmers have developed ingenious adaptations that do not depend on costly external inputs, that allow long-term use of a limited land base, and that function even in marginal environments. I will first focus on one such case, Amerindian farmers of manioc (cassava), to examine the relevance of their practices for sustainable agriculture today. We can learn not only from present-day farmers, but also from the "fossil" folk knowledge of societies from the past who employed now-forgotten agricultural techniques. History and prehistory offer many examples of diverse trajectories to agricultural intensification. By the time depth they offer and the multiplicity of cases permitting a comparative approach, archaeological studies can provide unique insights into the sustainability of agricultural systems, the sources of their resilience, and their vulnerability. Archaeological and geoarchaeological studies of pre-Columbian Latin America offer examples of once widely practiced, but now virtually extinct, agricultural techniques that are considered to have real potential for contributing to the design of sustainable agroecosystems today. I will focus on two sets of such techniques--farming on terra preta anthrosols, and raised-field agriculture in seasonally flooded wetlands--and examine their relevance for the 21st Century.

**Parallel session | Hall III:**

**HOTSPOT WALLACEA: UNDERSTANDING THE PAST TO SAVE THE FUTURE**

Chairs: Stefan Merker, Sebastian Klaus

Contact: [smerker@bio.uni-frankfurt.de](mailto:smerker@bio.uni-frankfurt.de)

Nested between two biogeographic realms and isolated from major landmasses, Wallacea is not only a melting pot of Asian and Australian fauna and flora but is also characterized by an extraordinary degree of species endemism. The session is intended to bring together experts from different fields of research, e.g. botany, geology, molecular biology or zoology, to share and discuss insights and ideas on the origin, distribution and dispersal routes of biota across the region. Possible areas of discussion include: tectonic and climatic events shaping Wallacea's topography, the phylogeography of model taxa, the conservation status of Wallacea's insular biota; fields of interaction between Wallacea researchers.

THURSDAY 10:00 Hall H III





## HOTSPOT SULAWESI: TARSIER DIVERSITY MIRRORS WALLACEA'S TROUBLED PAST

Stefan Merker<sup>1</sup>, Christine Driller<sup>2</sup>, Dyah Perwitasari-Farajallah<sup>3</sup>, Joko Pamungkas<sup>3</sup>, Wirdateti<sup>4</sup>, Bruno Streit<sup>1</sup>

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Due to its location in the transition zone between Asia and Oceania, to its effective isolation from major landmasses, and to a troubled geologic history, the Indonesian island of Sulawesi hosts a high diversity of endemic vertebrates. Among these are tarsiers, very small nocturnal primates of an ancient evolutionary lineage. Here, we evaluate likely effects of microplate tectonic shifts and sea level fluctuations on the allopatric diversification of *Tarsius* in the Wallacea region. Our presentation covers multibiological evidence of Sulawesi's high tarsier diversity, a detailed analysis of an interspecific hybrid zone, and our thoughts on the geological and biological processes underlying these patterns. Most tarsier ranges roughly concur with areas of endemism as identified for other taxa. There are, however, notable exceptions challenging our current view of primate dispersal across the region. One of these concerns Wallace's tarsier, a recently discovered species occupying a disjunct range in Central Sulawesi. Morphological and bioacoustic traits as well as mitochondrial, Y-chromosomal, and microsatellite DNA patterns clearly separate the new taxon from all other tarsiers. The two isolated populations slightly differ from each other in body size and duet call characteristics but share an ancestral mtDNA polymorphism predating population segregation. Owing to the new species' distribution across a geographic bottleneck (the Isthmus of Palu), it plays a key role in our quest to understand tarsier dispersal across the island. Thus, based on the evidence uniting as well as untying the two populations, we discuss reasons and timing of their divergence in the light of climatic history.

## THE BIOGEOGRAPHY OF SULAWESI - IS THERE EVIDENCE FOR A VICARIANT ORIGIN OF TAXA ON THE ISLAND?

Björn Stelbrink<sup>1</sup>, Matthias Glaubrecht<sup>1</sup>, Thomas von Rintelen<sup>1</sup>

<sup>1</sup>Museum f. Naturkunde Berlin, Berlin, DE, [bjoern.stelbrink@mfn-berlin.de](mailto:bjoern.stelbrink@mfn-berlin.de)

Sulawesi is the largest island of the Wallacea, an area of oceanic islands between the continental Sunda and Sahul shelves. The non-marine fauna of Sulawesi is highly endemic and contains some apparently ancient elements such as the Babirusa. Dispersal, e.g. across Makassar Strait, is now widely accepted as accounting for the origin of most of Sulawesi's animals. Vicariance scenarios cannot be a priori excluded, though. The complex geologic history of the island, which has been connected to Borneo in the Eocene and is a tectonic composite comprising also terranes from the Australian margin, offers a theoretical chance for a vicariant origin of Sulawesi's taxa both from west and east. While the rise of molecular phylogenetics during the last two decades has helped to clarify the relationships of taxa from Sulawesi, the timing of diversification events is more difficult and can be crucial with respect to discussing dispersal versus vicariance hypotheses.

Recent biogeographic studies containing or allowing divergence time estimates of Sulawesi taxa are reviewed here with respect to the Island's geology. It is suggested that there is as yet little reliable evidence for a vicariant origin of taxa on Sulawesi from the west. Molecular phylogenetic data from two freshwater gastropod groups with poor dispersal capabilities suggest a potential vicariant origin of these snails via terrane rafting from the Australian margin, though. Tectonic events, i.e. the separation of candidate terranes from the Australian margin and their collision with Sulawesi, provide the temporal bounds for testing this hypothesis, which is attempted with a molecular clock approach. The past distribution of land and sea, particularly for small continental fragments, is a crucial issue debated among biogeographers and geologists, and well-supported biological data can make a contribution here.

Phylogeographic patterns within Sulawesi are used as an additional line of evidence for identifying potential candidate terranes. In at least one snail group, the correlation of phylogeographic subdivisions with tectonic provinces suggests that not only the colonization of Sulawesi, but also subsequent diversification events on the island have been greatly influenced by geologic events. The respective gastropod data are contrasted with patterns derived from the study of vertebrates and insects.



### DIVERSITY AND ENDEMISM OF SULAWESI WATER MONITORS: IMPLICATIONS FOR CONSERVATION EFFORTS OF A HIGHLY EXPLOITED CITES (SUB)SPECIES COMPLEX

Andre Koch<sup>1</sup>, Evy Arida<sup>2</sup>, Bernhard Misof<sup>1</sup>, Wolfgang Böhme<sup>1</sup>

<sup>1</sup>Forschungsmuseum A. Koenig, Bonn, DE, a.koch.zfmk@uni-bonn.de, <sup>2</sup>Museum Zoologicum Bogoriense, Cibinong, IN

Southeast Asian water monitors (*Squamata: Varanidae: Varanus salvator* complex) are not only among the largest squamate lizards in the world, they are also highly exploited target (sub)species of the international reptile leather trade. Annually, nearly half a million skins and leather products are legally exported from Indonesian islands. The dark figure is probably much higher because the illegal trade is flourishing and international CITES regulations are often violated.

In addition, water monitors are well known for their good swimming ability which enables them to cross marine barriers and colonize new terrains. Therefore, they exhibit the largest distribution range of all varanids. It extends from Sri Lanka in the west through continental Southeast Asia, and the Sunda Islands east to the Philippines, Sulawesi, and the Moluccas. On the oceanic islands of the Wallacea biodiversity hotspot at the eastern margin of their

distribution range, water monitors show the highest diversity and endemism including several locally restricted taxa.

Applying AFLP-fingerprinting method and advanced statistics, we investigated phylogeography and morphological diversity of Southeast Asian water monitors from Sulawesi and its satellite islands, the so-called Sulawesi region.

Our results show that Sulawesi monitor lizards belong to two different evolutionary lineages, those of the northern Minahassa peninsula and those of the central, south-western and eastern regions. Surrounding off-shore islands like Sangihe, Banggai, Kalaotoa and Tanahjampea harbour further endemic and undescribed taxa due to their spatial separation from mainland Sulawesi by deep ocean trenches and strong sea currents.

Therefore, the current taxonomy of Sulawesi water monitors does not reflect the observed diversity and demonstrates the urgent need for a thorough taxonomic assessment to manage future conservation efforts for Central Indonesian water monitors.



**PAST, PRESENT AND FUTURE OF BORNEAN CARNIVORES**Andreas Wilting<sup>1</sup>, Heribert Hofer<sup>1</sup>, Jörns Fickel<sup>1</sup><sup>1</sup>*Inst. f. Zoo & Wildl. Res., Berlin, DE, wilting@izw-berlin.de*

Carnivores are among the most threatened of the world's mammals. As recognized by the IUCN Species Survival Commission, southeast Asian mammals are of particular conservation concern and face an accelerated extinction crisis. The limited information about carnivores in southeast Asia greatly complicates conservation efforts. We therefore investigated (1) the evolutionary history of southeast Asian carnivores using molecular genetic tools (to elucidate the past), (2) the consequences of different types of forest exploitation on the distribution of carnivores using different field techniques, mainly camera-trapping (to understand the present), and (3) the distribution of carnivores across the whole island of Borneo using predictive distribution modelling (to assist future conservation efforts). Here we show new insights on the phylogeography of some carnivores (clouded leopards *Neofelis* sp., common palm civet *Paradoxurus hermaphrodites*, leopard cat *Prionailurus bengalensis* and fishing cat *Prionailurus viverrinus*) which suggest that their distribution cannot be explained solely by existing land bridges between the islands during the last glacial maxima. Field data from over two years of intensive camera-trapping provide first insights about habitat selection and species-specific abilities to cope with changing environments. These results are used to explain the phylogeographic past and are the basis for predictive distribution models to identify priority areas for future conservation.

**Merian Award Winner 2011**



PARALLEL SESSION THURSDAY 10:00 HALL H IV:

FREE CONTRIBUTIONS

Chair: Meike Piepenbring

## SPECIES INVASION IN TURKWEL RIVERINE FOREST, KENYA

Gabriel Muturi<sup>1</sup>, Bernard Kigomo<sup>2</sup>, Godefridus Mohren<sup>3</sup>

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About 27.7 million ha of riverine ecosystems in Kenya are potentially threatened by *Prosopis* invasion. Information on the nature of invasions is required to develop intervention strategies. The ecological impact of *Prosopis* species invasion in the Turkwel riverine forest in Northern Kenya was investigated by assessing herbaceous and woody species under canopies of *Acacia tortilis*, *Prosopis* and a mixture of *A. tortilis* and *Prosopis*, using 40 sample plots.

Tree diameters at breast height (DBH) and plot canopy area were assessed, and soils sampled for determination of physical soil properties and soil nutrient availability. Soils nutrient levels were homogeneous at a depth of 0-10cm, while crown canopies for most plots ranged from 70-80% among the three canopy types, suggesting homogeneous site conditions. Sixty herbaceous species were found in the sample plots, with 51, 34 and 33 species occurring under *A. tortilis*, under *Prosopis* and under mixed species canopies respectively. The mean number of species per plot and ground vegetation cover were significantly higher under *A. tortilis* and under mixed species canopies than under *Prosopis* canopy.

Regeneration of 6 wood species (*A. tortilis*, *Ficus sycomorus*, *Grewia bicolor*, *Prosopis*, *Ricinus communis* and *Zizyphus mauritania*) and one palm (*Hyphaene compressa*) was observed in the sample plots. *Prosopis* were the dominant regenerating species, occurring under all the canopy types, while *A. tortilis* was conspicuously absent under *Prosopis* canopy. Distribution of *Prosopis* DBH revealed an inverse J-shaped curve, indicating active regeneration but this trend was lacking in *A. tortilis*.

The results suggest that *Prosopis* was inhibiting herbaceous species cover, their biodiversity, suppressing the regeneration of *A. tortilis* and other indigenous woody species. Management interventions for containing *Prosopis* invasion in the riverine ecosystems is therefore required for pasture improvement and restoration of the original *Acacia* woodlands.



## SOIL CO<sub>2</sub> EFFLUX IN AN AFROMONTANE FOREST OF ETHIOPIA AS DRIVEN BY SEASONALITY AND TREE SPECIES

Yonas Yohannes<sup>1,2</sup>, Olga Shibistova<sup>1,3</sup>, Asferachew Abate<sup>1</sup>, Masresha Fetene<sup>4</sup>, Georg Guggenberger<sup>1</sup>

<sup>1</sup>Institute of Soil Science, Leibniz Universität Hannover, Hannover, DE; <sup>2</sup>Forestry Research Center, Ethiopian Institute of Agricultural Research, Addis Ababa, ET;

<sup>3</sup>VN Sukachev Institute of Forest, SB-RAS, Akademgorodok, Krasnoyarsk, RU;

<sup>4</sup>Department of Biology, Addis Ababa University, Addis Ababa, ET

Variability of soil CO<sub>2</sub> efflux strongly depends on soil temperature, soil moisture and plant phenology. Separating the effects of these factors is critical to understand the belowground carbon dynamics of forest ecosystem. In Ethiopia with its unreliable seasonal rainfall, variability of soil CO<sub>2</sub> efflux may be particularly associated with seasonal variation. In this study, soil respiration was measured in nine plots under the canopies of three indigenous trees (*Croton macrostachys*, *Podocarpus falcatus* and *Prunus africana*) growing in an Afromontane forest of south-eastern Ethiopia. Our objectives were to investigate seasonal and diurnal variation in soil CO<sub>2</sub> flux rate as a function of soil temperature and soil moisture, and to investigate the impact of tree species composition on soil respiration. Results showed that soil respiration displayed strong seasonal patterns, being lower during dry periods and higher during wet periods. The dependence of soil respiration on soil moisture under the three tree species explained about 50% of the seasonal variability. The relation followed a Gaussian function, and indicated a decrease in soil respiration at soil volumetric water contents exceeding a threshold of about 30%. Under more moist conditions soil respiration is tentatively limited by low oxygen supply. On a diurnal basis temperature dependency was observed, but not during dry periods when plant and soil microbial activities were restrained by moisture deficiency. Tree species influenced soil respiration, and there was a significant interaction effect of tree species and soil moisture on soil CO<sub>2</sub> efflux variability. During wet (and cloudy) period, when shade tolerant late successional *P. falcatus* is having a physiological advantage, soil respiration under this tree species exceeded that under the other two species. In contrast, soil CO<sub>2</sub> efflux rates under light demanding pioneer *C. macrostachys* appeared to be least sensitive to dry (but sunny) conditions. This is probably related to the relatively higher carbon assimilation rates and associated root respiration. We conclude that besides the anticipated changes in precipitation pattern in Ethiopia any anthropogenic disturbance fostering the pioneer species may alter the future ecosystem carbon balance by its impact on soil respiration.

## TREE-GRASS COMPETITION IN SAVANNA DEPENDING ON ORGANIC AND MINERAL NUTRIENTS

Judith Sitters<sup>1</sup>, Anneke Valk<sup>2</sup>, Milena Holmgren<sup>2</sup>, Peter Edwards<sup>1</sup>, Harry Olde Venterink<sup>1</sup>

<sup>1</sup>ETH Zurich, Zurich, CH, [judith.sitters@env.ethz.ch](mailto:judith.sitters@env.ethz.ch), <sup>2</sup>Resource Ecology Group, Wageningen University, Wageningen, The Netherlands

Tree-grass co-existence in savannas is affected by competition for nutrients. Grasses appear superior competitors, but only inorganic nutrients were studied, not organic forms like dung. Particularly legume trees may be better able to use organic-P than grasses because of a higher phosphatase activity. We studied competition between a grass (*Panicum infestum*) and a tree seedling, of either a legume (*Acacia nilotica* or *Albizia lebbek*) or non-legume (*Garcinia livingstonii* or *Keetia zanzibarica*). Plants grew in pots with soil for 11 weeks, with mineral nutrients, dung, or no fertilizer. In contrast to previous experiments, the grass did not reduce tree growth. It benefit from competing with trees in the control, but not when fertilized with dung or mineral nutrients. Phosphatase activity was highest for the legumes, intermediate for the grass and lowest for the other trees. Dung and mineral nutrients had a similar effect on phosphatase. So, higher phosphatase activity of the legume trees did not improve their performance under organic-nutrient supply. Whether this depends on time or interspecific differences in nutrient uptake needs further study.





**Thursday, 24 February, 10:45, Hall H IV**

**BIOGEOGRAPHY AND CENOZOIC CLIMATE CHANGE: ON THE OCCURRENCE OF TROPICAL FORMS IN GRUBE MESSEL AND OTHER MID-LATITUDE FOSSIL SITES**

Krister T. Smith<sup>1</sup>

<sup>1</sup>*Dept. of Palaeoanthropology and Messel Research  
Forschungsinstitut und Naturmuseum Senckenberg  
Frankfurt, Germany*

Grube Messel, near Frankfurt, Germany, is renowned for the extraordinary preservation of its fossils. One of the most remarkable aspects of the species composition at Messel is the prevalence of poikilothermic forms that today are predominantly found at low elevation in tropical to subtropical latitudes. These occurrences are wholly consistent with the warm and equable temperatures and high precipitation rates suggested by independent data sources for the early Paleogene, particularly the Eocene. Yet these occurrence data can be explained by different biogeographic models, and understanding their significance for modern patterns of biodiversity requires a diachronic perspective. I review studies of squamate (lizard and snake) occurrences at mid-latitudes throughout the Eocene. Predominantly tropical forms – especially various members of *Anguidae* and *Iguanidae* – first appear at middle latitudes near the base of the Eocene and disappear from those latitudes near the close of the epoch. This pattern of appearance and disappearance coincident with episodes of significant climatic change suggest that climate is responsible for major biogeographic shifts which may have contributed to the observed latitudinal diversity gradient. Yet a Paleogene perspective from the tropical latitudes, necessary for more closely testing these results, remains elusive.

**Parallel session: Thursday, 24 February, 11:30, Hall H III**

**TROPICAL ECOLOGISTS AT WORK:  
WHERE AND HOW TO FIND A JOB**

Chair: Manfred Niekisch

Contact: [Manfred.Niekisch@stadt-frankfurt.de](mailto:Manfred.Niekisch@stadt-frankfurt.de)

A number of organisations, ranging from non governmental organisations and private consultancy companies to government institutions present themselves and describe the role of and working opportunities for tropical ecologists (and scientists in related fields) within their structures and areas of activity. The session aims at assisting students and young academics to get an overview and orientation over different occupational images, job descriptions and potential careers and employees.

THURSDAY 11:30 Hall H III



THURSDAY 10:45 Hall H IV

**Session: Tropical ecologists at work: where and how to find a job**  
**Thursday, 24 February, 11:30, Hall H III**

**BROAD-BASED EXPERTISE FOR SUSTAINABLE DEVELOPMENT  
 - UNDER ONE ROOF - Deutsche Gesellschaft für Internationale  
 Zusammenarbeit (GIZ) GmbH**

Harald Lossack

**Broad-based expertise for sustainable development – under one roof**

Working efficiently, effectively and in a spirit of partnership, we support people and societies in developing, transition and industrialised countries in shaping their own futures and improving living conditions. This is what the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH is all about. Established on 1 January 2011, it brings together under one roof the long-standing expertise of the Deutscher Entwicklungsdienst (DED) gGmbH (German Development Service), the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH (German technical cooperation) and InWEnt – Capacity Building International, Germany. As a federally owned enterprise, we support the German Government in achieving its objectives in the field of international cooperation for sustainable development. We are also engaged in international education work around the globe.

**Making development effective**

Our partners want to take responsibility for achieving their own long-term development goals. We support them by offering demand-driven, tailor-made and effective services for sustainable development. We apply a holistic and value-based approach to ensure the participation of all stakeholders. In doing so, we are always guided by our concept of sustainable development. We take account of political, economic, social and ecological dimensions as we support our partners at local, regional, national and international level in negotiating solutions in the broader social context. This is how we drive development.

GIZ operates in many fields, including economic development and employment; governance and democracy; security, reconstruction, peace building and civil conflict transformation; food security, health and basic education; and environmental protection, resource conservation and climate change mitigation. We also provide management and logistical services to help our partners perform their development tasks. In crises we carry out refugee and emergency aid programmes. As part of our development services, we also second technical advisors to partner countries.

We advise our clients and partners on drawing up plans and strategies, place integrated experts and returning experts in partner countries, and promote

networking and dialogue among international cooperation actors. Capacity building for partner-country experts is a key component of our services, and we offer our programme participants diverse opportunities to use the contacts they have made. We also give young people a chance to gain professional experience around the world – exchange programmes for young professionals lay the foundations for successful careers in national and international markets.

**Who we work for**

Most of our activities are commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ). GIZ also operates on behalf of other ministries – in particular the Federal Foreign Office, the Federal Environment Ministry and the Federal Ministry of Education and Research – as well as German federal states and municipalities, and public and private sector clients both in Germany and abroad. These include the governments of other countries, the European Commission, the United Nations and the World Bank. We work closely with the private sector and promote results-oriented interaction between the development and foreign trade sectors. Our considerable experience with alliances in partner countries and in Germany is a key factor for successful international cooperation, not only in the business, academic and cultural spheres but also in civil society.

**The company at a glance**

GIZ operates in more than 130 countries worldwide. In Germany we maintain a presence in nearly all the federal states. Our registered offices are in Bonn and Eschborn. GIZ employs approximately 17,000 staff members worldwide, more than 60% of whom are local personnel. In addition, there are 1,135 technical advisors, 750 integrated and 324 returning experts, 700 local experts in partner organisations and 850 'weltwärts' volunteers. With an estimated turnover of EUR 1.9 billion as at December 2010, GIZ can look to the future with confidence.

**Growing commitments for biodiversity, forests and ecosystems' conservation**

The German Government has recognised the importance of biodiversity and the necessity to take action on a global scale. In recent years, funding in the form of long-term pledges to partner countries has risen steeply; in 2009 it rose to approximately €260 million, which is a 30 % increase on 2008. Further significant increases are planned between now and 2012. From 2013, the German Government intends to make €500 million available each year to support the worldwide creation of the enabling environments and capacities needed to preserve global biodiversity and forests in the long term.



The implementation of these commitments create a growing demand for experts in the field of natural resource management, tropical forests, ecology and other ecosystem services. Since the mid-1980s, Germany has supported over 500 programmes and projects worldwide that have contributed to the conservation and sustainable use of biological diversity. More than 90 % of these are bilateral or regional projects in financial, technical and human resource cooperation and have a term of 10 to 15 years. The remaining 10 % are supranational sectoral projects that mostly develop and test certain concepts and tools for the conservation and sustainable use of biodiversity.

**Session: Tropical ecologists at work: where and how to find a job**  
**Thursday, 24 February, 11:45, Hall H III**

**KfW DEVELOPMENT BANK – OPPORTUNITIES FOR TROPICAL ECOLOGISTS**

Peter Hilliges<sup>1</sup>

<sup>1</sup>KfW, Frankfurt, DE, [peter.hilliges@kfw.de](mailto:peter.hilliges@kfw.de)

KfW Development Bank implements the official bilateral financial cooperation in developing countries and economies in transition on behalf of the German Government. This includes financial cooperation with a significant number of tropical countries in Latin America, Africa and Asia. In about 30 countries, KfW supports activities related to ecological issues like tropical forestry, ecosystem- and biodiversity protection, sustainable use of natural resources (including agriculture, agro-forestry, fisheries, rangeland management, watershed management).

KfW Development Bank employs roughly 550 people, excluding national staff in our partner countries. A significant share is project manager out of which presently about 20 are responsible for projects in the above specified areas. Additionally, a small number of technical experts and sector economists are working on those topics. KfW has been recruiting regularly over the past few years to replace staff and to expand. It is our objective to find highly qualified people with a broad qualification, understanding for economic considerations and the ability to work on many different sectors and in different job descriptions. Sector flexibility and the willingness to adapt to changing requirements are essential.

Additionally to direct employment opportunities within KfW, we are frequently contracting consultants for a broad range of sector assignments. Contracts can considerably vary in size and be concluded with consulting firms as well as individuals. Contracts can be issued by KfW or by our partners in developing countries under financing from KfW.



**Session: Tropical ecologists at work: where and how to find a job**  
**Thursday, 24 February, 12:00, Hall H III**

**IUCN - the International Union for Conservation of Nature**

Hans Friederich<sup>1</sup>

<sup>1</sup>IUCN, [hans.friederich@iucn.org](mailto:hans.friederich@iucn.org)

IUCN helps the world find pragmatic solutions to our most pressing environment and development challenges. It supports scientific research, manages field projects all over the world and brings governments, non-government organizations, United Nations agencies, companies and local communities together to develop and implement policy, laws and best practice.

*Dr Hans Friederich, Regional Director for Europe has worked for IUCN since 1989, and will reflect on his own career to give insight in how one can find a job with an international organization such as IUCN. He will present the work of the organization, give some statistics about the current IUCN work force and give a few examples about the challenges and opportunities of working with IUCN.*

**Session: Tropical ecologists at work: where and how to find a job**  
**Thursday, 24 February, 12:15, Hall H III**

**OROVERDE – TROPICAL FOREST FOUNDATION - OPPORTUNITIES AND CHALLENGES OF SMALL NGOS**

Elke Mannigel<sup>1</sup>

<sup>1</sup>OroVerde, Bonn, DE, [emannigel@oroverde.de](mailto:emannigel@oroverde.de)

OroVerde is a German Tropical Forest Foundation founded in 1989. We are a non-profit organization cooperating with local partners in tropical forest countries for the conservation of the tropical forests. We promote technical and financial cooperation focusing both on conservation and sustainable development. In Germany we promote environmental education projects concerning tropical forest issues, highlighting the importance of the tropical forest for Germany and German consumers, as well as the impact our consume has on tropical forests. The aim is to increase the ability of the citizens to act and promote change, showing that can everybody in Germany can contribute to tropical forest conservation. We are also engaging in policy works especially concerning climate change and the importance and role of tropical forests. We were also active in promoting an European Legislation concerning the import of timber from illegal sources.

The international projects in tropical forest countries focus on different issues ranging from:

- Conservation of intact forest areas and establishment and management of protected areas
- Promotion of sustainable forestry
- Reforestation of degraded areas
- Promotion of alternative and adapted agriculture
- Establishment of alternative incomes
- Promotion of indigenous rights and traditional resource use
- Awareness building and transfer of knowledge

Our projects are small local interventions which make direct involvement of local populations possible. Many are successful pilot projects and models for future work. We provide not only financing for the projects, but also technical assistances and promote networking on national and international level. This way we can on one hand integrate ongoing international debates into our local projects and on the other hand provide input from the local experiences in national and international policy discussions.



We are a small professional team in the headquarters in Bonn. Most of us are biologists, although almost everybody has specialized in different areas, such as project management, international development, public relations, management of non-profit organizations and fundraising. Working in a small non governmental organization has many advantages and some challenges. While decisions are easily agreed upon and can be reached fast and efficiently, technical expertise for specific questions has to come sometimes from partner organizations and cooperation with Universities.

**Session: Tropical ecologists at work: where and how to find a job  
Thursday, 24 February, 12:30, Hall H III**

**Examples and tips from a WWF (World Wide Fund for Nature) perspective**

Philipp Göldenboth<sup>1</sup>

<sup>1</sup>*Director Forest Program WWF Germany, philipp.goeldenboth@wwf.de*

The presenter will give an overview of WWF – the largest conservation organization world-wide and will give examples of specific fields of work within the organization. The presentation will then go into details of how current employees got into the field of work and will give specific criteria for new employment decisions and what WWF looks out for during candidate selection. Lastly the presenter will give a perhaps more personal tips for graduates and job-seekers that which to start a career in conservation with an NGO.

About the presenter:

Philipp Göldenboth currently directs the Forest Program at WWF Germany. He has been working for WWF for the last 11 years in different positions and different parts of the world, including as Program Officer for East Africa at WWFUS. Philipp started with WWF as an intern coordinating the elephant / ivory trade positioning for a CITES COP. He has a formal training through the Freie Universität Berlin and the Institute for Zoo and Wildlife Research as a Biologist, specializing in Zoology and Wildlife Management.





**Session: Tropical ecologists at work: where and how to find a job**  
**Thursday, 24 February, 12:45, Hall H III**

**Consulting firms - opportunities for working in the field of development cooperation**

Wolfgang Scharm<sup>1</sup>

<sup>1</sup>*GOPA Worldwide Consultants, wolfgang.scharm@gopa.de*

GOPA Consultants is an independent, private German consulting firm that for the most part implements projects in the field of technical and financial assistance. The company provides its services to both bilateral and multilateral donors/organisations. Work is carried out mainly for the European Commission, Deutsche Gesellschaft für internationale Zusammenarbeit (GIZ), Kreditanstalt für Wiederaufbau (KfW), Worldbank and other development banks, the Millennium Challenge Corporation and others. With its group of affiliated companies, GOPA Consultants is one of the strongest European consulting firms in the field of development cooperation.

The technical fields covered include amongst others agriculture and rural development, forestry, fisheries, economic development and good governance, information and innovation services, education and employment promotion, and infrastructure development. As other consulting firms in the field of development cooperation, GOPA Consultants works with a diversity of staff of many different professional backgrounds.

A general feature of the staff engaged at head office is that they have both a solid technical and academic background and general skills that enable them to deal with the diversity of tasks at hand, both at headquarters and while on mission abroad. Indeed, work is not only confined to head office, where people are either engaged in project acquisition or project backstopping but also usually includes short-term assignments abroad, for instance to gather facts and information on new projects, carry out backstopping on site or participate in planning and other workshops. For those wanting to involve themselves professionally in development assistance, opportunities to do so not only exist within funding organisations and NGOs but also in consulting companies that provide services in delivering technical and financial assistance projects. The presentation therefore centres on the role that consulting firms play in international cooperation and the chances that present themselves for young professionals.



PARALLEL SESSION: THURSDAY, 24 FEBRUARY, 11:30, HALL H IV

ANTHROPOGENIC INFLUENCES

Chair: Doyle McKey

### RESILIENCE OF ECOLOGICAL SERVICES IN HUMAN MODIFIED FOREST TYPES IN SOUTH AFRICA

Eike Lena Neuschulz<sup>1</sup>, Nina Farwig<sup>1</sup>

<sup>1</sup>University of Marburg, Marburg, DE, [neuschulz@staff.uni-marburg.de](mailto:neuschulz@staff.uni-marburg.de)

Human disturbance is a major threat to forest ecosystems modifying species diversity, community composition and ecological services. Local changes in insect and bird communities can affect pollination and seed removal which finally, may influence the persistence of plant populations. We investigated the effects of forest modification on insect and bird communities in South Africa and studied pollination and seed removal of the tree species *Celtis africana*. We chose six representative types of forest modification, influenced by different intensities of human disturbance. Species' abundance and composition of insect and bird communities differed significantly among the different forest types. Specialized forest birds strongly declined with increasing habitat modification, whereas generalist bird species and insect richness increased in more modified forest types. We found enhanced pollination and seed removal of *C. africana* in modified forests compared to natural forest types. These results indicate that the mobility of insects and birds seems to maintain pollination and seed removal even in isolated forests and implies resilience of these ecological services to habitat modification.

Session: Anthropogenic influences  
Thursday, 24 February, 11:45, Hall H IV

### FOREST REGENERATION DYNAMICS IN DIFFERENTLY MODIFIED SOUTH AFRICAN SCARP FORESTS

Alexandra Botzat<sup>1</sup>

<sup>1</sup>University of Marburg, Marburg, DE, [botzat@staff.uni-marburg.de](mailto:botzat@staff.uni-marburg.de)

Human disturbance imperils biodiversity and ecological processes involved in forest regeneration, such as seed fate and seedling recruitment. We conducted seed fate experiments and determined species richness, abundance and composition of small mammals, adult trees, seedlings and saplings in five representative types of South African scarp forest, including natural forest, differently modified fragments and secondary forest. Seeds were predominantly consumed by small mammals and not secondarily dispersed. Seed predation was highest in highly modified forest types, although we recorded no differences in species richness and abundance of small mammals. However, high species turnover indicated variations in species composition, which explain the differences in seed predation pressure. For trees we found lower richness, abundance and recruitment in highly modified forest types, as well as a shift in community composition towards early successional species. These findings indicate less forest regeneration potential in highly modified forest types and thereby suggest that isolated forest fragments and secondary forest act as population sinks in forest regeneration dynamics.



**Session: Anthropogenic influences**  
**Thursday, 24 February, 12:00, Hall H IV**

**DISENTANGLING SMALL-SCALE VARIABILITY IN TREE GROWTH, HERBIVORE DISTRIBUTION AND HERBIVORE-ANTAGONIST INTERACTIONS IN REFORESTATION PLANTATIONS ON FORMER TROPICAL PASTURE**

Karsten Mody<sup>1</sup>, Mirco Plath<sup>2</sup>, Judith Riedel<sup>2</sup>, Gisela Brand<sup>2</sup>, Hector Barrios<sup>3</sup>, Catherine Potvin<sup>4</sup>, Silvia Dorn<sup>2</sup>

<sup>1</sup>ETH Zurich, IPAS, Zurich, CH, karsten.mody@ipw.agrl.ethz.ch, <sup>2</sup>ETH Zurich, IPAS, Applied Entomology, Zurich, CH, <sup>3</sup>Universidad de Panama & Smithsonian Tropical Research Institute, Panama, PA, <sup>4</sup>Smithsonian Tropical Research Institute, Panama & McGill University, Montreal, CA

Deforestation has produced vast expanses of degraded lands across Central America. Reforestation of degraded sites with native timber trees may mitigate degradation. However, unsuitable environmental conditions and pest insects often impair reforestation success.

We investigated effects of different planting regimes (tree monoculture, tree mixture and tree mixture protected by insecticides) and of small-scale environmental heterogeneity (1) on establishment and growth of three native timber trees, *Anacardium excelsum*, *Cedrela odorata* and *Tabebuia rosea*, (2) on distribution of associated insect herbivores, and (3) on herbivore-antagonist interactions.

We found effects of planting regimes and small-scale heterogeneity (1) on tree growth but not on tree survival, (2) on the distribution of key herbivores and on herbivore feeding damage, and (3) on the distribution of herbivore-antagonists.

Our studies revealed that small-scale environmental heterogeneity affects timber tree establishment on former pastures. The impact of insect herbivores on establishing trees may be alleviated by local measures such as planting regimes, which suppress herbivores or support herbivore-antagonists.

**Session: Anthropogenic influences**  
**Thursday, 24 February, 12:15, Hall H IV**

**ANT DIVERSITY VS. SINGLE SPECIES DOMINANCE IN INDONESIAN COCOA PLANTATIONS**

Arno Wielgoss<sup>1</sup>, Yann Clough<sup>1</sup>, Teja Tscharntke<sup>1</sup>, Brigitte Fiala<sup>2</sup>

<sup>1</sup>Univ.Göttingen -Agroecology, Göttingen, DE, arno.wielgoss@uni-wuerzburg.de,

<sup>2</sup>Univ.Würzburg, Zoology III-Tropical Biology, Würzburg,

With our a large scale and long term ant fauna manipulation experiment in cocoa plantations, we study the impacts of ants on pests and diseases in tropical agroforestry. We compare the possible effects of diverse ant communities and single species dominated communities and quantify the total ant ecosystem services by using ant exclusion plots as zero-control.

The 16 study plots at the margins of the Lore-Lindu National Park (Sulawesi, Indonesia) differ in altitude, density and diversity of shadow trees and distance to the nearest rain forest. Each plot contains four subplots of nine cocoa trees in which we experimentally manipulate the ant communities during two cocoa yield seasons in 2010 and 2011 by:

- a) Ant Exclusion;
- b) Establishment of the dominant ant *Philidris* cf. *cordata*;
- c) Establ. of *Dolichoderus thoracicus*;
- d) Control

We continuously collect data of yield and incidence of pests and diseases and conduct predation experiments. We examine the abundances and identity of ground and tree dwelling ants using standardized baits and test for possible effects of ant species, environmental variables and management on pests and diseases of cocoa.



**Session: Anthropogenic influences**  
**Thursday, 24 February, 12:30, Hall H IV**

**BIRD DIVERSITY AND FEEDING GUILD COMPOSITION ALONG A TROPICAL FOREST-FARMLAND GRADIENT IN WESTERN KENYA**

Ronald Mulwa<sup>1</sup>, Katrin Böhning-Gaese<sup>1</sup>, Matthias Schleuning<sup>1</sup>

<sup>1</sup>*BiK-F Senckenberg, Frankfurt, DE, Ronald.Mulwa@senckenberg.de*

In many tropical regions, forests have been replaced by secondary forests and farmland habitats that often occur adjacent to remnants of near natural forest. Whereas numerous studies have investigated the effects of human disturbance in forest habitats, little is known about bird communities in tropical farmlands. We surveyed bird communities in Kakamega Forest and adjacent farmlands in western Kenya to assess variations in bird abundance, diversity and feeding guild composition across a habitat gradient during different seasons. In two types of forest (near natural vs. secondary forest) and farmland habitats (mixed and sugarcane farmland), we conducted point counts to record birds and their key resources (i.e., fruits, flowers and invertebrates) over an entire year. Bird abundances and resource availability fluctuated over the course of the year. Surprisingly, overall bird abundances were higher in farmland than in forest habitats. Accordingly, flower, fruit and invertebrate availability were in higher farmland than in forest habitats, whereas the structural vegetation diversity was higher in forest than in farmland habitats. However, feeding guilds of birds responded differently to differences between forest and farmland habitats. Frugivorous birds tended to be more numerous in farmland than in forest habitats, whereas insectivorous birds showed the opposite pattern. The higher frugivore richness in the farmland was directly related to the higher fruit availability in farmland than in forest habitats. Within forest and farmland habitats, bird species richness and abundance were higher in near natural than in secondary forest types and in mixed than in sugarcane farmland types, respectively. These differences might be due to the higher structural diversity in near natural forests and mixed farmlands, indicating that structurally diverse habitats support larger and more species-rich bird communities in both forest and farmland habitats. The differential response of different bird feeding guilds to tropical forest-farmland gradients indicates that conservation research of tropical bird communities should not rely on measures of overall bird diversity.

**Session: Anthropogenic influences**  
**Thursday, 24 February, 12:45, Hall H IV**

**IMPACT OF ANTHROPOGENIC PRESSURE ON THE POPULATION STRUCTURE OF ANOGEISSUS LEIOCARPA WITHIN WARI-MARO FOREST RESERVE IN BENIN (WEST AFRICA)**

Achille Ephrem Assogbadjo<sup>1</sup>

<sup>1</sup>*LEA-FSA-UAC, Cotonou, BJ, assogbadjo@yahoo.fr*

The present study focused on the analysis of the structure of the *A. leiocarpa* dominated natural stands in the Wari-Marou forest reserve which are under high and minimal anthropogenic pressures. These stands were considered for forest inventory after carrying out a random sampling scheme of 40 sample units of 30 m x 50 m. In each level pressure stand, the dbh and tree-height of identified tree-species were measured in each plot. Data analyses were based on the computation of structural parameters, establishment of the stem diameter and height distributions and the floristic composition of the two types of stands. Results obtained showed higher values for the overall basal area, mean height and diameter for *A. leiocarpa* presented in low-pressure stands. In the high-pressure stands, the frequency of trees in the successive diameter classes dropped rapidly and the value of the logarithmic slope of the height-diameter relationship was lower indicating a lanky shape. Results from the present study suggest that effective conservation is needed for *A. leiocarpa* stands under high pressure by developing appropriate strategy for restoration purposes.



**Session: Keynote****Thursday, 24 February, 14:25, Hall H III****Chair: Heribert Hofer****GENETIC DIVERSITY AND TROPICAL BIODIVERSITY  
CONSERVATION: NEGLECTED COMPONENT OR NEEDLESS  
DISTRACTION?**Michael Bruford, Cardiff University, Cardiff, UK, [brufordmw@cf.ac.uk](mailto:brufordmw@cf.ac.uk)

Given the numerous calls on conservation funding and the alarming rate at which tropical biodiversity is currently being lost, prioritisation of conservation action and research is a necessity. Genetic diversity is considered by many to be a relatively low priority in conservation of biodiversity. A commitment to conserve genetic diversity is absent from many national and international agreements and from the scientific underpinning of the CBD which, while concentrating on species diversity (Global Taxonomy Initiative) and ecosystem stability (Ecosystems Approach), neglects genetic diversity almost completely. No targets for the conservation of genetic diversity were set for 2010 within the EU. Yet genetic diversity is one of the three important components of biological diversity and provides the raw material for natural selection and adaptation to environmental change which will certainly be needed in the future. I will use this presentation to first ask why genetics is ignored in this way, and what can geneticists do to change attitudes within the biodiversity community. Research on genetic diversity of species in tropical ecosystems has yielded knowledge of conservation relevance which was previously unsuspected and in the second part of my talk I will summarise what new knowledge has come from research on tropical ecosystem genetics. Finally, evidence that genetic data may impact directly on management of tropical biodiversity and alter priorities for funding and action may be considered equivocal, yet such examples are beginning to come into the literature and in the third part of my talk I will use one example to illustrate how genetic data can alter the 'bottom line' in tropical biodiversity conservation.

**Thursday, 24 February, 15:15 | Hall H III | Second part of the session:  
THE ANDEAN BIODIVERSITY HOTSPOT AND ITS FUTURE: BIODIVERSITY,  
ECOSYSTEM FUNCTIONING & ECOSYSTEM SERVICES UNDER  
ENVIRONMENTAL CHANGE**

Chairs: Jörg Bendix, Erwin Beck

**FUNCTIONAL SOIL-LANDSCAPE MODELLING - ESTIMATING SLOPE  
STABILITY IN A STEEP ANDEAN MOUNTAIN FOREST REGION**Mareike Liess<sup>1</sup><sup>1</sup>Bayreuth University, Bayreuth, DE, [mareike.liess@uni-bayreuth.de](mailto:mareike.liess@uni-bayreuth.de)

Landslides are a common phenomenon within the Ecuadorian Andes and have an impact on soil-landscape formation. Within the research area, landslides are mainly composed of soil and mud slides, while rock slides occur to a much lesser extent.

Landslide susceptibility was determined in a steep mountain forest region in Southern Ecuador. Soil mechanical and hydrological properties in addition to terrain steepness were hypothesized to be the major factors in causing soil slides. Hence, the factor of safety (FS) was calculated as the soil shear ratio that is necessary to maintain the critical state equilibrium on a potential sliding surface. Regression tree (RT) and Random Forest (RF) models were compared in their predictive force to regionalise the depth of the failure plane and soil bulk density based on terrain parameters. The depth of the failure plane was assumed at the lower boundary of the stagnic soil layer or soil depth respectively, depending on soils being stagnic or non-stagnic.

Bulk density and the depth of the failure plane were regionalised with RF performing better than RT. The FS was determined in dependence of soil wetness referring to 0.001, 0.01, 0.1 and 3 mm/h net rainfall rate. Sites with a FS  $\geq 1$  at 3 mm/h (complete saturation) as unconditionally stable, sites with a FS  $< 1$  at 0.001 mm/h were classified as unconditionally unstable. The latter coincide well with landslide scars from a recent aerial photograph.





**Session: The Andean biodiversity hotspot and its future: Biodiversity, ecosystem functioning & ecosystem services under environmental change**

**Thursday, 24 February, 15:30, Hall H III**

**INFLUENCE OF SHALLOW LANDSLIDES ON FOREST DYNAMICS IN A SOUTH ECUADORIAN TROPICAL MONTANE FOREST**

Claudia Dislich<sup>1</sup>, Andreas Huth<sup>1</sup>

<sup>1</sup>UFZ Leipzig, Leipzig, DE, [claudia.dislich@ufz.de](mailto:claudia.dislich@ufz.de)

Shallow landslides are a major source of natural disturbance in tropical montane forests. Due to shallow landslides vegetation and often the upper soil are removed, leaving space for a quasi primary succession and resulting in strongly changed conditions for forest regeneration. Landslides might therefore affect different processes of forest dynamics: tree growth can be reduced due to nutrient limitation, tree recruitment can be reduced due to a thick vegetation of shrubs and ferns that establishes on young landslide sites and mortality can be increased due to instability of soils and exposition to wind. We utilize an individual based model of forest growth to investigate how changes in these processes affect the temporal and spatial succession process and to estimate the effect of landslides on the carbon balance of forest. The forest model was parameterized for one forest type of the Reserva Biológica San Francisco in the Andes of South Ecuador, where approximately 4% of the area is covered with visible traces of landslides. The terrain is characterized by deeply incised valleys and steep slopes. We developed different scenarios of forest succession after landslides, where different processes (tree growth, recruitment, mortality) are changed compared to processes in undisturbed forest. For the different scenarios we find distinct patterns of spatial variation of tree biomass within the first fifty years of succession. For all scenarios, overall tree biomass recovers after approximately 100 years but species composition takes longer time to recover (> 200 years). On the landscape level landslides reduce standing biomass and produce a high spatial heterogeneity.

**The Andean biodiversity hotspot and its future: Biodiversity, ecosystem functioning & ecosystem services under environmental change**  
**Thursday, 24 February, 15:45, Hall H III**

**IMPLICATIONS OF LAND-USE CHANGE AND PASTURE-FERTILIZATION ON SOIL MICROBIAL ACTIVITIES AND COMMUNITIES IN A MOUNTAIN RAINFOREST REGION OF SOUTHERN ECUADOR**

Karin Potthast<sup>1</sup>, Ute Hamer<sup>1</sup>, Franz Makeschin<sup>1</sup>

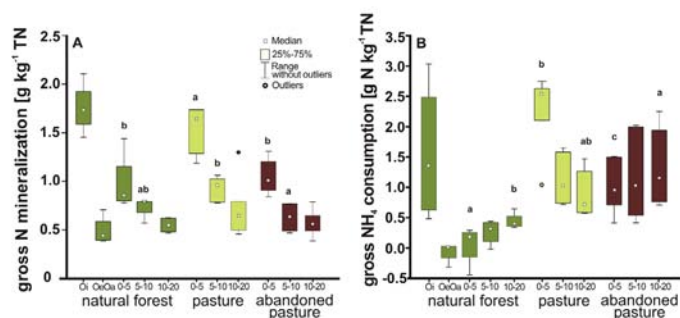
<sup>1</sup>TU Dresden/Soil Science, Dresden, DE, [kpotthast@web.de](mailto:kpotthast@web.de)

In the South Ecuadorian Andes, vast areas of the mountain rainforest have been converted to cattle-pastures by slash and burn practice. Frequently, these pastures were invaded by the fire-tolerant tropical bracken fern. When the bracken becomes dominant on the pasture sites the productivity decreases and the sites are abandoned. To assess the implications of land-use changes and pasture-fertilization on ecosystem functioning, a study was conducted in the area of the German research station Estación Científica San Francisco (ECSF) in Ecuador. For comparison of different land-uses three adjacent sites were selected at 2000 m asl: a mountain rainforest site, an active pasture site dominated by the grass species *Setaria sphacelata* and an abandoned pasture site overgrown by bracken (*Pteridium arachnoideum*). To investigate the effect of the fertilization of pastures with urea and/or rock phosphate on soil microbial properties, a fertilization experiment was conducted in situ as well. For soil microbial analysis, the amounts of microbial biomass (CFE-method), the microbial activity (basal respiration; net and gross N mineralization rates) and the microbial community structure (PLFA-analysis) were determined.

17 years after pasture establishment, a threefold higher content of microbial biomass C and N as well as significantly lower C:N ratios were determined compared to the other land-uses. Furthermore, highest C and gross N mineralization rates (Fig.1) were observed in the pasture soil. An actively microbial inorganic N immobilization indicated an easy availability of organic substrates partly due to the prolific fine-root system of the pasture grass. These differences within the land-use gradient were also associated with shifts in the microbial community structure (MCS). After bracken-invasion the MCS shifted again towards the forest whereby a higher relative abundance of actinomycetes was associated with a higher acidity and exchangeable Al-concentration.



In general, one year after the establishment of the fertilization experiment, higher microbial biomass and C mineralization rates were detected in all fertilized treatments compared to the control. Highest net N mineralization rates were observed in the plots fertilized with urea only, indicating a rapid microbial use of the amended organic N. In conclusion, the observed land-use change and pasture-fertilization had an impact on nutrient transfer and on ecosystem functioning in the mountain rainforest region.



**Fig. 1:** Comparison of the gross N mineralization rates (**A**) and of gross  $\text{NH}_4$  consumption rates (**B**) related to total N content between land-use types. Significant differences between land-use types were indicated by different letters ( $n=6$ , Tukey-test,  $p<0.05$ ).

### Session: The Andean biodiversity hotspot and its future: Biodiversity, ecosystem functioning & ecosystem services under environmental change

Thursday, 24 February, 16:30, Hall H III

### REGENERATION OF ABANDONED PASTURES IN SOUTH ECUADOR

Kristin Roos<sup>1</sup>, Erwin Beck<sup>1</sup>

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*Pteridium* spp. (bracken) is one of the most persistent weeds worldwide. In South Ecuador, where former pastures are overgrown by *P. arachnoideum*, 13 different control measures were examined with six repeated treatments over a time period of 23 months. Subsequently, the pasture grass *Setaria sphacelata* was planted. Growth of *P. arachnoideum* and later the grass was monitored monthly using the variables cover and height of vegetation. *P. arachnoideum* frond biomass was determined at the end of the control treatments. None of the treatments resulted in a complete eradication of the weed. The efficacy of the control treatments differed considerably, but the subsequently planted grass balanced out these differences, suppressing the fern to a cover of less than 40%. Thus, in spite of the high resistance of *P. arachnoideum* to any kind of control, regeneration of abandoned pastures is possible, using a two-step strategy: i) depleting the reserves in the rhizomes by repeated killing of the leaves and ii) subsequent suppression by a highly competitive pasture grass.



**Session: The Andean biodiversity hotspot and its future: Biodiversity, ecosystem functioning & ecosystem services under environmental change**

**Thursday, 24 February, 16:45, Hall H III**

**SIMULATION OF NET PHOTOSYNTHESIS OF TWO COMPETING SPECIES, THE SOUTHERN BRACKEN AND THE PASTURE GRASS *SETARIA SPHACELATA*, IN A TROPICAL MOUNTAIN ECOSYSTEM.**

Brenner Silva<sup>1</sup>, Jörg Bendix<sup>1</sup>

<sup>1</sup>LCRS - Marburg University, Marburg, not U, DE, [brenner.silva@students.uni-marburg.de](mailto:brenner.silva@students.uni-marburg.de)

The tropical mountain forest in the Andes of Ecuador is the second hottest biodiversity hotspot of the world and suffers from a high deforestation rate, mainly to gain pastures. However, the planted pasture grass (*Setaria spaciata*) is frequently overgrown by an aggressive weed (southern bracken), probably due to recurrent burning and competition for light. As a result, pastures are abandoned and natural succession is affected. To understand the growth efficiency of bracken and its competitive strength an experimental site was established in the Rio San Francisco Valley. A numerical model (The Southern Bracken Competition Model SoBraCoMo) was developed to simulate the growth of both competing species which will be presented in the talk. Validation was conducted by means of independent measurements of daily courses. Following, the model was initialized with meteorological data for 2008 in 10 minutes steps. It will be shown that the grass *Setaria* was more productive, assimilating up to 40% more atmospheric CO<sub>2</sub> than the southern bracken. It contrasts with field observations and points out that other factors like cattle browsing might be responsible for the competitive strength of bracken.

**Session: The Andean biodiversity hotspot and its future: Biodiversity, ecosystem functioning & ecosystem services under environmental change**

**Thursday, 24 February, 17:00, Hall H III**

**NEOTROPICAL C3/C4 GRASS DISTRIBUTION - PRESENT PAST AND FUTURE**

Laurent Bremond<sup>1</sup>, Charly Favier<sup>2</sup>, Arnoud Boom<sup>3</sup>

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The main environmental factors controlling C3 and C4 grass distribution in the intertropical zone are not well known. Some C3/C4 distribution models based on photosynthetic grass physiologies have been developed but not easily validated with field measurements. Nonetheless, these models are quite useful because they are able to estimate the response of grasslands to past and future CO<sub>2</sub> atmospheric concentration changes.

The aim of our study is to establish a schematic of the present altitudinal C3/C4 grass distribution in tropical South America and to then compare it with a simple photosynthetic model and with a dynamic global vegetation model (DGVM) for present, past and future climate.

Grass species richness distribution data were compiled from literature and interpreted in term of species altitudinal distribution and of C3/C4 proportions. A regression was established between mean annual temperatures and C4 grasses. This relationship was then compared to simulations of the LPJ-GUESS model for the present climate. Finally, the photosynthetic model and the DGVM were compared with the IPCC climate projections for 2100, and the simulations of the PMIP2 models at 6k and 18k yrs BP.



**Session: The Andean biodiversity hotspot and its future:****Thursday, 24 February, 17:15, Hall H III****EFFECTS OF GRASS (SETARIA SPHACELATA) COMPETITION AND FERTILIZATION ON ROOT LENGTH AND BIOMASS ALLOCATION OF NATIVE TREE SPECIES FROM ECUADOR**Bernd Stimm<sup>1</sup>, Ximena Palomeque<sup>1</sup>, Paula Loaiza<sup>1</sup>, Sven Günter<sup>2</sup>, Patrick Hildebrandt<sup>1</sup>, Helmut Blaschke<sup>1</sup>, Michael Weber<sup>1</sup><sup>1</sup>TU Muenchen Forest Science, Freising, DE, [stimm@forst.wzw.tum.de](mailto:stimm@forst.wzw.tum.de), <sup>2</sup>CATIE, Turrialba, CR

Assessments on plant dynamics have focused primarily on above-ground processes, while below-ground processes are less well understood, in particular in tropical forests. Within the context of restoration of degraded lands in the tropics it is well known that *Setaria sphacelata* is a strong aboveground competitor and limits the suitable establishment of tree seedlings on pasture sites. Moreover, sometimes fertilizers are used to improve the growth performance of tree species in restoration efforts without understanding the genuine effect on the establishment of tree species. Therefore, the aim of this study was to detect the effects of grass competition and fertilizer addition on the development of the root system (i.e. total root length and biomass allocation) of three native tree species (*Cedrela montana*, *Tabebuia chrysantha* and *Alnus acuminata*).

We established 60 rhizotrons under nursery conditions in Loja – Ecuador (4 rhizotrons/treatment x 5 repetitions x 3 species) where roots were weekly traced during several months. At the end of the experiment the tree seedlings and grass were harvested to calculate the above and below ground biomass allocation.

The results showed: 1) that with *Setaria* competition all tree species were stimulated to produce a higher root length to cope with the grass root system, 2) tree species and grass had a clear tendency to allocate more on aboveground than on belowground biomass, even with fertilization. This is interpreted as a strategy of the seedlings to increase especially its height growth to escape the grass competition earlier and improve the rate of photosynthesis under the given environmental conditions. 3) *Setaria* had higher biomass allocation compared to tree species and the intensive root system makes it a very efficient competitor that can impede vital growth of tree seedlings. A comparison between tree species showed that *Alnus* was more successful producing both, higher total root length as well as higher above and below ground biomass than *Tabebuia* and *Cedrela*. Therefore, *Alnus* could be a good candidate to start rehabilitation processes on pastures dominated by *Setaria*.

**Session: The Andean biodiversity hotspot and its future:****Thursday, 24 February, 17:30, Hall H III****APPLICATION OF NATIVE ARBUSCULAR MYCORRHIZAL FUNGI FOR REFORESTATION WITH NATIVE TREE SPECIES IN SOUTH ECUADOR**Claudia Krüger<sup>1</sup>, Narcisa Urgiles<sup>1</sup>, Arthur Schübler<sup>1</sup><sup>1</sup>LMU München, Planegg-Martinsried, DE, [claudia.krueger@lrz.uni-muenchen.de](mailto:claudia.krueger@lrz.uni-muenchen.de)

Ecuador shows the highest deforestation rate in South America and sustainable reforestation programs with native tree species are timely to reduce deforestation pressure on natural forests and to re-establish stable and diverse ecosystems. Most tropical trees strongly depend on associations with arbuscular mycorrhiza (AM) forming fungi, which are obligate symbionts of >80% of land plants. These fungi provide large amounts of inorganic nutrients, such as P and N to the plant. In our research area, the Reserva Biológica de San Francisco (RBSF) in South-Ecuador, the vast majority (113/115) of the investigated mountain rainforest tree species was proven to form AM (Kottke et al. 2008, Ecological Studies 198: 137-148).

Our approach was, to relate ecosystem knowledge to sustainable management practices, namely afforestation attempts with native, potential crop trees. The capability of applying AM fungi (AMF) in a tree nursery for a more efficient reforestation of abandoned pastures (close to the RBSF) was evaluated. Native AMF were isolated from roots of earlier experiments (Urgiles et al. 2009, New Forest 38: 229-239) and existing reforestation plots, analysed morphologically, DNA barcoded and established as stable cultures with *Plantago lanceolata* as a plant host (see poster Krüger et al.). Ten cultures were chosen to produce an AMF 'cocktail' that was used to inoculate seedlings of three tree species, *Cedrela montana*, *Heliocarpus americanus* and *Tabebuia chrysantha*. Two samplings were conducted during the 6-months nursery phase and two during 12-months after outplanting at the pastures.

We address the question, whether the tree seedlings inoculated with AMF show improved growth and/or mortality rates. In addition, we monitored the AMF with the 454FLX-Titanium amplicon sequencing technology and found certain AMF to persist during the nursery phase and also after outplanting. In other experiments, each of the tree species was inoculated with a set of individual AMF and growth performance was studied. When combined with low fertilization up to 10-times more biomass was formed by certain plant-AMF combination in the nursery, as compared to control treatments.

With these approaches we distinguish AMF that preferentially associate with the native tree seedlings, under nursery condition, and we correlate these data with the plant performance in the field. The results will allow recommending a more efficient management strategy for reforestation attempts in Ecuador.



**Session: The Andean biodiversity hotspot and its future: Biodiversity, ecosystem functioning & ecosystem services under environmental change**

**Thursday, 24 February, 17:45, Hall H III**

**GROWTH PERFORMANCE OF SIX NATIVE TREE SPECIES PLANTED AT THREE SUCCESSIONAL SITES IN THE ANDES OF SOUTH ECUADOR**

Michael Weber<sup>1</sup>, Ximena Palomeque<sup>1</sup>, Sven Günter<sup>2</sup>, Bernd Stimm<sup>1</sup>

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The Andes of Ecuador present the highest number of plant species and high endemism but also one of the highest deforestation rates on earth. There are many good reasons to assist forest recovery, inter alia that healthy forest ecosystems provide goods and services of inestimable value for societal benefits. Tree plantations as an active approach of rehabilitation play an important role in tropical forest restoration preferably with a choice of native species according to their adaptation to the environmental conditions at the planting site.

The aim of this study was to investigate the effect of three distinct successional site conditions on the growth performance of six native tree species with different light requirements over time: light demanding (*Alnus acuminata*, *Morella pubescens*, and *Heliocarpus americanus*) and shade tolerant (*Cedrela montana*, *Tabebuia chrysantha*, and *Juglans neotropica*). A total of 144 plots were monitored from 2003 to 2008. The results showed that there exist strong species-specific patterns in terms of height growth with respect to the ecological conditions at the pasture, bracken and shrub site. For instance, *Alnus* demonstrated to be very successful at the Pasture site but not at the other sites due to better adaptation to open areas and its higher capacity to compete with grasses. *Morella* which is known to improve soil conditions due to its potential to fix nitrogen had a better growth performance at the Bracken site. *Tabebuia* had a better development at the Shrub site because it requires light shelter

**Session: Link for survival - Science and the conservation of tropical landscapes**

**Thursday, 24 February, 15:15, Hall H IV**

**LINK FOR SURVIVAL - SCIENCE AND THE CONSERVATION OF TROPICAL LANDSCAPES**

Chairs: Christof Schenck, Antje Müllner - Frankfurt Zoological Society  
Contact: [schenck@zgf.de](mailto:schenck@zgf.de)

While many tropical ecologists focus on understanding the fascinating and complex tropical systems, conservationists try to protect habitats often without knowing the biodiversity values and ecosystems services the areas offer. In this session we want to present and discuss examples on how tropical ecology research might contribute to the conservation of biodiversity. We would like to encourage researchers and conservation practitioners to present their experiences, best-practice work and lessons learnt to bridge the gap between daily conservation needs and research. Innovative approaches and methods are of special interest. Success stories and failures shall serve as a base of discussing ways to improve the link between science and conservation.





**Session: Link for survival - Science and the conservation of tropical landscapes** Thursday, 24 February, 15:15, Hall H IV

**THE GREAT GREEN MACAW (*ARA AMBIGUUS*): CONSERVATION BIOLOGY FOR THE IMPLEMENTATION OF A TRANSBOUNDARY BIOLOGICAL CORRIDOR IN THE LOWER WATERSHED OF THE SAN JUAN RIVER (COSTA RICA / NICARAGUA)**

Olivier Chassot<sup>1,2,4</sup>, Guisselle Monge Arias<sup>2</sup>, Antonio Ruiz Meléndez<sup>3</sup>, Teresa Mariscal Poeyo<sup>3</sup>, Alfredo Figueroa Rodríguez<sup>3</sup>, Monika Melisch<sup>5</sup>

Speaker: Monika Melisch

<sup>1</sup>*Latin American School for Protected Areas, University for International Cooperation, San José, CR, ochassot@uci.ac.cr.* <sup>2</sup>*Tropical Science Center, San José, CR,* <sup>3</sup>*Fundación del Río, San Carlos, Río San Juan, NI,* <sup>4</sup>*Deputy Vice-Chair for Connectivity Conservation, Mountains Biome, Vice-Chair for Mesoamerica, Transboundary Specialist Group, World Commission on Protected Areas, International Union for Conservation of Nature (WCPA-IUCN),* <sup>5</sup>*Tropica Verde e.V., Frankfurt, DE, monika.melisch@tropica-verde.de.*

The Great Green Macaw Research and Conservation Project was launched in 1994 and aims to study the conservation biology of the Great Green Macaw in northern Costa Rica. The project's first-year findings indicated that the population was showing a strong decrease pattern. The endangered Great Green Macaw (*Ara ambiguus*) has a limited distribution in the Atlantic wet lowlands of Central America. The survival of the Great Green Macaw depends on the availability of adequate, intact forest habitat. For this reason the Tropical Science Center proposed the implementation of a conservation plan, which is known as the San Juan-La Selva Biological Corridor, based on the scientific data generated by the multi-year telemetry study with the aim to protect enough habitat to maintain a small and viable breeding population in Costa Rica.

As migrating species are not limited by borders, the successful establishment of a bi-national biological corridor has been and remains essential for the conservation of the Great Green Macaw. The Tropical Science Center (Costa Rica) and Fundación del Río (Nicaragua) took a leading role in the consolidation and implementation of cross-border alliances and nature conservation activities through a campaign that focuses on environmental education and promoting the awareness. Data from a 2009 census show that the population of Great Green Macaws has been increasing, which is correlated with the conservation actions. The Great Green Macaw is used as a flagship species within the biological corridor. As a consequence, the entire biodiversity benefits from the conservation measures. The project is supported by multiple sources, including since 2004 by Tropica Verde e.V..

**Session: Link for survival - Science and the conservation of tropical landscapes** Thursday, 24 February, 15:30, Hall H IV

**ADDING A DISTRIBUTION MODELLING TOOL FOR CONSERVATIONISTS TO THE AFRICAN ODONATA DATABASE**

Nirmal Ojha<sup>1</sup>, Viola Clausnitzer<sup>2</sup>, Frank Suhling<sup>3</sup>, Gertrud Schaab<sup>4</sup>

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Species distribution models have often been employed to find the potential habitat range. Making use of the unique African Odonata database which covers over 800 species, we present a logistic-regression based modelling tool for predicting their potential distribution. Thus, the scientifically collected database has the potential to be useful for conservation related applications; as determining the species potential distribution range is one of them. E.g. the potential distribution range can aid in the assessment of IUCN's threat status. Odonata (dragonflies and damselflies) serve as good indicator species for conservation and environmental monitoring and planning for various reasons: they are easy to monitor, the taxonomy is straight forward, they inhabit aquatic (larvae) and terrestrial (adults) habitats, and they are top predators. Here we present the example of modelling, currently based on presence-only data, of two Odonata species in tropical Africa categorised as vulnerable in the IUCN red list of threatened species. The tool applies the maximum likelihood method based on the expectation-maximisation approach. In order to develop a tool in particular useful to conservationists, emphasis is given mainly to a) functions to ensure proper harmonisation of raster and vector datasets, b) a user-friendly graphical user interface, and c) a comprehensive help system.

*Coryphagrion grandis*, mainly residing in the coastal areas of Kenya and Tanzania and *Pseudagrion bicoeruleans*, mainly found in the montane areas of Kenya, Uganda and Tanzania have been threatened by wood extraction (deforestation), agriculture and water pollution. Therefore, the variables used for modelling are surrogates of a) climate (like 6 bioclimatic variables), b) habitat (land-cover, elevation), c) resources (vegetation index, distance to water) and d) potential anthropogenic impact (population density). These example species show the model's usefulness in e.g. identifying areas in need of conservation for these species in East-Africa. An assessment of the sensitivity of the variables in regard to the predicted habitat ranges can help to project relative impacts caused by the various variables.



**Parallel session, Thursday, 24 February, 15:45, Hall H IV**

**Session: Link for survival - Science and the conservation of tropical landscapes**

### **HOW TO ESTIMATE THE CONSERVATION STATUS OF VASCULAR PLANTS IN A SMALL SCALE AREA? A CASE STUDY IN EAST AFRICAN RAIN FORESTS**

Katja Rembold<sup>1</sup>, Eberhard Fischer<sup>1</sup>

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With the objective of establishing an ex-situ conservation collection of vascular plants from East African rain forests, we first had to investigate the concerned species and assess their conservation status. Two model forests were selected which provide the full range from primary forest to young secondary forest under different anthropogenous and ecological pressures: Budongo Forest in Uganda and Kakamega Forest in Kenya. To find out which plant species occur in our study area in what abundance and under which conditions vegetation mapping was carried out along a disturbance gradient.

The IUCN provides an excellent classification scheme which is very useful to estimate the global conservation status of organisms. Considering a small scale area some points of the IUCN classification scheme lapse while others can be examined in more detail and new aspects can be included (e.g. ecological interactions between organisms). Basing on this field observations as well as literature data and information provided by the local people, we developed a small scale classification scheme which enables us to give evidence about the conservation status of each plant species in our forests.

**Parallel session, Thursday, 24 February, 16:30, Hall H IV:**

**Link for survival - Science and the conservation of tropical landscapes**

### **THE CUTTING EDGE OF SUSTAINABILITY: EXPLORATIONS OF AMPHIBIAN FUNCTIONAL DIVERSITY IN SELECTIVELY LOGGED SILVICULTURAL SYSTEMS OF THE GUIANA SHIELD**

Monique Hölting<sup>1</sup>, Raffael Ernst<sup>1</sup>

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The predominant use of tropical forest as a source for timber is causing high pressure on these complex ecosystems. Even though in the past Guyana, which harbours the anchor site of our study, has had among the lowest deforestation rates of the world, 13.5 of its approximately 15 million ha of rainforest is classified as state forest and thus potentially open to logging. Only little is known about the actual affect of logging on complex forest ecosystems and whether sustainable forestry can be an adequate strategy to mitigate possible negative impacts. Our study aims to fill that gap by resolving interactions between different levels of biodiversity and ecosystem functioning in a region that is subject to selective sustainable silviculture. We use amphibian communities as a suitable and sensitive organismic model that allows the analysis of diversity pattern changes at different levels.

The main study is being conducted within a controlled polycyclic timber harvesting scheme implemented by our project partner Iwokrama International Centre for Rainforest Conservation and Development under the auspices of Forest Stewardship Council (FSC). These circumstances put us into the exceptionally rare position of conducting true pre-and post impact studies that allow linking impacts, effects and underlying processes at the ecosystem functioning level in a direct manner. We hope to analyze anthropogenic drivers of amphibian diversity loss in the tropics in order to help improving conservation activities and harvesting guidelines of selective logging operations. The presentation provides insights into the first results of the field work conducted in 2009 and 2010.



## SPIDER SPECIES RICHNESS IN CACAO AGROFORESTRY SYSTEMS, COMPARING VERTICAL STRATA, LOCAL MANAGEMENT AND DISTANCE TO FOREST

Kathrin Stenchly<sup>1</sup>, Yann Clough<sup>1</sup>, Teja Tschardt<sup>1</sup>

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Naturally shaded cacao agroforestry systems provide various ecological niches within a complex, multistratum habitat. Spiders are abundant and diverse in these systems and may be economically important predators, but little is known on the determinants of spider communities in agroforests. We used data from twelve differently managed cacao agroforestry systems in Indonesia to investigate how the abundance, diversity and composition of spider communities of litter, herb and canopy layer are affected by local management (weeding, leaf litter remove) and landscape context (forest distance). Cacao tree canopies accommodated the most diverse spider assemblage, which was positively affected by the herbaceous species richness, a stratum-overlapping influence. On a community level, we found no effect of forest edge proximity on spider abundance or species richness, but species-specific responses showed that with distance to forest there seems to be a shift of species dominance in favour of generalists. The results showed an impact of all three spatial scales and suggest a focus beyond shade management is required to understand determinants of spider community in cocoa agroforestry systems.

## UNDERSTANDING IMPACTS OF FRAGMENTATION AND HUMAN DISTURBANCE ON TREE SPECIES COMMUNITY IN TROPICAL FOREST FRAGMENTS

Sandro Pütz<sup>1</sup>, Jürgen Groeneveld<sup>1</sup>, Luciana F. Alves<sup>2</sup>, Jean Paul Metzger<sup>3</sup>, Andreas Huth<sup>1</sup>

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Increasing demand for bio fuels may lead to even stronger human land use pressure in the tropics with the consequence of massive habitat destruction and following habitat fragmentation, for example within the Brazilian Atlantic Forest (Mata Atlântica), one of the biodiversity hot spots in the world. Already approximately 92% of the former Atlantic forest has disappeared within the last five centuries and the remaining forests are mostly highly fragmented.

However, fragmentation processes acting on structure and dynamics of tropical forest fragments are not the exclusive drivers, low intensive logging may act as factor, too. Combined impacts of different drivers may lead to an increasing complexity of the response of different tree species groups (plant functional types, PFTs) and thus challenge our understanding of fragmentation effects on tropical tree species communities on the long-term. Such challenges can ideally be tackled with simulation models.

We present the first simulation study of remnant and secondary tropical forest fragments taking fragmentation processes and human disturbance into account, gaining an improved understanding of how tree species in tropical forest fragments react both to fragmentation and human disturbances. We present simulation results analysing different intensity levels of human disturbances in combination with fragmentation processes using the individual based spatially explicit forest growth model FORMIND. We apply FORMIND with a plant functional type approach to the Brazilian Atlantic Forest at the study site Caucaia/Ibiuna at the Plateau of São Paulo.

Our results show that shade tolerant species groups will suffer strongly from the combined impact, intermediate shade tolerant and shade intolerant species groups show a hump-shaped response at different levels of human disturbance intensity. A significant fraction of these impacts occur during transient dynamics within the first 100 years. The strong impact on shade tolerant species groups may have serious consequences for tree species impoverishment and may lead to carbon loss in fragmented tropical forest landscapes both on larger spatial and temporal scales.

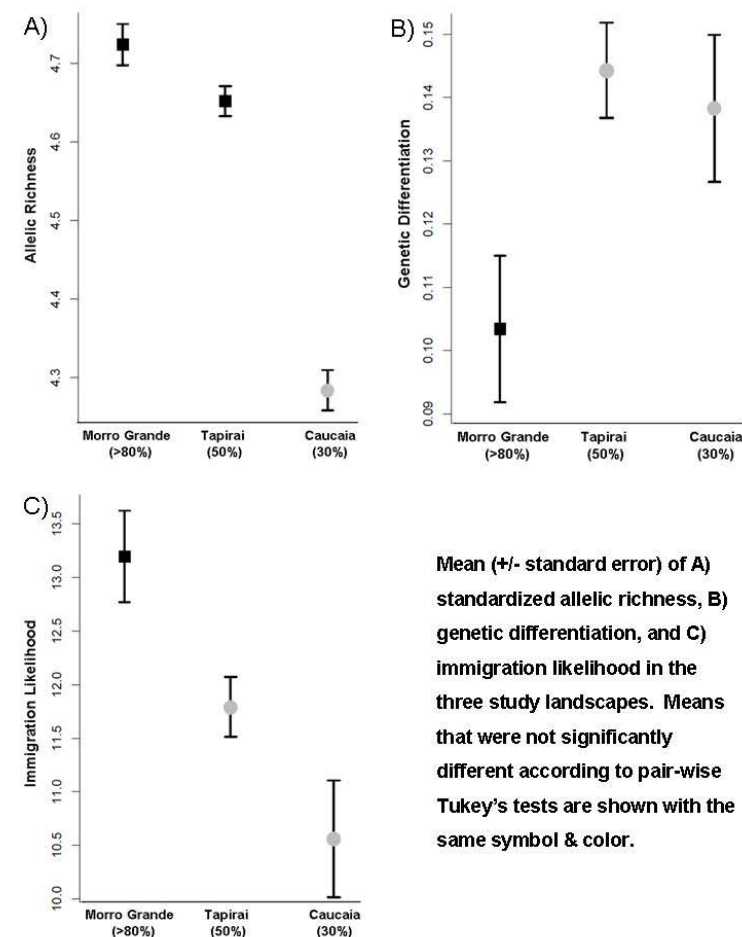


## HABITAT THRESHOLD EFFECTS ON GENETIC DIVERSITY AND DIFFERENTIATION: EMPIRICAL EVIDENCE FROM A SPECIALIST SPECIES IN THREE ATLANTIC FOREST LANDSCAPES

Niko Balkenhol<sup>1</sup>, Renata Pardini<sup>2</sup>, Cintia Cornelius<sup>2</sup>, Fabiano Fernandes<sup>1</sup>, Simone Sommer<sup>1</sup>

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Simulation studies and literature reviews suggest the existence of a fragmentation threshold, around 10-30% of remaining habitat, below which biodiversity loss is accelerated. Habitat thresholds could also affect different components of genetic variation, namely the amount of genetic variation (i.e., genetic diversity) and the distribution of genetic variation (i.e., genetic differentiation). Here, we provide the first test of habitat threshold effects on genetic variation. Specifically, we used 12 microsatellite markers to analyze 529 samples of *Marmosops incanus*, a small marsupial that is restricted to areas of native forest at both local and range-wide scales. Samples were gathered from three 10,000-ha landscapes differing only in the proportion of remaining forest (30, 50, and >80%). Using landscape- and patch-level analyses, we used this data set to address two interrelated questions: (1) Do genetic diversity, genetic differentiation and effective (i.e., genetic) immigration differ among landscapes with varying proportion of forest cover? (2) Does the importance of local patch characteristics in determining genetic diversity, differentiation and effective immigration vary among these landscapes? Congruent with our expectations, genetic diversity was significantly lower in the most deforested landscape (30% forest cover) compared to the two most forested landscapes. In contrast, genetic differentiation and effective migration did not differ between the 30% and 50% forest cover landscapes, while being significantly higher in the most forested landscape (> 80% forest cover). Finally, local patch characteristics explained genetic variation only in the most deforested landscape. Our study provides strong support for the existence of habitat threshold effects on genetic variation. Results demonstrate that different components of genetic variation respond to habitat loss at varying rates, and that local patch characteristics become increasingly important at higher levels of habitat loss. Furthermore, our study illustrates the utility of genetic estimates of migration rates to evaluate habitat loss effects on effective dispersal. These findings have important consequences for understanding landscape- and patch-level effects on genetic variation, and for conserving the most basic level of biodiversity in natural and human-altered tropical landscapes.



Mean (+/- standard error) of A) standardized allelic richness, B) genetic differentiation, and C) immigration likelihood in the three study landscapes. Means that were not significantly different according to pair-wise Tukey's tests are shown with the same symbol & color.



## ECONOMIC INCENTIVES FOR MITIGATING FRAGMENTATION AND EDGE-EFFECTS IN THE BRAZILIAN ATLANTIC FOREST

Florian Hartig<sup>1</sup>, Sandro Pütz<sup>1</sup>, Cristina Banks-Leite<sup>2</sup>, Andreas Huth<sup>1</sup>, Martin Drechsler<sup>1</sup>

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Habitat loss and fragmentation are the main causes of biodiversity loss in the Mata Atlântica region. Rainforest is still being lost at an alarming rate, but there is hope that forest protection laws and carbon sequestration initiatives such as REDD (Reducing Emissions from Deforestation and Degradation) will create incentives for preservation and reforestation in the future.

Practically all of these initiatives express their targets in terms of forest area within a larger region. However, area-based policies alone bear the danger of creating forest patches that are too small and too isolated to support important ecosystem functions.

In our contribution, we discuss how international forest protection initiatives such as REDD and national forest protection laws could be altered to consider not only total area, but also size and connectivity of forest fragments. We show evidence from theoretical and empirical studies that have examined the applicability of such structural incentives for conservation policy. We argue that the implementation of incentives that consider the spatial distribution of forest on a regional scale, together with prioritization of biodiversity hotspots on larger spatial scales, will maximize cobenefits between carbon sequestration, conservation, and other ecosystem services that arise from preserving the Atlantic Forest.



## SCIENTIFIC POSTER SESSION

**Wednesday, 23 February 2011, 16:30 – 18:00,  
foyer**

Posters are listed in alphabetical order of the first author. Unless otherwise stated, the first author is the person who will present the poster during the session.

Wednesday | 16:30 | Foyer



**Topic:** East African mountain forests: functional ecology and sustainable management

### REHABILITATION OF DEGRADED NATURAL FORESTS BY ENRICHMENT PLANTING OF FOUR NATIVE SPECIES IN ETHIOPIAN HIGHLANDS

Abebe G<sup>1</sup>, El Kateb H<sup>1</sup>, Fetene M<sup>1</sup>, Reinhard Mosandl<sup>1</sup>

<sup>1</sup>Technische Univ. München, Freising, DE, mosandl@forst.tu-muenchen.de

Presenter: Reinhard Mosandl

In the Munessa-Shashemene Forest in Ethiopia the survival, growth and photosynthetic performance of enrichment planting of four species (*Cordia africana*, *Juniperus procera*, *Prunus africana*, and *Podocarpus falcatus*) was investigated. Planting was undertaken in gaps in the degraded natural forest. Two years after planting, only 23% of the *C. africana* and *P. africana* seedlings had survived, while *J. procera* and *P. falcatus* showed higher survival rates of 76% and 47%, respectively. The development of the height over the first two-year observation period was reasonable for *J. procera* and *P. falcatus*. Inadequate height development was registered for *P. africana*, which was strongly affected by browsing and for *C. Africana*, which suffered from drought. *P. falcatus* exhibited the lowest photosynthesis and transpiration rates, which were associated with the highest water use efficiency of all the four species. Enrichment planting especially with *J. procera* and *P. falcatus* can be recommended to restore the degraded natural forests.

**Topic:** African savannas biodiversity - past, present, future

### MODELLING SPATIAL PATTERNS OF SAVANNAS IN CENTRAL AFRICAN REPUBLIC

Julie Aleman<sup>1</sup>

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Savannas are biomes where trees and grasses co-dominate. Woody cover is a determinant variable to define savanna type. Factors that determine the relative proportions of trees and grasses across the various savanna types are still under debate. Because savannas are one of the most sensitive ecosystems to future global changes, and known to have been so during the Holocene, we stress the need of a better understanding of the relationships between woody cover and those factors.

The aim of this study is to determine the functional relationships and the relative importance of several forcing factors (precipitation, soil properties and fire) in the distribution of woody cover in Central African savannas.

We used remote sensed data to determine the dependence of woody cover, expressed in LAI derived from MODIS product, to annual precipitation (Meteosat), soil properties (FAO data) and fire regimes (MODIS Burned Area product) using a statistical model.

Spatial modeling of vegetation will enable us to describe the functional relationships between woody cover, environmental forcing and anthropogenic pressure.

Moreover, applying this statistical model will enable us to predict vegetation changes over various scenario of climate and anthropogenic changes.

Free contribution

## EDGE EFFECTS ON THE DENSITY OF TREEFALL GAPS IN THE BRAZILIAN ATLANTIC FOREST

Walkiria Rejane Almeida<sup>1</sup>, Manoel Vieira de Araujo Jr.<sup>1</sup>, Elâine Maria Santos Ribeiro<sup>1</sup>, Inara Roberta Leal<sup>2</sup>

<sup>1</sup>PPGBV - UFPE, Recife, BR, [walreal@yahoo.com.br](mailto:walreal@yahoo.com.br), <sup>2</sup>Departamento de Botânica, UFPE, Recife, BR

We investigated the structure and density of treefall gaps with increasing distance from the forest edge towards the forest interior in a large remnant of the Atlantic Forest in northeastern Brazil. We hypothesized that due to edge effects, treefall gaps are (1) more frequent, (2) more recent, (3) smaller in size and adjacent canopy height, and (4) formed more often by uprooting and snap. Using the transect method (n = 24 transects, with surveyed area of 38 ha), we marked all treefall gaps we found with a GPS and measured their area, adjacent canopy height, age, and origin. The density of treefall gaps did not change with the distance from the forest edge ( $0.54 \pm 1.88$  to  $2.99 \pm 4.20$  treefall gaps/ha [lower to higher density];  $H = 8.86$ ;  $df = 11$ ;  $p = 0.58$ ), occurring uniformly in 12 different distance zones (0-50m, 50-100m, 100-150m, 150-200m, 200-250m, 250-300m, 300-350m, 350-400m, 400-450m, 450-500m, 500-550m and >550m). The disturbance regime was characterized by treefall gaps predominantly small (

Free contribution – invasive species

## ALIEN PLANTS IN ARID AREAS: THE CASE OF THE BRAZILIAN CAATINGA

Walkiria Rejane Almeida<sup>1</sup>, Ariadna Valentina Lopes<sup>2</sup>, Inara Roberta Leal<sup>2</sup>

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Introduction and spread of alien species are considered one of the main threats to biodiversity. Although a large body of literature exists on the impacts of plant invasion, as for the savannas in the Neotropics and northern Australia, the impacts of alien species in several other ecosystems is lacking. For instance, even the identity of alien plants in Caatinga, a semi-arid ecosystem in northeastern Brazil, has not been described. The goal of this study is to determine the exotic flora of the Caatinga, assess its taxonomic composition, as well as the history of invasion and the biological attributes of these species. A total of 213 alien plant species was recorded for Caatinga, distributed over 175 genera and 67 families. The families with the largest number of alien species were Fabaceae (38 species), Poaceae (35), and Asteraceae (16), accounting for 41.8% of all species; 38 families were represented by only one species, and 25 families by six species or less. The most speciose genera were *Urochloa* (7 species), *Mimosa* (4), *Crotalaria*, *Euphorbia*, *Sorghum*, and *Thunbergia* (3). About 39% of the species belonged to non-native genera in the Caatinga. Alien plant species in Caatinga originated from all continents, but the Old World accounted for 66.3%, with most species originating from Asia (33.5%) and Africa (22.8%). The most common biological attributes of alien plant species included (1) perennial herbs (57.3%), (2) pollination by bees (51.9%), (3) hermaphrodites (70%), (4) self-compatible (53.8%), (5) capsule fruits (24.4%), and (6) dispersal by animals (44%). In general, the most frequent vegetative and reproductive biological attributes among the exotic species appear to reflect the predominance of non-specialized strategies involved in ecological processes driving the dynamics of plant populations.



**Topic:** Link for survival - Science and the conservation of tropical landscapes

### DEPLETION OF FUNCTIONAL ATTRIBUTES IN TREE SEEDLING ASSEMBLAGES IN A FRAGMENTED TROPICAL RAIN FOREST

Wanessa Rejane Almeida<sup>1</sup>, Edgar Alberto do Espírito Santo Silva<sup>1</sup>, Felipe Pimentel Lopes de Melo<sup>2</sup>, Marcelo Tabarelli<sup>2</sup>

<sup>1</sup>PPGBV, Dep. Botânica, UFPE, Recife, BR, wanereal@yahoo.com.br,

<sup>2</sup>Departamento de Botânica, Universidade Federal de Pernambuco, Recife, BR

Forest fragmentation negatively affects tree regeneration in tropical rain forests by reducing seed germination, altering seed rain and increasing seedling mortality what leads to drastic changes in tree seedling assemblages. We carried out a study in a severely fragmented landscape of Brazilian northeast Atlantic forest to test if forest fragmentation can modified the structure, functional and taxonomical composition of tree seedling assemblages. Species richness and the proportion of species in nine functional groups were analyzed by sampling 3900 seedlings (10-50 cm tall), 100 in each of the 39 0.1-ha plots in two types of habitat: mature forest areas and small forest fragments (< 100 ha). The average and total species richness was higher in mature forest than in small fragments. However, our results indicate that this loss of species is not random. In small fragments, pioneer, vertebrate-dispersed, and medium-sized-seeded species showed an increase of 35.4%, 6.6%, and 27.1% in average proportion of species, respectively, and large-seeded species a decrease of 59.7%. In addition, our results suggest that these changes in functional composition resulted in a taxonomical divergence between small fragments and mature forest. We conclude that many old-growth forest species may not be able to regenerate in severely fragmented forest. Consequently, the future flora of small fragments tends to diverge in terms of functional and taxonomic composition in comparison with preserved mature forest areas.

**Topic:** Link for survival - Science and the conservation of tropical landscapes

### INCREASED DOMINANCE OF PIONEER SPECIES ACROSS TREE ONTOGENETIC STAGES IN A FRAGMENTED LANDSCAPE OF BRAZILIAN ATLANTIC FORESTS

Wanessa Rejane Almeida<sup>1</sup>, Felipe Pimentel Lopes de Melo<sup>2</sup>, Marcelo Tabarelli<sup>2</sup>

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Forest fragmentation affects leads to a non-random loss of tree species and forest remnants tend to retain only a limited subset of their original flora. Our study compared the seedling, sapling, and adult communities in terms of richness, functional groups and taxonomic composition. We aimed to evaluate whether the regenerating stand (i.e. seedling bank) is dominated by pioneers and small seeded species, and if there is any taxonomic differentiation among seedlings, saplings, and adults. We sampled seedlings (all individuals with less than 50 cm high, without evidence of vegetative propagation) and both adults and saplings (individuals with DBH  $\geq 2$  e  $\leq 5$  cm) were sampled in plots of 0.1 ha of 20 fragments between 3.4 and 91.1 ha, in a severely fragmented landscape of Brazilian northeast Atlantic forest. In a set of pairwise comparisons we found differences on species richness between seedlings and adults with the former being 27% lower than the later. We did not observed differences between seedlings and saplings, nor saplings and adults. Moreover, the seedling bank presented 10% more individuals and 11% more small-seeded species than the sapling pool. An ordination analysis identified a significant taxonomic differentiation between ontogenetic stages. Our results suggest that the regeneration pool points that this fragmented landscape tends to follow an alternative state of succession, impoverished in number of species and biased in functional and taxonomic composition when compared to later ontogenetic stages.



Free contribution – invasive species

## AN OVERVIEW OF INVASIVE ALIEN WEEDS IN INDIA

Daizy Rani Batish<sup>1</sup>

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Invasive alien plants pose a major threat to biodiversity and have homogenized the world flora. They change structure and composition of native ecosystems and cause economic loss. Upon entering (accidentally or purposefully), these species spread rapidly and form their own colonies at the cost of native species. Their spread in the alien ecosystems could be attributed to a set of traits such as fast growth rate, reproductive and regenerative potential and adaptability. In India, several invasive plants viz. *Parthenium hysterophorus*, *Lantana camara* and *Ageratum conyzoides*, *Leucaena leucocephala*, *Propolis juliflora* and *Broussonetia papyrifera* have made their abode. Their spread in the region has caused a number of environmental and economic implications for the local people. These can be seen growing luxuriantly in a variety of habitats like vacant areas, pastures, forests and forest edges and cultivated areas. A number of invasive weeds are reported from India. *Parthenium hysterophorus*, *Ageratum conyzoides*, *Eupatorium odoratum*, *Lantana camara* and *Mikania micrantha* are highly invasive and cause several problems in the invaded area including health hazards to human beings and livestock. There are many others which are rapidly spreading and establishing in different habitats. It is proposed to discuss the status of invasive plants in India with special reference to their origin, ecological harms and possible management options.

Free contribution

## THE GEOGRAPHY OF SPECIMEN SAMPLING: A CASE STUDY ON AFRICAN SPHINGID MOTHS

Liliana Ballesteros-Mejia<sup>1</sup>, Ian J. Kitching<sup>2</sup>, Jan Beck<sup>1</sup>

<sup>1</sup>*University of Basel, Department of Environmental Science (Biogeography Section), Basel, Switzerland; Email to jan.beck@unibas.ch;* <sup>2</sup>*The Natural History Museum, Department of Entomology*

Presenter: Jan Beck

**Abstract:** Most biodiversity studies rely on specimen records, but “presence-only” distribution data typically represents an idiosyncratic compilation of records. There are geographic biases in such data that may affect subsequent analyses. We aim to understand the factors determining the spatial distribution of the collection of species distribution data. We used a database on distributional records of African sphingid moths to quantify record availability. We fitted multivariate models to test which features affected the geography of sampling. Observed species richness in grid cells was strongly related to record numbers. Model results suggested that accessibility, tourism and population density were important predictors of record numbers. In contrast, we could not find strong effects due to the prevalence of violent conflicts, the presence of pristine nature, the protected status of regions, or the colonial history of regions. Our approach allowed understanding the main geographic biases in specimen sampling effort, and it can provide an a priori estimate of how well-sampled areas are.





**Topic:** The Andean biodiversity hotspot and its future: biodiversity, eco-system functioning and ecosystem services under environmental change

### CLIMATE CHANGE IN THE CENTRAL ANDES OF SOUTHERN ECUADOR – A MODELLING PERSPECTIVE

Jörg Bendix<sup>1</sup>, Katja Trachte<sup>1</sup>

<sup>1</sup>LCRS, University of Marburg, Marburg, DE, bendix@staff.uni-marburg.de

The Andes of Ecuador are one of the 'hottest' hotspots of vascular plant biodiversity and responds very sensitively to any changes in its ecological system. Forest clearing for conversion to agricultural land is the main threat to Ecuador's biodiversity. Within the DFG research unit 816 investigations of the interaction between biotic, abiotic and human factors provide a profound knowledge of the relevant ecosystem and its human users. In order to analyze features and processes of this ecosystem and to capture climate feedbacks on the land coverage and vice versa a coupled atmosphere-soil-vegetation model (Weather Research and Forecasting model and Community Land Model) is implemented. This model is also used to unveil the impacts of climate and land cover change on the regional climate of the ecosystem. The poster will present the concept and first results of the atmospheric component of the study, which will be discussed in the context of the environmental conditions of the target area.

**Topic:** African savannas biodiversity - past, present, future

### THE EVOLUTION OF SAVANNA GRASSES: A CASE STUDY ON THE EVOLUTIONARY HISTORY OF ANDROPOGONEAE

Gaelle Bocksberger<sup>1</sup>, Philippe Daget<sup>2</sup>, Marco Schmidt<sup>3</sup>, Jan Schnitzler<sup>1</sup>, Thomas Janssen<sup>4</sup>, Bernard Toutain<sup>2</sup>, Adjima Thombiano<sup>5</sup>, Georg Zizka<sup>4</sup>, Cyrille Châtelain<sup>6</sup>

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Grasses (Poaceae) are a dominant element of the African savanna vegetation, the tribe Andropogoneae typically being represented with high diversity and abundance. Given the importance of grasses in the savanna ecosystem, as a carbon sink, and livelihood product, it is crucial to understand their distribution, identify the underlying climatic factors and predict how their ranges might be altered by climate change. Moreover, the evolution of the savanna ecosystem is considered to be closely linked to that of grasses. We analysed a) patterns of grass diversity in West Africa, b) the relationship between the development of African savannas and the evolution of grasses, and c) the evolution of the ecological niche of selected Andropogoneae. Using a database including more than 250 grass species, we modelled spatial and temporal distribution patterns of Poaceae. Furthermore, combining a dated molecular phylogeny with species distribution modelling, we reconstruct the evolutionary history of Andropogoneae to better understand the drivers of the major grass expansion during the Miocene. Grass diversity was found to be highest in the Sudanian savanna regions, decreasing towards desert biomes and the Guinean zone, an area of markedly wetter climate. Our analysis of the distribution of selected tribes of Poaceae confirmed a higher diversity of Chlorideae in arid climates and the presence of Andropogoneae preferably in less arid regions.

Topic: The Andean biodiversity hotspot and its future

## CULTURAL KEY SPECIES FOR BIOCULTURAL CONSERVATION IN THE BOLIVIAN ANDES

Regine Brandt<sup>1</sup>, Stephan Rist<sup>2</sup>, Isabell Hensen<sup>1</sup>

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In biocultural conservation, the concept of Cultural Key Species (CKS) provides useful approaches for dialogues between local actors and ecologists aiming at balanced integration of use and conservation. The concept allows the human-environmental relationships to be understood and shows how cultural and biological diversity are linked. It supports the assessment of current patterns of land and resource use, which is of fundamental importance in agropastoral landscapes of the Bolivian Andes. CKS are characterized by high use values and have crucial socioeconomic and cultural roles. Depending on environmental and societal contexts, CKS vary according to human needs and their availabilities. Therefore, our case study focussed on woody species and addressed the following questions: Which are CKS of the area? Are CKS among the most abundant species? Which species' traits favour high use values of CKS?

The study was carried out in the peasants' community Tres Cruces (2800-3800 m a.s.l.) in Cochabamba, Bolivia. For data collection, vegetation surveys (n=42) and semi-structured interviews (individual n=10, group n=3, family n=9, transect walk n=2) were combined. For each species, their uses were grouped into 11 use categories. Use values (Relative Importance [RI]) were assessed and "apparency" (Importance Value [IV]) was estimated for each species using data of floristic composition. Data were analyzed using correlation and principal components analyses (PCA).

A total of 58 woody species were identified. The shrubby *Baccharis dracunculifolia* DC. and *Cestrum parqui* L'Hér were of highest importance (IV). The trees *Schinus molle* L. and *Eucalyptus globulus* Labill. were among the most useful (RI) species and thus considered as CKS within the local context. From an ecological perspective, exotic *Eucalyptus* spp. are controversial, but might be assessed within their interspecific relationships due to their negative but also positive effects on native threatened species (e.g. *Polylepis* spp.). Shown by correlation analysis, useful species were also among the most abundant plants. Availability of timber was determined by PCA as most important species' trait for high use values, which is in line with lacking timber and fuel wood accessibility in the area. Similarly, species' abundance was assessed to be crucial for determining CKS. In general, shrubs had lower use values than trees, but were shown to be more apparent and capable of being integrated into agropastoral land use.

Topic: The Andean biodiversity hotspot and its future

## COLLECTION AND USE OF FIELD SPECTRAL DATA FOR LAND COVER CHANGE DETECTION IN A TROPICAL MOUNTAIN FOREST

Giulia Curatola<sup>1</sup>

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The analysis of land use change of the past decades is fundamental for a deeper understanding of the natural and anthropogenic landscape dynamics in the southern Ecuador's tropical mountain forest ecosystem. Not only to clarify the past and present situation but also to estimate the future landscape development through predictive models. This information will be finally a powerful basis for the elaboration of sustainable land use options.

A time period of 35 years, from 1975 until 2010, will be studied using multitemporal satellite data. Particular attention will be dedicated to the spatial distribution of the Bracken fern (*Pteridium arachnoideum* and *Pteridium caudatum*) and to the deforestation process.

Preprocessing of individual satellite scenes is a fundamental step to prepare the images for information extraction. Accurate topographic and atmospheric corrections are essential to acquire precise ground surface reflectances. For this reason, a new physically based atmospheric and topographic program (AtToCor) was developed within the working group. After applying the correction algorithms using the AtToCor program and IDRISI Andes, visual comparison of the resulting images were made. The combination of the Sandmeier & Itten algorithm and the Teillet et al. c-correction yielded the best results.

For the classification phase, two different methods are going to be compared. Training sites extracted from the image are used in the first approach to create the land cover classes. However, this technique produces good results only if expert knowledge of the landscape characteristics is accessible. Therefore, it is extremely difficult to identify sampling sites in the old images where no land cover information is available. Following this method, it was not possible to classify the Bracken fern in the 1987 image. However, the forest pattern was clearly observable because it was visually recognizable. Further research using field spectral data is being performed to improve individual image classifications, to allow multitemporal spectral data comparison and to detect land use change in the study area.



Free contribution

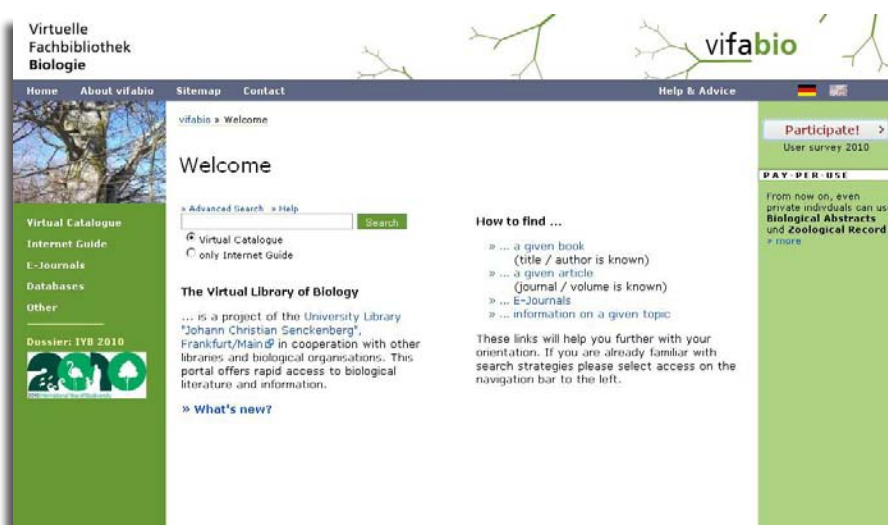
## THE VIRTUAL LIBRARY OF BIOLOGY (VIFABIO): SUBJECT PORTAL FOR BIODIVERSITY AND OTHER FACETS OF BIOLOGY

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The Virtual Library of Biology (vifabio, see [www.vifabio.de/?lang=en](http://www.vifabio.de/?lang=en)) combines high-quality scientific sources from libraries, article databases and the Internet. vifabio's goal is to cover biology in its entire breadth and to meet the different requirements of users demanding a good library service: not only molecular biologists who want to search the latest journals, but also taxonomists who require species descriptions from the 18th century, should be able to find what they need. The central element of vifabio is the Virtual Catalogue: multiple libraries and journal databases and the Internet Guide from vifabio can be searched with a single query. Links to the electronic journals library and delivery services simplify access to full-texts or hard copies. Modules like the Internet Guide or the Database Guide open up further research options. vifabio offers additional services such as lists of new titles and subject dossiers e.g. "Internet sources for the International Year of Biodiversity" ([www.vifabio.de/iyb2010/?lang=en](http://www.vifabio.de/iyb2010/?lang=en)).

vifabio is a project of the University Library, Frankfurt am Main (Germany), in conjunction with further libraries and biological organisations.



Free contribution

## SPATIO-TEMPORAL DYNAMICS OF SHIFTING CULTIVATION PRACTICES OF PEMON AMERINDIANS IN THE VENEZUELAN GUAYANA

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The Gran Sabana, in southeastern Venezuelan Guayana, is the home of the Pemon people, the biggest Amerindian group in Venezuela. Forests constitute their primary natural resource, as they are used for their shifting cultivation (SC) fields. However, little is known about their dynamics and impacts on biodiversity conservation. The goals of this study were: i) to quantify the spatial extent of SC among Pemon people in contrasting socio-ecological environments; ii) to re-construct the land cover changes associated with SC in the last 20 years; iii) to identify driving factors of land-cover changes and the spatial and temporal dynamics of SC; and, iv) to assess the impact of alternative practices / land uses. We used a time series of Landsat imagery, field surveys and semi-structured interviews to characterize SC. Land cover maps for each date were obtained using supervised classification, and change analysis techniques and landscape metrics employed to determine the magnitude and direction(s) of change. Statistical modeling allowed us to identify driving factors of the patterns observed. Our results show a general trend of increasing number of fields and a reduction of fallow period with increasing population. However, environmental constraints and new patterns of settlement are responsible for the non-increase in the forest areas used for SC, which determine a local dynamic of forest degradation and a regional one of forest stability when fire is not present. Until sustainable land uses are offered, all present alternatives imply a risk for forest conservation and the subsistence of Pemon people.

**Keywords:** Shifting cultivation, forest conservation, land cover change, Pemon Amerindian.



**Topic:** Tropical island biodiversity: magnitude, function and conservation

### ON THE SUNNY SIDE - EPIPHYTE ASSEMBLAGES OF DECIDUOUS AND EVERGREEN TREES IN A TROPICAL LOWLAND FOREST

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The stunning species diversity in the tropics has provoked the current debate on neutral vs. deterministic processes in ecology. Vascular epiphytes are a major component of this phytodiversity and current research tries to understand the underlying mechanisms. Here, we focus on a possibly deterministic effect of host tree phenology on epiphyte assemblages. During the 2010 dry season we conducted a quantitative study of epiphyte assemblages in four tree species on BCI, Panama. In this tropical lowland forest epiphytes on deciduous trees are exposed to much higher evaporation and radiation in the host's leafless phase. We found significantly lower species richness for deciduous *Pseudobombax septenatum* compared to evergreen *Anacardium excelsum* and *Brosimum alicastrum* and semi-deciduous *Ceiba pentandra*, whereas the CAM-epiphytes' proportion was lowest in *Anacardium*. Moreover, there was intraspecific variation: common epiphytes had significantly lower  $\delta^{13}C$  values in *Anacardium* than individuals in the other trees. The differentiation of epiphyte assemblages on deciduous and evergreen trees at the intra and interspecific level will be further analysed by growth measurements in 2011.

**Topic:** Tropical ecologists at work: where and how to find a job

### REQUIREMENTS FOR THE PRIVATE CONSULTANCY JOB MARKET - A FIRST HAND DAILY EXPERIENCE REPORT

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To provide best possible services and convince clients in the tender competition, suitable short- and long-term junior and senior consultants with a project-related technical and regional expertise are required.

Based on practical examples, we will provide a first hand inside look in the daily business of consultancy head hunting and elucidate the requirements and chances for a successful consultant career for tropical ecologists and scientists in related fields.



**Topic:** Ecological networks and ecosystem functioning

## **GEOLOGICAL SUBSTRATE DETERMINES TREE SPECIES AND TRAIT DISTRIBUTIONS IN AFRICAN TROPICAL MOIST FORESTS**

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Presenter: Delicia Rayda Pino Garay

The EU-funded project CoForChange1 aims at predicting the fate of African tropical moist forests under conditions of global change. A prerequisite for such predictions is understanding the factors shaping tree species distribution under past and current conditions. In this study we aimed at identifying the determinants of species distribution patterns at large spatial scales in the semi-evergreen forests of Central Africa and at testing whether tree species with similar distribution patterns share similar functional traits due to environmental filtering. We analyzed the distribution patterns of 31 common tree species in an area of more than 700,000 km<sup>2</sup> covering the Central African Republic, Cameroon and the Republic of Congo based on forest inventory data for trees  $\geq 30$  cm in diameter in 56,445 0.5-ha plots. Spatial variation of environmental factors pertaining to climate, geology, topography and disturbance were quantified from maps and satellite records. Four key functional traits of tropical tree species were calculated or extracted from the literature: maximum growth rate, wood density, leaf phenology and shade tolerance. The geological substrate turned out to be of preeminent importance in shaping species distribution patterns. Two contrasting species groups emerged: absent on sandstone, and those reaching high abundance on sandstone. Species associated with sandstone showed a suite of functional traits indicative of a strategy of efficient resource conservation: they had slower growth rates, higher wood density and more evergreen leaf phenology, and higher shade tolerance than species on other substrates. These results are consistent with the hypothesis that tree distribution is determined by species tolerance to low soil resource availability (nutrients and/or water) on sandy soils. Additionally, past human disturbance (slash and burn agriculture) concentrating on resource-rich soils may have

contributed to the observed patterns of species and trait distributions in the region. Experiments will be required to disentangle the effects of species-specific resource requirements for nutrients and/or water, from that of past human disturbances on patterns of species and trait distributions in African moist forests.

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**Topic:** Link for survival - Science and the conservation of tropical landscapes

**SPECIATION IN THE NEOTROPICAL GIANT DAMSELFLY  
MEGALOPREPUS CAERULATUS REFLECTS FOREST FRAGMENTATION  
(PSEUDOSTIGMATIDAE: ODONATA)**

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Increasing fragmentation rates of tropical forests disturb ecological dynamics and result in loss of biological and genetic diversity. Odonates, which are sensitive indicator organisms, face the destruction of tropical forests as probably the most important threat (Kalkman et al. 2008). Due to their complex life cycle and specific habitat preferences odonates come to know an increasing importance for measuring environmental health and identifying driving factors controlling biodiversity. *Megaloprepus caerulatus* the world's largest damselfly is widespread in the Neotropics from the South of Mexico to Bolivia (Davies & Tobin 1984, Finke & Hedström 2008). It is highly restricted to primary forests and old grown secondary forests, which provide water filled tree holes needed for reproduction. Females exclusively oviposit in water filled tree holes, which are defended by males. The size and the density of these microhabitats ultimately affect larval abundance and survivorship (Fincke 2006) resulting in changes in population size and structure. We used two mitochondrial sequence marker (ND1 and 16S rDNA) and microsatellites to analyze the population structure and diversities between populations covering the northern range of *M. caerulatus* between Mexico and Panama. High sequence divergences and an absence of gene flow indicate complete separation of all populations studied. Our results suggest ongoing speciation processes within the genus *Megaloprepus* probably driven by ongoing fragmentation of their forest habitats. Genetic distances at the species level suggest that the *Megaloprepus caerulatus* is not a single species rather than a group of at least three species. Our data illustrate the impact of tropical rainforest fragmentation on genetic isolation of a habitat specialized species and demonstrate how important it is to evaluate genetic diversities of indicator species. Together with general monitoring data the knowledge about conservation genetic parameters allow to propose refined conservation decisions in tropical forests.

**Topic:** Hotspot Wallacea: Understanding the past to save the future

**POLLINATION MODES IN THE PIONEER TREE GENUS MACARANGA  
IN MALAYSIAN RAINFORESTS**

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Many species of *Macaranga* (Euphorbiaceae) are fast-growing pioneer trees with an important role in early succession in SE Asian rainforests. The genus is involved in diverse types of biotic interactions and it has therefore been a model system for studying mutualistic associations. Despite its ecological importance little was yet known about its reproductive biology. A comparative study in the genus *Macaranga* in Sundaland revealed specific flower characteristics and brood-site pollination systems in many species: enclosed inflorescence morphologies with narrow entrances strongly restrict the set of potential flower visitors. Different species of thrips were the most abundant insects in 20 of the 26 investigated *Macaranga* species and heteropterans dominated three species. They use the flower chambers as breeding sites and feed on nectar-producing trichomes inside the bracteoles. Both insect groups contribute to pollination, and different plant sections appear to be isolated by different specific pollinators. Thrips pollination and myrmecophyly often occurred in the same clades. The development of enclosed flowers might have facilitated tight ant-plant interactions and prevent ant-pollinator conflicts. Due to the ability for explosive population increase, the pollination by thrips can be of advantage for pioneer trees such as *Macaranga*. Due to ongoing anthropogenic destruction it has become one of the most abundant tree genera in disturbed Malaysian rainforests. However, the complex ecosystems in which the mutualistic systems evolved are rapidly changed with unknown consequences for these specific interactions.



Free contribution

## THE LICHEN DIVERSITY OF MADAGASCAR – REPORT OF AN ONGOING PROJECT

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Madagascar harbours a very rich and diverse angiosperm flora with more than 10.000 species estimated. Approximately 80% of this flora is considered to be endemic. This contrasts sharply to the lichen flora where actually 368 species are recorded and only 5 endemics are known up to now. Recent field work, however, showed that the lichen flora is poorly known. Prospection of different biomes, e.g. montane rainforests, rock outcrops and coastal sand dunes, revealed numerous new records for the island. Amongst others, at least 3 new species were discovered. Most of the new records, however, comprise widespread species not confined to Madagascar. Thus, endemism is most probably much lower than in vascular plants. The centres of diversity for lichens in Madagascar do not correspond with those of the higher plants. As an example, the Didiereaceae-forests around Toliara are a hotspot for endemic angiosperms while the lichen flora is rather species poor. Important areas for lichen diversity are situated in the montane rainforests where urgent conservation measures are needed. Another area that proved to be very rich in lichens are the coastal sands east of Taolanaro. Here even a genus new to science could be recorded. This region is highly endangered by mining and fire. The aim of our project is to highlight the important areas for lichen conservation and to provide a field guide as a tool for identification.

**Topic:** East African mountain forests: functional ecology and sustainable management

## RESPONSE OF A KEY AGROFORESTRY SPECIES *SCLEROCARYA BIRREA* TO CLIMATE VARIABILITY IN EAST AND WEST AFRICA: DETECTED FROM STABLE CARBON AND OXYGEN ISOTOPES IN TREE RINGS

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Since instrumental climate data are scarce or of rather short duration in vast areas of Africa, the range of natural climate variability and the range of tree species tolerance to climatic extremes is not known. As part of the projects "Adaptation of land use to climate change in Sub-Saharan Africa (ALUCCSA) and "Resilient Agro-landscapes to Climate Change in Tanzania (ReACCT)" we have explored the potential of stable isotopes in tree rings as climate proxies and adaptations of key agroforestry species from East to West Africa, respectively. Stable carbon ( $\delta^{13}\text{C}$ ) and oxygen ( $\delta^{18}\text{O}$ ) mean values in tree rings of *Sclerocarya birrea* showed similar inter-annual patterns with significant positive correlations ( $r=0.53$ ). In general, both  $\delta^{13}\text{C}$  and  $\delta^{18}\text{O}$  show negative correlations with rainfall, relative humidity and PDSI (Palmer Drought Sensitivity Index). On the contrary, they are positively correlated with sunshine hours, maximum temperature and evaporation. The results will help to establish large-scale correlation patterns between tree growth and sea-surface temperatures in order to understand climate changes in Africa and its impacts.



Free contribution

# **LIVING DOWN THE TUBE: ROOSTING CONDITIONS AND BEHAVIORAL ADAPTATIONS OF THE SPIX'S DISK-WINGED BAT *THYROPTERA TRICOLOR***

Inga Geipel<sup>1</sup>, Melanie Mangold<sup>1</sup>, Elisabeth K. V. Kalko<sup>1,2</sup><sup>1</sup>*Institute of Experimental Ecology, University of Ulm, Albert Einstein Allee 11, 89069 Ulm, Germany, inga.geipel@uni-ulm.de; melanie\_mangold\_33@yahoo.de;*<sup>2</sup>*Smithsonian Tropical Research Institute, Balboa, Panamá, elisabeth.kalko@uni-ulm.de*

Availability of suitable shelters is one of the most important factors for the survival of animals, as they protect the animals from predators, contribute to thermoregulation and serve as nurseries. Bats, in particular in the tropics, use a wide range of different roosts. One of the highest specializations to roosting sites is found in the Disk-Winged bat *Thyroptera tricolor*. This species uses unfurled leaves of certain plants, e.g., *Heliconia* sp. and *Calathea* sp. as shelters. The freshly produced leaves form tubes which unfurl during the leaf development and lose their protecting properties for the roosting bats. Since the plants grow scattered in the dense understory of tropical rainforests and irregularly produce new leaves, the bats are continuously forced to search and find new, adequate roosts. Here, we present data to demonstrate that suitable roosts can constitute a limiting factor for *T. tricolor* in the forest on Barro Colorado Island, Panamá. Continuous monitoring of leaf development shows that roosting duration in a natural, unfurled leaf is determined by the unfurling process happening within 24 h. In an experiment with artificial tubes we revealed that the roosting duration of the bats is significantly increased if the leaf tubes stay unfurled. *T. tricolor* shows two activity peaks during the night in which the bats use high frequency, broadband echolocation calls to evaluate previously found leaf tubes as possible roosts.

Merian Award Winner 2011

Topic: Hotspot Wallacea

# **PHYLOGEOGRAPHY OF TWO TROPICAL PIONEER TREE SPECIES, *MACARANGA GIGANTEA* AND *M. PEARSONII* (EUPHORBIACEAE)**

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Phylogeography of two tropical pioneer tree species, *Macaranga gigantea* and *M. pearsonii* (Euphorbiaceae). *Macaranga* (Euphorbiaceae) has received much ecological and evolutionary research attention as a genus that includes some of the most conspicuous pioneer trees of Southeast Asian tropical rainforests and because of its manifold associations with ants, including about 30 species that are obligate ant-plants (*myrmecophytes*). We used sequence data from three chloroplast DNA loci (*ccmp5*, *ccmp6*, *atpB-rbcL*) to assess phylogeographical patterns in species of section *Pruinosae*, sampled from various regions of Borneo and the Malay Peninsula. Forty-one haplotypes were species-specific, whereas eight haplotypes were shared by two, three or four species and occupied internal positions in a parsimony network. The non-myrmecophytic *M. gigantea* and the ant-associated *M. pearsonii* have overlapping distributions in northern and eastern Borneo. A comparison of GST and NST values revealed a strong phylogeographic structure in both species, whereas colonization pathways suggested by the network topology were different. In the widespread species *M. gigantea* identical or closely related haplotypes occurred in East Kalimantan and on the Malay Peninsula. This pattern most likely originated from migration across land connections between Borneo and the mainland during cold periods with low sea levels during the Plio- and/or Pleistocene. The central mountain range in Borneo forms an intraspecific barrier both in *M. gigantea* and *M. pearsonii*, with eastern and western haplotypes clearly differentiated from each other, suggesting long-term independent evolution. Myrmecophytes need a suitable partner ant to establish a new population at a remote site, whereas in non-myrmecophytes the successful recruitment is mainly restricted by seed dispersal efficiency. We found, however, no obvious indications for a strong influence of the symbiotic ant partners on the population structure of their host plants.



Free contribution

## REVISION OF ORIENTAL MONOLEPTA AND RELATED GROUPS OF LEAF BEETLES

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We have revised the taxonomy of Oriental Monolepta and related taxa, one of the most species-rich groups of leaf beetles (*Chrysomelidae*). Up to now 259 species are described for the oriental fauna. With very few exceptions, the descriptions by preceding authors have been based on external characters only, and this group was up to now not revised. On base of 18,000 museum specimens and further newly collected material, in particular from Malaysia, a revision was started two years ago. Intensive studies on genital structures has resulted several taxonomic changes and new phylogenetical relationships. An example is *Ochralea*, a genus that been synonymised with *Monolepta* since 1924, but could be found as distinct group of galerucines and restricted to the Oriental Region. As well as the genus *Arcastes* that possess very peculiar genitalic structures, is an endemic to South-East Asia. The studies on *Monolepta* are ongoing, and additional to the high number of described species many new taxa could be found. Next to descriptions of the taxa, including illustrations of external and genital characters, geographical distribution are compiled in maps, and identification keys are provided. The primary type specimens are photographed, and an electronic type catalogue will be available by the internet.

**Topic:** The Andean biodiversity hotspot and its future: biodiversity, ecosystem functioning and ecosystem services under environmental change

## ARBUSCULAR MYCORRHIZAL COMMUNITIES OF CEDRELA SEEDLINGS AND TREES IN REFORESTATION PLOTS AND PRISTINE FOREST

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Mycorrhizas of *Cedrela* sp. were sampled on different sites in the Rio San Francisco valley in Southern Ecuador. Planted seven years old seedlings were sampled on three different successional stages of abandoned pastures and in a gap of a pine forest; mycorrhizas of planted and naturally regenerated seedlings were collected in the pristine forest. Old growth forest trees were sampled on the pasture site and in the pristine forest. The arbuscular mycorrhizal communities at the different sites was investigated with molecular methods and compared with former results, which showed different communities in reforestation plots and pristine forest.



**Topic:** Biodiversity & economy

# **FOR FREE, STILL AVAILABLE - BUT THREATENED: THE ECONOMIC CONTRIBUTION OF SAVANNA WOODLANDS TO RURAL LIVELIHOODS IN NORTHERN BENIN**

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As provisioning ecosystem services of Westafrican savannas non-timber forest products (NTFPs) make a significant contribution to household income in rural African communities. Undertaking a livelihood approach focussing on multi-purpose useful plants our study aims to identify their respective share in a household's total income in order to elicit the strong interrelation between local natural resource use and livelihood maintenance. We interviewed a total of 230 households across five different ethnic groups (Fulani, Ditammari, Yom, Kabié and Bariba) in two villages in Northern Benin, Papatia and Chabi-Couma. Coevally, data on the economic value of the studied NTFPs was gathered by conducting market surveys as well as applying participatory rural appraisal techniques. At present we are applying simple choice experiments due to investigate individual preferences concerning both direct use values and cultural / spiritual values of the studied plant species and ecosystem services, respectively. The results of the livelihood approach reveal the unquestionably high economic importance of biodiversity provided by savannas: 39 % of a household's total income is generated by NTFPs. Up to now, this existential value of savanna woodlands has been largely disregarded by local policy-makers and landowners deciding whether to shift long-standing forest into agricultural land or . Findings will be used to assist with appropriate decision making.

**Topic:** The Andean biodiversity hotspot and its future

# **THE VARIATION OF WOOD SPECIFIC GRAVITY AND ABOVEGROUND BIOMASS ALONG GRADIENTS OF TOPOGRAPHY AND ELEVATION IN THE ANDES OF SOUTHERN ECUADOR**

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Wood specific gravity (WSG) is a key plant functional trait and an important variable for aboveground tree biomass (AGB) and carbon stock estimation. Knowledge about spatial patterns of WSG and its environmental constraints in tropical mountain forests is comparatively scarce, especially when it comes to the ef

ects of elevation and topography. Moreover, the answer to the question whether gradients in WSG influence spatial patterns of AGB remains uncertain. In this study, altitudinal and topographical gradients in AGB and WSG were assessed in a tropical mountain forest ecosystem in southern Ecuador. For this purpose, a total of 1769 trees in 54 permanent sample plots along environmental gradients were censused and WSG was

measured using a Pilodyn 6J wood tester. The obtained data were used to estimate AGB using allometric models from Chave et al. (2005) both with and without tree height as a predictive variable. WSG was found to increase significantly upslope by an average of 9,3 %, but did not show altitudinal gradients. If computed with tree height, AGB decreased significantly both upslope and with elevation. AGB on lower slopes in the average was 95,8 % bigger than on upper slopes and decreased more than 1.5-fold with increasing altitude from a mean of 288.9 t/ha at approx. 1000 m a.s.l. to 112.3 t/ha at approx. 3000 m a.s.l.. If computed without tree height, AGB was found to be lowest at intermediate elevations, and AGB results were systematically higher.

A possible explanation for the upslope decrease in WSG are reduced growth rates induced by nutrient limitation. The reason for the gradients in AGB is most likely the altitudinal and upslope decrease in tree height in the study area which in former studies has been related to nutrient limitation as well. Given the enormous altitudinal decrease of tree height in tropical mountain forests, performance of allometric models which do not use tree height as a predictive variable was found to be poor. The observed gradients in WSG could not predict the patterns in AGB, in contrast, AGB was found to be highest in sites with low WSG.





**Topic:** The Andean biodiversity hotspot and its future: biodiversity, ecosystem functioning and ecosystem services under environmental change

### A HOLOCENE POLLEN-RECORD REFLECTING VEGETATION, CLIMATE, AND FIRE VARIABILITY IN A HIGH-ALTITUDINAL ECOSYSTEM OF THE SOUTH ECUADORIAN ANDES

Nele Jantz<sup>1</sup>, Hermann Behling<sup>1</sup>

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The region of southern Ecuador is known to be a hot spot of biodiversity. However, little is known about paleoecological conditions that led to the development of this species richness. Pollen analysis can be a useful tool to help shed light on past vegetation, climate, and fire dynamics to give valuable information for future conservation strategies in the region.

Holocene environmental changes are reconstructed from the core "Tres Lagunas" (03°02'S, 79°14'W), situated in a bog at an elevation of 3788m. Important facts can be obtained from the record about local vegetation changes and the dynamics of neighbouring areas with upper and lower mountain rainforest and páramo, as well as the anthropogenic impact in the region. Furthermore, multivariable analyses provide insights into the development of biodiversity in the northern Andes throughout time.



**Topic:** African savannas biodiversity - past, present, future

### DEMOGRAPHIC PERFORMANCE OF WOODY PLANTS IN SEMI-ARID SAVANNAS UNDER HUMAN IMPACT IN NORTHERN BENIN

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The utilisation of timber and non-timber forest products for several applications has a central position in everyday life in West Africa. People harvest indigenous species around their settlements mainly on fallows or in savannas which are not well suited for agriculture. These habitats are decreasing as the landscape is continuously transformed due to the cultivation of cash crops, especially cotton. The consequence is overexploitation of resources in harvesting sites and we presume a shift in population age structures of trees and shrubs. Thus, we investigated the diversity and demographic performance of woody plant species to estimate their potential to survive in the long run under the given environmental conditions. We explored population structures on 1800 m<sup>2</sup> by measuring diameter in breast height (dbh) and height of all individuals above 5 cm in dbh. We monitored regeneration on permanent plots in different vegetation units. Diameter size class distribution of woody plant species was analyzed for several species and tested between vegetation units.

Most of the species exhibited a more or less healthy regeneration. However, there are noticeable differences in distribution for some species in larger diameter classes. Especially large, single-trunked trees showed a quite similar number of individuals in each diameter class over the pole stage. Most of the shrubs and treelets showed the more classical J-shaped decline in size classes above 8 cm in diameter. In regard to size class distribution performance in different habitats there was a high amount of species where no significant difference between vegetation units was found. A small group of species performed differently due to ecological preferences to habitat conditions. Tree species seemed more sensitive to disturbances by shifts in population age structures than shrubs and treelets. The study provides basics for management actions for more sustainable use of woody plant species in high disturbed settled areas.



Free contribution – invasive species

## THE NATURE OF INTERFERENCE OF TROPICAL INVASIVE WEED AGERATUM CONYZOIDES: ROLE OF ALLELOPATHY

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*Ageratum conyzoides* (Billy goat weed; family Asteraceae) is an invasive, annual, aromatic weed from tropical America that has spread into various tropical and sub-tropical regions of China, Japan, Korea and India. In India, it is one of the serious weeds in northwestern Shivalik hills (India) where it has invaded pastures, plantations, forests and arable land and has formed monospecific strands. Its invasion has severely affected the structure and dynamics of natural communities and severely affects the growth and yield of crop plants. Though allelopathy is speculated to play an important role in its successful colonization, yet very little is known about the nature and mechanism of its interference that leads to drastic reduction in growth and yield of crops. With this objective a series of studies were planned involving rhizosphere soil and soils amended with *A. conyzoides* and their impact was studied on the growth and development of crop plants. It was observed that early growth of radish and mustard was significantly reduced in *A. conyzoides* rhizosphere and amended soil. These soils were found to be rich in phenolics – the known phytotoxins, often implicated in allelopathy. Presence of significantly higher amounts of phenolics in all amended soils indicates their possible involvement in the growth inhibitory effects and their possible interaction with soil chemical properties. Further, in order to establish the nature and mechanism of interference of *A. conyzoides*, whether phenolics affect the plant growth directly or indirectly, the amended soils were analyzed for available nutrient. The pH of all the amended soils decreased whereas conductivity, organic carbon and organic matter increased compared to the unamended soils. A strong correlation was obtained between phenolics and various soil properties. The study concludes that *A. conyzoides* negatively affects the establishment of associated species through chemical-mediated interference, and alterations in soil nutrient availability.

Free contribution – invasive species

## AN ASSESSMENT OF THE SPREAD OF WOODY INVASIVE SPECIES BROUSSONETIA PAPYRIFERA ON THE STRUCTURE AND COMPOSITION OF NATIVE VEGETATION IN NORTHWESTERN INDIA

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*Broussonetia papyrifera*, commonly known as Paper Mulberry tree (family Moraceae), is a deciduous tree native of China. It has now been introduced to various other parts of the world, primarily for paper, shade and ornamental purposes. However, it has been found to spread very fast at the expense of native vegetation. Due to its aggressive nature, it has now formed monotypic stands in forest fringes and wastelands, and has even spread along roadsides. It is a dioecious tree with separate male and female flowers and has an efficient seed dispersal mechanism. Additionally, the plant has an excellent mechanism of vegetative propagation through root suckers, from where new shoots arise. We conducted a survey-based study in the forest areas in and around Chandigarh (North India) to assess the impact of *B. papyrifera* on the structural composition of the vegetation. It was observed that the tree severely affects the richness, density, biomass and diversity of the vegetation in the invaded areas compared to uninvaded areas. Species diversity measured in terms of Shannon-Weaver Index and Margalef's richness Index was drastically reduced in invaded areas. In contrast, invaded areas had a higher rate of dominance, largely dominated by *B. papyrifera*. The present paper discusses the impact of tropical invasive perennial *B. papyrifera* on the forest health, and sustainability in terms of ground vegetation and soil chemistry.



Free contribution

## GALLERY FORESTS IN WEST AFRICA - REFUGIA DURING CLIMATE OSCILLATIONS

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Gallery forests form diversity "islands" in the West African savanna region and are assumed to have served as diversity and repopulation centres during climate oscillations in the Cenozoic.

Gallery forests were sampled along a climatic gradient from the Sahelian zone to the South Sudanian Zone in Burkina Faso. Plant material from both, typical gallery forest species like *Paullinia pinnata*, *Cola laurifolia*, *Berlinia grandiflora* und *Pterocarpus santalinoides* and more widespread species like *Anogeissus leiocarpa*, *Diospyros mespiliformis* and *Tamarindus indica* was collected.

The genetic diversity within the species was analysed using AFLP data to investigate various populations along the transect. The population structure and the genetic variation are then correlated to the geographic distribution and discussed in the light of past climate and vegetation changes in the region.

**Topic:** Hotspot Wallacea: Understanding the past to save the future

## PATHWAYS FOR FRESHWATER FAUNA INTO WALLACEA

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Presenter: Bruno Streit

Most islands that comprise the biogeographic region of Wallacea never had terrestrial contact with neighbouring Southeast Asian and Australian continental shelves. This poses the question where, how, and when freshwater organisms colonised Wallacea. One completely freshwater adapted group, lacking any marine planctonic larvae, are freshwater crabs of the family Gecarcinucidae. Based on molecular phylogenetic data of the Gecarcinucidae and fossil calibrated molecular clock estimates, we show that this group entered Wallacea during the Miocene several times independently. At least two different biogeographic dispersal pathways can be identified: (5) from the Sunda shelf to Sulawesi and (2) from the Philippines to the Moluccas. Possibly, gecarcinucid crabs were able to surmount shorter marine passages, using islands as stepping stones.



Free contribution

### **BOTANICAL AND FIRST ZOOLOGICAL STUDIES OF DESICCATION-TOLERANT, MAT-FORMING MONOCOTS ON INSELBERGS IN IVORY COAST**

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The Cyperaceae *Afrotrilepis pilosa* is a desiccation-tolerant, mat-forming species that frequently colonizes West African inselbergs. Combined botanical and zoological research was carried out to measure, for the first time, the growth rate of individuals and to make an inventory of arthropods living in the mats in Ivory Coast. On the botanical side, a growth rate of up to 37 cm per leaf was detected over a period of three months. A high seasonal leaf turn-over was found as outer leaves were shed very quickly. On the zoological side, a shift in species dominance and distribution between the drier savanna regions and the wetter rain forest zone was apparent. Several ant species (Formicidae) were abundant in all zones; millipedes were very common in the rain forest zone. Outside *A. pilosa* mats an exceedingly high rate of termites (up to 10 species) were identified in a relatively small area (i.e. one inselberg), which is very rare in other terrestrial ecosystems.

Free contribution

### **FUNGAL BIODIVERSITY IN SOUTH-WESTERN CHINA**

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In the South-West of PR China one of the biodiversity hotspots of the world is located. Therefore the region of three parallel rivers was declared as a world heritage. The province Yunnan is extraordinarily rich in species of Agaricales (agarics). Higher fungi with colourful fruit-bodies in various forms were collected in biotops with diverse ecology from lowland tropical and subtropical forests up to alpine meadows. The complex topography and geography combined with highly variable climate, luxuriant vegetation, and other environmental and biological factors provide a wide variety of favourable niches for the growth and reproduction of higher fungi. To date, more than 3000 species belonging to about 1000 genera of higher fungi have been reported from Yunnan. In our Sino-German cooperative mycological project (University of Marburg and Kunming Institute of Botany KIB) we started to study the still insufficient investigated  $\alpha$ -taxonomy of Yunnan agaric Basidiomycota and their phylogeographic relationships. Pantropic distributed fungi could be found in the tropical regions of Yunnan as well as some species, which are endemic in the tropical Asia. Although this region is actually protected by law, key habitats are still threatened by intensively logging, mining and farming.



**Topic:** East African mountain forests: functional ecology and sustainable management

### DO TROPICAL EVERGREEN CONIFER TREES GROW CONTINUOUSLY? - INTERCONTINENTAL COMPARISON OF PODOCARPACEAE FAMILY

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The evergreen conifer family Podocarpaceae occurs under varying tropical climate conditions. We compare the impact of climate seasonality on growth dynamics of indigenous Ethiopian *Podocarpus falcatus* and Ecuadorian *Prumnopitys montana*, both occurring in tropical montane forests. Microscopic thin sections of microcores of the outermost centimetre of the tree stem and dendrometer data were used to analyze cambial activity. Samples of *P. falcatus* could be correlated to the bimodal, but highly variable rainfall pattern at the Ethiopian study site. We found that *P. falcatus* shows a period of cambial dormancy during the dry season, however it is able to interrupt its dormancy during sufficient rain events. Juvenile *P. falcatus* trees have a straight stem, but over the years parts of the cambium are inactivated inducing a lobate growth form leading to wedging and missing rings. For better understanding of tree growth changes during the biography of *P. falcatus*, we tried to reconstruct the growth history of a fallen tree. Counting of visible tree-ring boundaries and probably annually formed wood density variations on stem disks and increment cores indicate tree ages of around 450 years, which is verified by radiocarbon dating.

In contrast to the seasonal climate in the Ethiopian study area, climate in the Ecuadorian mountain forest is humid all around the year, however, occasional dry periods may occur during September to November ('veranillo del Niño'). These dry spells initiate growth interruptions in *Prumnopitys montana* indicated by stem shrinkage. As shown by wood anatomy, the formation of density bands is associated with dry weather conditions. We conclude that growth activity of both Podocarpaceae species in the two study regions is directly controlled by moisture availability, and plant internal processes seem to play a minor role for growth dynamics.

**Topic:** The Andean biodiversity hotspot and its future: biodiversity, ecosystem functioning and ecosystem services under environmental change

### CHARACTERISATION OF SOME NATIVE ARBUSCULAR MYCORRHIZAL (AM) FUNGI FORMING SYMBIOSES WITH TREES NATIVE TO SOUTH ECUADOR

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In former studies of the Ecuadorian mountain rainforest in the Reserva Biológica de San Francisco (research area of the DFG RU402 and RU816) it was shown, that uncharacterized arbuscular mycorrhizal fungi (AMF, Glomeromycota) from the considered ecosystem improve the growth performance of nursery grown native tree seedlings (Urgiles et al. 2009, New Forest 38: 229-239). AMF from those nursery grown trees and also from afforestation plots were isolated and characterized. The goal was to later utilize them in the tree nursery as a defined 'cocktail' of AMF to inoculate seedlings of native, potential crop trees, such as *Cedrela montana*, *Heliocarpus americanus* and *Tabebuia chrysantha* and to analyse, which of the AMF species from the applied cocktail persist during a six months nursery phase and after outplanting on reforestation plots, and which AMF have an impact on the growth of certain tree species.

Here, we characterise the used AMF morphologically and by a DNA barcoding approach using the complete SSU and ITS rDNA regions and 800 bp of the LSU rDNA (in total 3.3 kb; Krüger et al. 2009, New Phytol. 183: 212-223; Stockinger et al. 2010, New Phytol. 187: 461-474). We established a number of defined AMF cultures, whereas most of them are single spore isolates. Eventually, we could culture and characterise six different native AMF species, from phylogenetically very distinct clades, including two or three new species. The detailed molecular phylogeny of the species is also shown.





**Topic:** East African mountain forests: functional ecology and sustainable management

### CONSERVATION AND MANAGEMENT OF MOUNTAIN FORESTS THROUGH EDUCATION-MOUNTAIN FORESTRY MASTER PROGRAM AT BOKU, VIENNA

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Mountain regions are complex systems with a critical importance for global resource availability. As such they present challenges for integrating different stakeholders interests. The Mountain Forestry Master Program is a specialized education scheme targeting employees of governmental and non-governmental organizations dealing with the management and conservation of forests in mountainous areas with special emphasis on developing countries.

Ethiopia was, ever since the beginning of the Mountain Forestry Master Program in 2002, one of the main countries of origin of students. Ethiopian Mountain Forestry students are dominantly from the Amhara region. Forest cover is very low in Ethiopia with a high percentage of the poverty-stricken economy based on agriculture. Ongoing deforestation contributes to land degradation. Nearly all Mountain Forestry graduates, 92% returned to Ethiopia and are currently employed with the Amhara regions environmental protection authority.

The Mountain Forestry Master Program provides students with a holistic education approach and information systems to empower them as resource users in mountain societies. The aim of the Master Program is to enable graduates do contribute to improved extension services and changes in development as qualified field officers and foresters leading to more diverse sources of income through agro forestry and non-timber forest products and in particular to food security through improved land management. Direct investments in human capacity for sustainable management in mountain regions an effective lever for poverty alleviation.

**Topic:** African savannas biodiversity - past, present, future

### PHYLOGENETIC AND PHYLOGEOGRAPHIC ANALYSES OF AFRICAN AND ARABIAN DORCAS GAZELLES (*GAZELLA DORCAS*)

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Once common throughout the entire Sahelo-Saharan region, population sizes of Dorcas gazelles (*Gazella dorcas*) are nowadays decreasing dramatically. The uncertain taxonomy of this species—with a variety of described subspecies without validated status—hampers conservation efforts. In this situation, phylogenetic and phylogeographic investigations using molecular techniques are highly warranted conservation tools. Here we provide a first analysis of the genetic variability of Dorcas gazelles from the species' entire distribution range. We sequenced the cytochrome b gene and a 540bp fragment of the mitochondrial control region of more than 70 individuals. Unlike in other gazelle taxa examined by our group, genetic variability within *G. dorcas* was surprisingly low. Dorcas gazelles are migratory depending on local precipitation, which may account for the observed lack of larger geographic population differentiation, but the generally low genetic variability cannot be explained by this fact alone. A recent bottleneck seems to be the most likely explanation for this pattern.

**Merian Award Winner 2011**



**Topic:** Ecological networks and ecosystem functioning

## BIOMASS ESTIMATIONS IN FORESTS OF DIFFERENT DISTURBANCE HISTORY IN THE ATLANTIC RAINFOREST OF RIO DE JANEIRO, BRAZIL

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Tropical forests are large reservoirs of biomass and the carbon stored in aboveground living tree biomass (AGB) makes up the biggest stock of carbon sequestered by this ecosystem. Reliable estimates of aboveground biomass stocks within the Atlantic Forest are rarely available. Past human disturbance is an important factor affecting forest structure variation and biomass accumulation among tropical forest ecosystems. For a better estimation of the current biomass carbon storage capacity of this disturbed forest we compared the aboveground tree biomass of forest sites with three disturbance histories: complete cut down, selective logging and conservation since 60 years. We identified high AGB-values in the preserved forest area. Intermediate results for AGB were found at the former clear cut site and lowest AGB was calculated for the area with past selective logging. Our results lead to the conclusion that biomass productivity can recover in a forest which was completely cleared 60 years ago. On the other hand the outcome of our study shows that "gentle" influences like selective logging can have tremendous impact, even if stopped several decades ago.

**Topic:** The Andean biodiversity hotspot and its future: biodiversity, ecosystem functioning and ecosystem services under environmental change

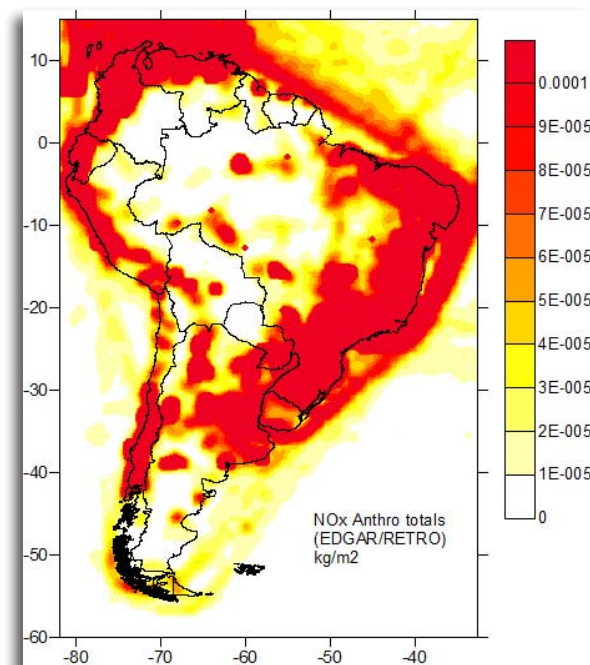
## DATA HANDLING AND ANALYSIS OF NEW EMISSION DATABASES FOR MATTER DEPOSITION IN THE TROPICAL MOUNTAIN FOREST

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The tropical mountain forest of southern Ecuador is among the most biologically diverse places in the world. However, the stability of the ecosystem can be threatened by a variety of phenomena. Since this particular ecosystem has developed above very acidic and nutrient-poor soils, the equilibrium among the plant species and between them and their environment is very delicate.

It has been revealed by the study of Boy and Wilcke (2008) and confirmed by Fabian et al. (2009), that many of the nutrients which are essential for the tropical mountain forest of southern Ecuador are transported as far as from the Bodelée depression, in the African Chad, and deposited in the Amazon basin. However, Saharan dust is not the only element which is transported from long distance sources and deposited in the Eastern hills of the Ecuadorian Andes. Limiting factors, such as elevated sulphates and nitrates, generated in the atmosphere from biomass burning emissions and pollution, and deposited primarily during the dry season, can reduce niche dimension and therefore affect plant diversity (Harpole and Tilman, 2007).



Though the fact that some of these sources have been established and are well documented, there is still a gap in knowledge concerning the sources of other emissions and their contribution to the total amount of aerosols deposited in the RBSF research area. Therefore, analyses of data from more accurate databases and the combination with remote sensing and field techniques are needed to bring new insights into the role of long range transported aerosols. Results using newly created databases and methods to handle these data for the analysis of aerosol transport from the sources to the study area are presented.

**Topic:** Link for survival - Science and the conservation of tropical landscapes

### **AVIFAUNA ASSOCIATED TO NATIVE FOREST AND FOREST PLANTATIONS OF EXOTIC CONIFERS IN THE RESERVA FORESTAL GRECIA, COSTA RICA**

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Forest plantations of exotic conifers have been used as a management

strategy for restoring forests in many areas of the Neotropics. However, there is a remarkable lack of information of these plantations on the value for conservation biodiversity. To evaluate these plantations as habitat for wildlife, I studied bird communities in native secondary forest and in plantation of exotic tree species (*Pinus oocarpa* and *Cupressus lusitanica*) in the Reserva Forestal Grecia, Costa Rica. Bird assemblage composition, richness, abundance, diversity, and evenness were compared between habitats using the fixed-radius point count method. Fieldwork was conducted from September 2008 to May 2009. A total of 743 birds of 79 species corresponding to 10 orders and 25 families were recorded. The bird composition varied across habitats, sharing 51.9% of the same bird species. Although I found no significant differences in the patterns of bird diversity or evenness, the native forest had a greater bird richness and abundance than the plantation. This could be explained by the higher spatial heterogeneity and productivity in the native forest than in the plantation. On the basis of these results, secondary native forests seem to have a greater value for bird conservation than conifer plantations.

Therefore, some management measures could favor bird communities in the Reserva Forestal Grecia, such as the implementation of strategies for ecological restoration in order to gradually replace the exotic vegetation by native species which offer more resources available for bird populations. The continuation of studies in plantations of exotic conifers may provide more knowledge that will allow a better understanding of the role played by exotic plantations in maintaining bird populations and biodiversity in general.



**Topic:** Tropical island biodiversity: magnitude, function and conservation

### COMPARATIVE ECOPHYSIOLOGY OF CARIBBEAN AND MAINLAND NEOTROPICAL TREES

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In tropical rainforests, interspecific variation in leaf- and wood functional traits represents the spectrum of tree life-history strategies, from shade-intolerant “pioneers” to shade tolerant late successional species. Several studies have invoked functional trait variation across light gradients to explain tree species co-existence. While it remains untested, it may be expected that biogeographical differences in disturbance regimes may drive community-level trait distributions. For instance, in Caribbean rainforests where large-scale disturbances with multi-decadal return intervals (i.e. hurricanes) drive forest dynamics, one may expect tree floras to primarily express “pioneer” leaf and wood traits. However, in comparing leaf and wood functional traits across two forest types (hurricane disturbed forests in Dominica, versus seasonally dry Panamanian rainforests), we found no evidence for disturbance-mediated shifts in traits. Common Dominican and Panamanian species exhibited similar ranges and distributions of photosynthetic capacity (A<sub>max</sub>), leaf nitrogen (N), leaf mass per area (LMA), and wood density (Dt). However, an interesting pattern unique to Dominican species was the ecophysiological traits of 2 near-endemic dominant species, *Amanoa caribaea* (Euphorbiaceae) and *Tapura latifolia* (Dichapetalaceae). Both species have restricted ranges from St. Lucia to Guadeloupe. When compared to 13 additional common Dominican species, *A. caribaea* and *T. latifolia* consistently showed traits which bracketed the “shade tolerant” end of trait axes. For example, A<sub>max</sub> values for *A. caribaea* and *T. latifolia* were 3.15 and 3.09  $\mu\text{mol m}^{-2} \text{s}^{-1}$ , respectively, and only one species (*Licania ternatensis* (Chrysobalanaceae), considered a “regional endemic”) showed lower A<sub>max</sub>. Similarly, *A. caribaea* and *T. latifolia* exhibited 2 of the 3 lowest values for foliar N, and 2 of the 3 highest values for LMA and Dt. Overall, our results suggest severe disturbance regimes may not give rise to community-specific functional trait distributions. However, our results regarding the ecophysiology of dominant near-endemic tree species in Dominican rainforests may provide some insight as to processes structuring Caribbean rainforests. Specifically, our results suggest that tree species resistant or resilient to hurricane damage, and not fast-growing pioneers thriving in disturbed areas, may evolve locally and dominate hurricane-disturbed rainforest canopies.

**Topic:** Ecological networks and ecosystem functioning

### CALCIUM CYCLING IN THE SOIL-FIG-BAT COMPARTMENT OF A NEOTROPICAL RAIN FOREST ON SPATIALLY HETEROGENEOUS SUBSTRATE IN PANAMA

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Calcium concentrations in tropical soils are highly variable and commonly low. However, some plants, like *Ficus insipida*, show high Ca concentrations in their fruit and leaf tissues. Frugivores like the bat *Artibeus jamaicensis* rely probably entirely on fruits to meet their increased Ca demand during reproduction. Ca supplies in soils of the Barro Colorado Island vary much depending on the geological unit from which the soils developed. As Ca concentrations in fig fruits and leaves are consistently high and vary much less than in soils this suggests that figs use other Ca sources than soil. To investigate the fate and behaviour of Ca, we instrumented three fig trees on each of the four geologic units differing in Ca concentrations with stemflow and throughfall collectors and litterfall traps. We determined (i) Ca supply in soils, fruits and leaves of the figs, (ii) Ca fluxes with litterfall, throughfall and stemflow, (iii) the importance of *A. jamaicensis* to the Ca cycle through pellets and faeces, (iv) the effects of *F. insipida* on Ca concentrations in soil, and (v) the sources of Ca and the fractionation of Ca isotopes along the soil-plant-bat path.





**Topic:** Tropical aquatic ecosystems: diversity, ecophysiological processes conservation

### FLORISTIC ASSESSMENT OF 10 HECTARES OF BLACK-WATER INUNDATION FOREST (IGAPÓ) ACROSS THE NEGRO RIVER, CENTRAL AMAZONIA.

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The majority of floodplain research concentrates on white water forests, while igapó forests were scarcely inventoried. Little information is available about the flora of the igapó and most floristic inventories concentrated on the lower Negro River, near the city of Manaus. Based on a botanical inventory of 10 ha (160 x 625m<sup>2</sup>) in late-successional igapó forests along the upper, middle and lower sections of the Negro River, we examined phytosociological parameters and species composition for all plots combined and for each river section by means of ecological indices (IVI and FIV). Similarly, we evaluated species richness and diversity using various measures and estimators. Overall, we registered 6126 individuals of 244 species distributed in 136 genera and 51 families. The 30 most important species accounted for 58.43% of the importance value; in which the emergent legume *Aldina heterophylla* (Fabaceae) presented the highest value with 6.80% followed by *Gustavia augusta* (Lecythidaceae) and *Heterostemon mimosoides* (Caesalpinaceae) with 3.61% and 3.59% respectively. More than 50 % of family importance value is represented by only 5 families such as Fabaceae (16.93%), Caesalpinaceae (10.02), Euphorbiaceae (9.61%), Lecythidaceae (9.10%) and Chrysobalanaceae (6.84%). The present study contributes basic floristic data and forms the basis of several to be done aiming to provide knowledge and understand the relationship between the igapó forests and the flooding and edaphic gradients, in particular, the floristic and structural variation across the course of the river. These results also contribute essential data for the management and conservation of black water systems.

Free contribution

### RESPONSE OF COCOA TREES (THEOBROMA CACAO) TO A 13-MONTH DESICCATION PERIOD IN SULAWESI, INDONESIA

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Cacao is a major cash crop and driver of deforestation in Sulawesi. In this ecosystem experiment we studied if shaded cacao trees are vulnerable to ENSO droughts. We installed 3 sub-canopy roofs and 3 control plots (each 35mx35m) in a cacao plantation in the Kulawi Valley in direct vicinity to the Lore Lindu National Park, Central Sulawesi. The roofs were closed from March 2007 until April 2008. During the first months of desiccation roof cover was increased from 60 to 80% of the plot area.

During several months cocoa trees were exposed to soil water contents close to the conventional wilting point, but showed no significant decreases in leaf biomass, stem and branch wood production or fine root biomass. Possible causes are active osmotic adjustment in roots, mitigation of drought stress by shading from *Gliricidia* trees, root space partitioning or missing atmospheric drought conditions. Production of cocoa beans was significantly reduced in the roof plots. We conclude that cacao bean yield appears to be particularly drought sensitive, and that crop failure potentially accelerates forest transformation.





**Topic:** Ecological networks and ecosystem functioning

### **SOIL NUTRIENTS AND WATER AVAILABILITY SHAPING SPECIES DISTRIBUTIONS IN TROPICAL FORESTS**

Delicia Rayda Pino Garay<sup>1</sup>, Richard Condit<sup>2</sup>, Ben Turner<sup>2</sup>, Bettina Engelbrecht<sup>1</sup>, Rolando Perez<sup>2</sup>

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Identifying patterns of tree distributions across species, and understanding the underlying mechanisms is challenging in tropical forests due to their high species diversity. Rainfall and the subsequent variation in soil water availability, as well as soil nutrient availability have been shown to be associated with species distribution and forest diversity. However it remains difficult to disentangle the role of either soil nutrients or moisture because commonly both co-vary, and the strength and shape of their relationship vary spatially in a complex manner. In this study we analyzed the occurrence of 440 tree species in 44 1-ha plots across a strong rainfall gradient at the Isthmus of Panama. Soil nutrients were analyzed, and soil moisture deficit during dry season was modelled for every plot. Logistic regressions of species occurrences as a function of soil nutrients and moisture were carried out and univariate models were applied using individual nutrients. Soil nutrients and soil moisture showed tremendous variation in the area as plots locations encompass a wide range of geological substrates. Most nutrients were correlated among each other however phosphorous remained most significant in the models when tested against species occurrences. In addition, phosphorous and soil moisture were strongly negatively correlated. Phosphorous and moisture both contributed significantly to explaining species occurrence. Species showed three distinctive patterns of distribution with respect to phosphorous and moisture. Individual species related characteristically to particular combinations of moisture and phosphorous concentrations. 10% of the species correlated negatively with both phosphorous and moisture, 8% of the species correlated positively with phosphorous and negatively with moisture while 5% showed the inverse pattern. Our results strongly suggest that differential resource requirements for both moisture and phosphorous are important in shaping tree distribution patterns in these tropical forests. To conclusively evaluate the underlying mechanisms, experimental studies will be carried out to quantitatively link plant species responses to different nutrients with their distribution patterns.

**Merian Award Winner 2011**

**Topic:** Ecological networks and ecosystem functioning

### **INFLUENCE OF CLIMATIC CONDITIONS ON THE NUTRIENT STATUS OF TREES IN A HUMID FOREST IN SOUTHERN ECUADOR**

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So far, little is known about how climatic variations influence the availability and the uptake of nutrients in tropical trees and which implications climatic changes may have on the future growth potential of different ecological forest types. It has been shown that the nutrient input by dry and moist deposition into the humid lower montane rainforest of the RBSF in southern Ecuador varies considerably between different years as a consequence of varying climatic conditions. We combine dendrochemical analyses with the variations of the stable carbon isotope content to obtain information about how different climatic conditions influence the short-term and the long-term uptake of nutrients. We present the first preliminary results of the distribution and concentration of immobile elements in individual growth rings of *Cedrela montana* and compare these data with the ENSO index. We aim for a reconstruction of the variation of humidity conditions during the past decades derived from stable carbon isotopes and ring-width measurements. Finally, we try to evaluate how the uptake of immobile elements in the wood is influenced by the climatic conditions during the time of nutrient uptake.



**Topic:** Ecological networks and ecosystem functioning

### REQUIREMENTS FOR SUCCESSFUL FOOD ACQUISITION: INTERACTIONS BETWEEN *CAROLLIA CASTANEA* AND *PIPER SP.*

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Previous studies illustrated the role of *Piper sp.* as a reliable food resource for frugivores in the tropics. Like figs, *Piper sp.* produces fruits year-round but only with small crops per plant and day. Bats like *Carollia castanea* (Phyllostomidae, Carollinae), a *Piper* specialist, use fruit odour as primary cue for detecting ripe fruits as well as echolocation to define the exact position of the fruitstands. In contrast to some fig species, the volatile fruit odour components of *Piper sp.* are unknown. The aim of our study was to investigate the volatile patterns released by ripe fruits of two *Piper* species, *Piper arboreum* (Pa) and *Piper dilatatum* (Pd) in Panamá. The volatile fruit odour components of three different maturity levels (unripe, ripe, fully ripe) of fruits of *P. arboreum* and ripe fruits of *P. dilatatum* were collected by using Headspace-Adsorption technique. Qualitative and quantitative chemical analyses were performed using gas chromatography (GC) and GC/ mass spectroscopy.

A total of 14 compounds were identified in the fruit odour of both species including mainly terpenes for example alpha-Pinene, beta-Pinene, Limonene and beta-Caryophyllene. While the relative amounts of compounds differed significantly between different maturity levels the headspace sample of ripe fruits were similar in both investigated species (Dia.).

**Topic:** The Andean biodiversity hotspot and its future:

### TREE GROWTH DYNAMICS OF POYLEPIS FORESTS DURING THE DRY SEASON ALONG A HUMIDITY GRADIENT IN THE PEUVIAN ANDES

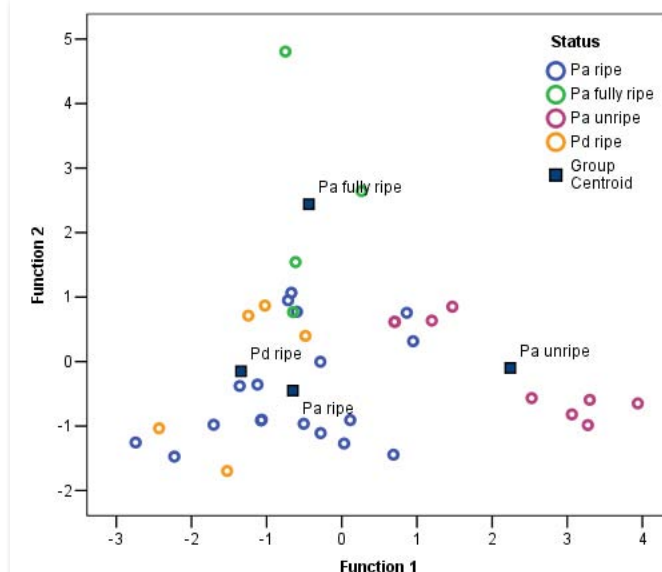
Sabine Remmele<sup>1</sup>, Andrej Niedermann<sup>1</sup>, R. Zimmermann, G. Aas

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The inter-annual radial stem growth dynamics of the genus *Polylepis*, Rosaceae, which forms the highest treelines worldwide, are not well known. In contrast to notes in older literature, *Polylepis* tolerates a wide range of site climate conditions. Mature stand tree density and adult tree growth appear to be driven by climatic and edaphic factors. The hygric limitation by seasonal plant water stress is considered to be of special importance in edaphically drought prone zones. Low air and soil temperatures in combination with episodic events and frost drought appear to limit the tree line at the dryer *Polylepis* Forest - Puna ecotones. The effect of the gradients in temperature, precipitation and soil humidity, which seem to determine biomass stocks and apical as well as cambial growth dynamics of these forests are basically unknown. Regarding seasonal and inter-annual growth dynamics and long term productivity of these forests, much discussion and speculation has been going on in the past decades, while studies clarifying these points were not available.

In the present study stem radius variation of two *Polylepis* species was investigated in the South American Andes. Two sites along a climatic humidity gradient were

selected in Peru: A semi-arid site with *Polylepis rugulosa* close to Huambo near the Cañon de Colca and a moist site with *Polylepis racemosa* at Yanacocha in the Urubamba Valley. Radial stem growth of seven to nine trees at each plot was measured with high resolution electric dendrometers.



Tree xylem flux, leaf conductivity, leaf water potential and leaf photosynthesis were measured to investigate tree ecophysiological processes during the dry season. Weather and soil conditions at the sites were recorded by automatic weather stations.

During the dry season, from June to the end of September, *Polylepis* trees showed little or no growth at the humid site or even shrunk in diameter presumably due to cell water storage losses. At the arid site *P. rugulosa* showed radial (cambial) stem growth. At both sites, soils were very dry. *P. racemosa* exhibited clear signs of impeded plant water uptake from the soil. *P. rugulosa* seems to be better adapted to dry soil conditions. Moderate frost events were rare during the observation period and did not influence radial tree growth. Apparently, the limiting factor of growth during the dry season was neither air temperature nor air humidity but soil drought.

**Topic:** The Andean biodiversity hotspot and its future: biodiversity, ecosystem functioning and ecosystem services under environmental change

## RAINFALL DISTRIBUTION IN THE ANDES OF SOUTHERN ECUADOR DERIVED FROM BLENDING WEATHER RADAR DATA AND METEOROLOGICAL FIELD OBSERVATIONS

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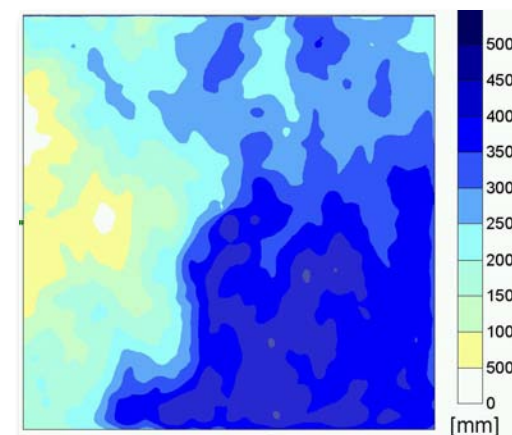
The Andes of Ecuador show an extreme heterogeneity of spatial and temporal distribution of precipitation. The existing operational network of the national weather service is not capable of reproducing these complex patterns. By using a cost-efficient rain radar and a network of high-resolution rain gauges, the real complexity of the rainfall distribution and the meteorological processes of rainfall formation can be assessed. A blending method encompassing geostatistical tools allows to derive a comprehensive rainfall climatology for the study area.

Precipitation is predominantly of the advective type, associated with humid air masses from the Amazon basin transported by the tropical easterlies. The typical form is light to heavy drizzle with long duration but lower rain rates.

However, in contrast to former knowledge there is no single mechanism of rain formation for any given place. Several processes interact like small and large-scale convective cloud systems, local and regional valley/mountain breeze systems and terrain-lines of preferred moisture transport interact on various time scale. This leads to complex patterns of rainfall in space and time.

Several types of characteristic weather situations are revealed by the study. They are characterized by specific combinations of local and regional atmospheric

processes and interactions with the topographical configuration. They are modified by mesoscale and continental circulation patterns as the annual shift of pressure cells, the east Andean low level Jet and katabatic flows.



Free contribution

## DIVERSITY PATTERNS AND LEAF CHARACTERISTICS OF TERRESTRIAL FERNS ALONG AN ALTITUDINAL GRADIENT IN ECUADOR

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In this work, we are studying the changes in the diversity and abundance of terrestrial fern species along an altitudinal gradient (500 m – 4000 m) on the eastern Andean slope (Reserva Biósfera Sumaco and Reserva Ecológica Antisana) in Ecuador. At each elevation level, three permanent plots (20 m x 20 m) were established for the study. All terrestrial fern individuals were permanently marked and registered. Furthermore, of the most common species, mature fronds were sampled and dried to evaluate the average leaf-area/leaf-length ratios, the specific leaf areas, and the foliar nutrient contents.

We obtained a total of 3684 terrestrial fern individuals on the 21 study plots. Both the number of species and the number of individuals showed clearly hump-shaped elevational patterns. This corresponds to the common pattern of fern diversity in tropical mountains and to the pattern which we aim to study in detail.

Topic: African savannas biodiversity - past, present, future

## THE WEST AFRICAN VEGETATION DATABASE

Marco Schmidt<sup>1</sup>, Thomas Janssen<sup>2</sup>, Adjima Thiombiano<sup>4</sup>, Brice Sinsin<sup>5</sup>, Ali Mahamane<sup>6</sup>, Bienvenu Sambou<sup>7</sup>, Mipro Hien<sup>8</sup>, Karen Hahn<sup>9</sup>, Anne Mette Lykke<sup>3</sup>, Georg Zizka<sup>1</sup>

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The West African Vegetation Database is an online database of vegetation data for West Africa. It has been developed to foster digitization and exchange of vegetation data in West Africa and at the same time ensure a safe long term data storage. It includes simple species inventories, phytosociological and dendrometrical relevés. Data holders can chose between different data access options (private, shared with selected users, public) to encourage data entry at an early stage. An offline database with synchronisation functions can be downloaded for data entry during field work or under insufficient internet connectivities.



Free contribution

## FRAGMENTATION-INDUCED EDGE EFFECTS ON THE TOP-DOWN-CONTROL OF INSECT HERBIVORES IN THE ATLANTIC FOREST OF NORTHEAST BRAZIL

Susanna Schmidt<sup>1</sup>, Christoph Dohm<sup>1</sup>, Inara Leal<sup>2</sup>, Rainer Wirth<sup>1</sup>

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Recent studies have shown that herbivores drastically benefit from tropical forest edges. The release of herbivore populations from their natural enemies (i.e. top-down regulation) in edge habitats has been suggested as an underlying mechanism but empirical evidence is scarce. We hypothesized that predation pressure is reduced along forest edges compared to in the forest interior due to adverse edge effects on forest-dwelling predators.

We used the artificial caterpillar method (Koh & Menge 2006) to assess the bite marks of predators on clay caterpillars as a measure for predation pressure on insect herbivores in a large forest remnant of the Atlantic forest in NE-Brazil. Twenty caterpillars were placed at systematic intervals in eight and ten 400-m<sup>2</sup> plots in the forest interior and along the forest edge, respectively. After 72 hours the caterpillars were retrieved from the forest to count the predation marks and assign them to easy-to-identify predator categories.

Preliminary findings suggest that overall predation in edge plots was lower (26%) than in the forest interior (34%). Most bite marks were from mandibles (e.g. ants, wasps), followed by bird beaks and negligible numbers of rodent teeth. While predation by mandibles was strongly reduced along the forest edge, bird predation tended to be unaffected, suggesting that different predator guilds are differentially influenced by edge effects. Additional goals of this ongoing study are to evaluate the influence of environmental factors (e.g. vegetation density) and compare the results with analogous studies conducted along temperate forest edges in the North Palatine Hills.

**Topic:** Tropical Aquatic Ecosystems: Diversity, ecophysiological processes conservation

## THE IMPORTANCE OF SURFACE WATER SALINITY FOR VEGETATION CHANGES IN THE WESTERN PART OF THE LAGOON SYSTEM OF THE CIÉNAGA GRANDE DE SANTA MARTA (CARIBBEAN COAST OF COLOMBIA)

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In the last fifty years, the lagoon system of the Ciénaga Grande de Santa Marta (Colombia) was exposed to changes to its hydrological system. The gradual reduction of freshwater supply from 1960 to 1995 resulted in salinity increase and the death of 286 km<sup>2</sup> of mangrove forests. With the purpose of restoring the ecosystem and renewing the freshwater supply, from 1995 to 1998 several channels between the Magdalena River and the lagoon system were re-opened. Due to the incoming freshwater, supported in some years by intense rainfall, surface water salinity decreased rapidly in the western part of the lagoon system. In 1999, at many sites this value was below 3 ‰. At the same time and in the same area, soil water salinity in a depth of 40 cm ranged from 13 ‰ to 59 ‰. The very low surface water salinity allowed freshwater plants to establish and spread. Among them was *Typha domingensis* (cattail) which, up until the year 2001, covered large parts of former mangrove areas where mangrove recovery was delayed. After some years of minor rainfall and a reduction of freshwater supply by the channels, surface water salinity increased and the cattail died. Thus, mangroves got a chance to extend their coverage. In the year 2009, surface water salinity ranged from 2.6 to 15.15 ‰ at distances of 15 to 25 km from the Magdalena River. Parallel to the salinity increase, the composition of the vegetation changed. At 15 km from the Magdalena River, well grown trees of *Avicennia germinans* and *Laguncularia racemosa* were found in periodically flooded sites and in shallow water while *T. domingensis* and other freshwater plants were still present in deeper water. In comparison, at 25 km the vegetation consisted of mangroves and halophytic herbs.



**Topic:** African savannas biodiversity - past, present, future

### HOW STRONG IS THE WEST AFRICAN SAVANNA VEGETATION AFFECTED BY HUMAN LAND-USE? A COMPARISON BETWEEN A PROTECTED AND A COMMUNAL AREA

Katharina Schumann<sup>1</sup>, Blandine Nacoulma<sup>2</sup>, Salifou Traoré<sup>2</sup>, Adjima Thiombiano<sup>2</sup>, Rüdiger Wittig<sup>1</sup>, Markus Bernhardt-Römermann<sup>1</sup>, Karen Hahn<sup>1</sup>

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Natural resources are particularly important for livelihood security in cash-poor households in semi-arid areas by ensuring food security, matching medicinal needs and as a source of income. In recent years, natural resources are declining due to land-use intensification. Thus, there is an urgent need for sustainable land use practices. Analysing the impact of land-use on phytodiversity and vegetation can help to understand anthropogenic influences on natural resource and to develop conservation and management strategies in accordance with human needs. The aim of the presented study is to compare a protected versus a communal area concerning their vegetation composition and phytodiversity. We studied if land-use has a specific effect on the vegetation composition and diversity pattern of vegetation types, which occur both inside and outside the protected area. Vegetation relevés were performed in the W National Park and its surrounding communal area in the eastern part of Burkina Faso. Vegetation types were established using ordination (DCA) and clustering methods (k-means with subsequent bootstrapping). For each of these types, typical species were detected using an indicator species analyses. Furthermore, we tested the effect of land-use on species richness, evenness, life form composition and ecosystem structure (cover and height) for the herb and woody layer. Our results reveal five vegetation types all occurring in the protected and the communal area. The impact of land-use on phytodiversity was vegetation type specific. However, for the woody layer species richness and evenness showed a more homogenous distribution in the communal area compared to the protected area. The opposite was observed for the herb layer vegetation. In addition, ecosystem structure and life form composition were also affected by land-use. We conclude that land-use has a certain impact on the vegetation. However, the vegetation differs more between the vegetation types than between the protected and communal area.

**Topic:** Ecological networks and ecosystem functioning

### BIODIVERSITY VS. SPECIES IDENTITY: ANT COMMUNITY EFFECTS ON LEAF HERBIVORES AND SPIDER GUILDS IN INDONESIAN CACAO PLANTATIONS

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Understanding herbivore-plant and predator-prey interactions or competition within a trophic level is essential to help maintain agricultural production. Ants and spiders are among the most abundant terrestrial predators in natural and agricultural habitats. Both groups may have negative impacts on important insect pests of cacao. Because of the unclear influence of ant diversity and activity on herbivore insects and spiders, we investigated how ant communities affect herbivory and the presence of spiders. And we tested whether the overall predation services of complex ant communities are higher than those of single, aggressive dolichoderine ant species known to have high impacts on herbivores. We surveyed arthropod communities and measured leaf area loss in cacao plantations in Sulawesi between July and September 2010. Observations were carried out within a large scale and long term ant fauna manipulation experiment. We sampled trees in 16 cacao plots situated in plantations differing in habitat characteristics, e.g. shade cover and distance to the nearest rain forest. Each plot consisted of four subplots, nine trees each, subjected to different treatments performed since August 2009: 1) control 2) ant exclusion 3) establishment of *Philidris cf. cordata* and 4) establishment of *Dolichoderus thoracicus* within the cacao trees in order to create single species dominated ant communities. Three trees per subplot were chosen to estimate herbivory and abundance of herbivores and spiders, twice during the study period. To assess herbivory we collected twenty fully developed leaves per tree using stratified random sampling. The abundance of herbivores and spiders was evaluated by inspecting trees visually. Spiders were classified into guilds according to their hunting strategies. The influence of ants in general and of *Philidris cf. cordata* and *Dolichoderus thoracicus* in particular on herbivory, herbivore density and composition, as well as on spider density is analysed using linear mixed models.



**Topic:** The Andean biodiversity hotspot and its future: biodiversity, eco-system functioning and ecosystem services under environmental change

### **BALLOON AERIAL PHOTOGRAPHY APPLIED TO THE INVESTIGATION OF THE SOUTHERN BRACKEN.**

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In the tropical mountains of southern Ecuador, forests have been converted to pasture at the highest rate in South America. Contrasting with the natural vegetation within one of the most diverse terrestrial ecosystems on the earth, an invasive weed (the southern bracken) has causing economic and ecological damages due to its competitive strength against pasture grasses and natural succession species. Ecological aspects of this competition are still not known and spatial distribution is a key to a better understanding of this problem. However, recent investigations on remote sensing have demonstrated that the distinction among bracken, pasture and other grassland species are not an easy task. Spectroscopy have shown a different spectral responses from leaves of bracken and the pasture grass *Setaria sphacelata* in the reflection and absorption of visible and near infrared radiation. Therefore, to a better investigation, a visible and a near infrared camera were mounted on a balloon for the recording of high resolution images of an experimental site (100 square meters) in the southern Andes of Ecuador. The double spectral information was used for image processing followed by segmentation and analysis of canopy geometry to evaluate the level of distinction between the species considered. In the present work, a method being developed for the processing of digital mosaics taken with a balloon will be presented, which may be helpful in many investigations in ecology of grassland species. In addition, a brief analysis of classified images is shown, considering a time series constructed for the observation of a succession after fire.

**Topic:** Open session – invasive species

### **IMPACT OF BURNING RESIDUES OF TROPICAL INVASIVE WEED PARTHENIUM HYSTEROPHORUS ON SOIL HEALTH AND ALLELOPATHIC POTENTIAL**

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*Parthenium hysterophorus* (Family Asteraceae) is an invasive weed from tropical America that has now invaded a wide variety of habitats in India and Australia. In India, the weed is very common in agricultural fields, wastelands, along water channels, and rights-of-way occupying all the available niches at the cost of native vegetation. The weed is known to be allelopathic in nature and affects the growth and yield of crops. To overcome the problems caused by weed, the farmers in northern parts of India have developed a strategy to burn the weed plants and let the burned residues mix into the soil before planting next-season crops. A study was conducted to explore the effect of burning on the allelopathic interference of the weed *P. hysterophorus*. For this purpose, the effect of unburnt and burnt residues of *P. hysterophorus* on the growth of two winter crops (mustard and turnip) was assessed. The extracts prepared from both unburnt and burnt residues were toxic to the seedling length and dry weight of the test crops. The extracts prepared from burnt residues were more phytotoxic than those from unburnt, although the amount of phenolics was significantly lesser in former. It was attributed to the highly alkaline nature of the extracts prepared from burnt residues. The inhibitory nature of unburnt and burnt residues was further evident from growth studies conducted in soil amended with either extracts or residues of unburnt or burnt residues. In amended soils, the inhibitory effect of unburnt residues was stronger than from burnt residues. This was due to the presence of phenolics in the former rather than any significant change in pH or conductivity. Further, the organic carbon content in soil amended with burnt residues was too less compared to that of soil amended with unburnt residues. The study concludes that burning decreases the allelopathic potential of the weeds, but it deteriorates soil quality to the extent of bringing significant inhibitions in the test crops. Thus, use of burning as strategy for the management of *Parthenium* residues should be avoided as it adversely affects soil health.



**Topic:** The Andean biodiversity hotspot and its future: biodiversity, ecosystem functioning and ecosystem services under environmental change

### COMPETITION-GROWTH-RELATIONSHIP OF *CEDRELA MONTANA* (MELIACEAE) IN SOUTHERN ECUADOR IN A NATURAL FOREST MANAGEMENT EXPERIMENT

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On the grounds of the dramatic loss of forest areas in Ecuador and the ensuing decrease of economic high quality timber species, it is mandatory to develop concepts of sustainable forest management to counteract these devastative tendencies. In the protected area of the Reserva Biológica San Francisco (RBSF), Ecuador, the DFG Research Unit 816 is trying to address this problem and to foster indigenous valuable species of trees with the help of silvicultural treatments. The application of 'Improvement Felling' (felling of the strongest competitor) was an attempt in a natural forest management experiment to achieve a positive influence on the radial growth of high quality timber species. On the one hand, competition of the surrounding trees should be lessened by this intervention, and on the other hand the fight for light was supposed to be minimized; both can be propitious for growth.

We studied the high quality timber species *Cedrela montana* and the effects of 'Improvement Felling' on competition-growth relationships. For this purpose, 38 individual trees of *C. montana* were examined in two catchment areas. The strongest competitor of each of 20 target trees was felled. The remaining 18 trees (reference trees) of the total 38 served as a comparative group, since no fellings were exercised. The competitive pressure on *C. montana* by surrounding trees was quantified by means of the HEGYI-index. The estimation of light absorption and the fight for light were based on the DAWKINS-classification. In order to measure the effects on the annual radial growth, radial mean ring-width curves were measured. In addition, the age of the trees was calculated to consider possible age effects.

The results show that despite the enhanced consumption of light and the reduced pressure of competitors on target trees, the latter grew less than their comparative group. However, the preliminary results do not allow the conclusion that the measures of the experiment have negative effects on growth of the target trees. In contrast to *C. montana*, other tree species showed positive growth reactions after removing competitors. Thus, *C. montana* might belong to a group of species showing a delayed positive reaction.

**Topic:** Ecological networks and ecosystem functioning

### CHARACTERIZATION OF THE ORAL MICROBIOTA OF FRUGIVOROUS BATS IN THE NEOTROPICS

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Dental caries is in today's modern human society one of the most widespread diseases. It affects humans and most mammal species as well. Although there are many studies about dental decay in humans and in animal models, the complex microbiological and environmental interactions which lead to dental caries remain little known. Most investigations of dental caries have focused on animal models where artificial diets or inoculation of cariogenic bacterial strains are used to induce tooth decay. However, it is essential to also understand the development of dental caries under natural conditions. Our study combines observations and examinations of the dental status of the frugivorous bat, *Artibeus jamaicensis* (Phyllostomidae) in the field and subsequent molecular characterization of the microbiota in its oral cavity. The bats showed a surprisingly low incidence of tooth decay although their food contains a high amount of carbohydrates that can be metabolized by bacteria into organic acids, usually known to promote the development of caries. To get a first impression of the incidence of dental plaque and decay in a population of bats, 203 individuals of *A. jamaicensis* were caught and examined. Only one individual showed a cavitation on one of its molars. Plaque staining with dye revealed that only about one third of the bats had plaque on their teeth surface. It was mostly concentrated on their lower premolars. To identify the members of the oral microbial community, swab samples from the bats' mouth were taken and analysed by performing denaturing gradient gel electrophoresis with amplified fragments of bacterial and archaeal 16S rDNA as well as by sequencing of 16S rDNA fragments. We found 28 different bacterial strains by sequencing 200 bp fragments of the bacterial 16S rDNA. Most of them belonged to the genera *Streptococcus* (28.6 %) and *Pseudomonas* (14.3 %). Strains probably associated with dental caries were less frequent. We also found members of methanogenic archaea of the genera *Methanoculleus* and *Methanosarcina* in the oral cavity of *A. jamaicensis*. This type of archaea has been known so far only from the oral cavity of humans. To understand more about appearance of dental decay and to establish new model systems of caries development, it is necessary to continue the field work in order to use the knowledge gained out of the tropics for the human well-being.



**Topic:** East African mountain forests: functional ecology & sustainable management

### DIVERSITY OF STEM EPIPHYTES IN MONTANE RAINFORESTS OF RWANDA – THE INFLUENCE OF ALTITUDE AND ANTHROPOGENIC DISTURBANCE

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Stem epiphytes are highly sensible bioindicators. They consist mainly of lichens and bryophytes. In contrast to the canopy the occurrence of vascular epiphytes is only scarce. The advantage of studying the epiphytes at the stem base is that complete inventories can be achieved. For the present study however lichens were excluded and it was focused on bryophytes and vascular plants.

The study area Rwanda is situated in the Albertine Rift which is one of the biodiversity hotspots in Africa. Altitudinal transects were investigated in Nyungwe National Park from 1700 m to 2900 m, in Gishwati Forest Reserve from 2200 m to 2400 m and in Volcanoes National Park from 2500 m to 3400 m. Along each transect usually five trees per 50 m of altitude were examined. The following vegetation belts were covered by the transects: lower montane rainforest, upper montane rainforest, bamboo forest and ericaceous shrub. Additionally transects were analysed in areas of different degrees of disturbance.

Primary results show that epiphyte communities of montane rainforest include *Frullania angulata*, *Plagiochila heterostipa*, *Bazzania decrescens* and *Pilotrichella ampullacea*. Typical bryophytes which can be found in ericaceous shrub are *Plagiochila colorans*, *Lepidozia cupressina*, *Dicranum johnstonii* and *Hypnum cupressiforme*.

First results also suggest that epiphyte diversity is much higher in forests of old crystalline precambrium rocks (Nyungwe, Gishwati) than in the volcanoes of basaltic rocks of recent origin (2 to 3 million years). Disturbed open secondary forest is characterized by canopy epiphytes growing at the stem base, e.g. *Cheilolejeunea* spp. and *Dicranolejeunea* spp. In primary forest highly sensitive species like *Porotrichum* spp., *Syrrhopodon* spp. and *Radula voluta* can be found.

**Topic:** The Andean biodiversity hotspot and its future: biodiversity, eco-system functioning and ecosystem services under environmental change

### DERIVING SPATIAL LEAF AREA INDEX-DATA FOR A TROPICAL RESEARCH AREA IN THE ECUADORIAN ANDES AS INPUT FOR A SVAT-MODEL, RESULTS AND FUTURE PROSPECTS

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The Leaf Area Index (LAI) is a key component of biochemical cycles in ecosystems because of the correlation between leaf area, gas exchange and biomass production. Hence, the variable leaf area has been established as a key input parameter for characterizing plants and ecosystems, last but not least for process-based ecological modeling. Difficulties regarding the measurement of the LAI especially for wide areas force scientists to use and adapt empirical methods to determine estimated spatial LAI-data. Unfortunately most studies deal with boreal and temperate forests and there are few studies addressing the relationship between LAI and remotely sensed vegetation indices for tropical regions. The scarce representation of research in the tropics might be caused by various reasons like low availability of cloud free satellite scenes or substandard infrastructure. However, in comparison to the importance of tropical forests in the global environmental system the concordant research seems to be inversely proportional.

The main goal of the presented study was to derive spatial LAI-data for a research area - located in the biodiverse tropical mountain forest of Southern Ecuador - as input for a SVAT-model making use of Spectral Vegetation Indices (SVIs) and in situ LAI-data. As there is no universal methodology provided in the literature, especially not for tropical regions, the approach was to empirically test different SVIs in a regression-analysis with field measured LAI-data (data: N= 82; LAI-range: 0.9 to 8.8).

For both slope-based SVIs (Normalized Difference Vegetation Index (NDVI) etc.) and the Tasseled Cap-based Greenness Vegetation Index (GVI) the field measured LAI-data showed a moderate correlation. An ordinary least squares (OLS) regression returned a linear model ( $R^2 = 0.415$ ) for NDVI to fit conditionally. The observed scatter of the LAI-SVI-data limits the significance of these results, considering that only one cloud free Landsat ETM+-scene and a low number of in situ LAI-data, measured from 2001 to 2009 with different methods, are available. Furthermore the LAI-range from 0 - 3 is underrepresented.





Free contribution

## DO CURRENT POPULATION STRUCTURES REALLY PREDICT COMMUNITY DYNAMICS OF VASCULAR EPIPHYTES?

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There is a long-standing debate whether current population structure of plants may be used to predict future change in population size. This notion, which was implicitly and explicitly prevalent for decades, has been empirically rejected for trees in a number of recent papers. However, a close correlation of population structure and species abundance that was found in a census of vascular epiphytes in Panama, led us to suggest that size distributions of populations can be still used to predict changes in the case of vascular epiphyte communities. Arguably, there are differences between tree and epiphyte communities due to fundamental differences in the ecology of these life-forms.

Here, we provide a direct test of this notion. We take advantage of two extensive data sets. These data sets comprise together about 20,000 individuals out of ca. 120 species in two lowland forests of Panama, which have been censused twice over a period of eight and nine years, respectively. In each epiphyte community we compare the population structure with changes in species abundance in time, excluding rare species, filmy ferns and hemiepiphytes.

**Topic:** The Andean biodiversity hotspot and its future: biodiversity, eco-system functioning and ecosystem services under environmental change

## THE IMPORTANCE OF NITROGEN FOR TREE SEEDLING NUTRITION ALONG AN ELEVATIONAL TRANSECT OF ANDEAN FORESTS IN SOUTH ECUADOR

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Tree growth in many tropical lowland forests is primarily limited by P while plant-available N seems to be relatively abundant. Tropical montane forests, in contrast, most often grow on younger soils where N should be short in supply whereas P limitation of growth should be of secondary importance compared to the older lowland soil. In tropical mountains, soils may further lose N through erosion or via large DON exports in a humid climate.

Changes in nitrogen availability may affect tree seedling performance in many different ways, such as growth rate, leaf morphology and physiology. For tropical trees the preferred N form is barely known. We aimed at testing the hypothesis that trees at lower montane elevation utilise both, ammonium and nitrate, those at upper montane elevation predominantly ammonium and also organic N. A mesocosm experiment was established with tree seedlings at three elevations (1000, 2000, and 3000 m a.s.l.). The experiment was run with representative tree species of each elevation. The seedlings were collected in the natural forest by carefully selecting individuals of comparable size and stature and planted in pots of 10 l volume using local topsoil material to provide close to natural soil conditions including the mycorrhizal fungi.

N was applied to part of the seedlings. For 12 months several variables were monitored, such as root collar diameter, shoot length, leaf morphology, leaf life span, and photosynthesis. With the remaining part of the seedlings a <sup>15</sup>N tracer study was conducted to detect differential preferences in the uptake of ammonium, nitrate, and organic N by the trees at 1000 m, 2000 m, and 3000 m elevation under assumed conditions of P or N limitation. Uptake rates of the respective N form were analyzed by harvest of the seedlings at 120 hours after applications and separate analyses of roots, stems and leaves.





Free contribution

# **REGULATION AND FEEDBACK STRUCTURE IN A POPULATION OF A DIDELPHID MARSUPIAL, *MARMOSOPS INCANUS* (LUND, 1840), IN ATLANTIC FOREST, SOUTHEASTERN BRAZIL.**

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The relative importance of exogenous and endogenous factors in the regulation of populations can be uncovered with the use of time series analyses. We analyzed a 12-year time series of abundances of a small nocturnal marsupial, *Marmosops incanus* (*Didelphimorphia*, *Didelphidae*), to determine the structure of possible regulatory processes. Marked animals were recaptured monthly in the locality of Garrafão (22°28'28"S, 42°59'86"W), Atlantic Forest, Southeastern Brazil, from April 1997 to December 2009. Annual abundances were the mean of monthly abundances, calculated by the Minimum Number Known Alive. The time series was log-transformed and linearly detrended, and the return time statistics (MRT ± VRT) calculated. The parameters of the R-function were estimated using the program PAS. The autocorrelation function (ACF) and the partial rate correlation function (PRCF) were used as diagnostic tools to help determine if the time series was stationary, and to detect the order of the endogenous dynamics. Information on the kind of dynamic pattern was also obtained by phase portraits, where the per capita rate of change (R) is plotted against abundances (with time lag 1 and 2) and the vector between successive points accessed. During the period 1997–2009, the *M. incanus* population displayed low fluctuations with short mean return time (MRT=1.72), typical of first-order dynamics, and variance smaller than the mean (VRT=0.65), suggesting stationarity.

The phase portrait with one time lag also indicates a first-order dynamic system, whereas a two time lag caused the vectors to circle in anticlockwise

direction, indicating that the lag is too long. The ACF was balanced, with no significant lagged terms, and the amplitudes decaying with increasing lags. The PRCF detected a strong first-order negative feedback, the only significant dimension in the dynamics. The coefficient of determination of the R-function ( $r^2=0.43$ ) indicated that less than half of the variation was contributed by endogenous feedback,

and the fitted R-function had the same value of  $r^2$ . A multiple linear regression model with both  $\ln(N_t-1)$  and  $\ln(N_t-2)$  as predictors increased the fit to  $r^2=0.61$ , suggesting a possible second delay, though much weaker than the first. The population of *M. incanus* is strongly regulated by a first-order endogenous feedback, which is generally a result of intraspecific competition.







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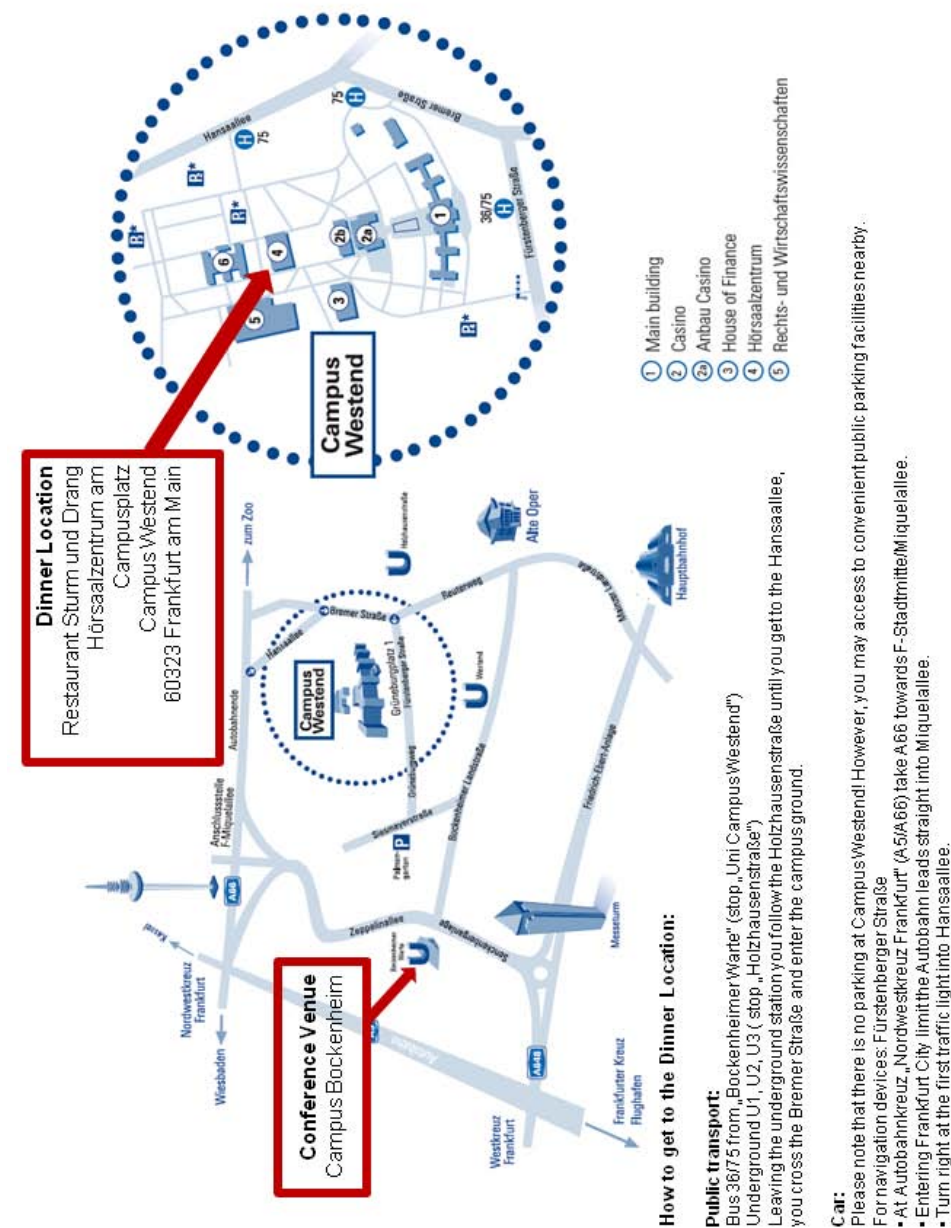
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- 1 refectory (Neue Mensa)
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  - 6 University's Computer room at "Universitätsbibliothek"
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