Impacts of Global Change on Tropical Ecosystems

Cross-cutting the Abiotic, Biotic and Human Spheres

ATBC *gtö*

Program - Abstracts

Joint meeting of:

Society for Tropical Ecology *gtö* with

Association for Tropical Biology and Conservation (ATBC)

Hosted by: Philipps Universität Marburg

Welcome by Prof. Dr. Volker Nienhaus, President of the Philipps-Universität Marburg

Dear Participants,

It is my great pleasure to welcome you in Marburg to the 2009 joint annual meeting of the Society for Tropical Ecology (*gtö*) and the Association for Tropical Biology and Conservation (ATBC). With about 600 participants from 45 countries, this conference is coming up the most important international event on tropical ecology in 2009 and I would like to stress that the Philipps University is proud to be the hosting organization selected by *gtö* and ATBC.

The title "*Impacts of Global Change on Tropical Ecosystems - cross-cutting the Abiotic, Biotic and Human Spheres*" reflects the truly interdisciplinary character of the conference. Despite a public awareness of the values of biodiversity and related functions and services of the complex tropical ecosystems, our knowledge is still scarce. Thus, tremendous research efforts in natural sciences (especially life and geosciences) are needed. At the same time, tropical ecosystems are threatened by men made local and global environmental changes which highlight the demand for complementary research in social sciences and economics to develop sustainable management strategies and to mitigate adverse human impacts.

The Philipps-Universität Marburg, a traditional full-scale university founded in 1527, is perfectly positioned to face the challenges of interdisciplinary ecosystem research. 16 faculties, about 20,000 students, complementary organizations like the Max Planck Institute for Terrestrial Microbiology and central facilities like the Botanical Garden as a repository for tropical plants form the backbone of internationally coordinated top research on biodiversity and tropical ecology. Managed by scientists from the faculties of Biology and Geography, this is for instance conducted in the framwork of the EU Network of Excellence Evoltree "*Evolution of Trees as drivers of terrestrial biodiversity*" and the DFG Research Unit 816 "*Biodiversity and Sustainable Management of a Megadiverse Mountain Ecosystem in South Ecuador* ".

The conference underpins the first of our four central research foci, "*Cultural and Environmental Dynamics*" with its central topic "*Interdependence of Culture and Environment*". Thus, it is obvious that the meeting is jointly organized by three contributing faculties, the Faculty of Biology, the Faculty of Geography and the Faculty of Economics.

It is my pleasure to offer our well-equipped facilities like the central lecture hall building and the leisure area of the adjacent Old Botanical Garden to the esteemed international audience of the joint annual meeting. I am confident that the attractive conference program in combination with the medieval charme of Marburg's old town, which can be experienced during the icebraker cocktail at the University's Landgrave Castle overtopping the city, will make your stay a memorable event.

On behalf of the Philipps-Universität Marburg I thank you for your participation and wish you all inspiring discussions, a fruitful exchange of ideas, and a pleasant stay at our university situated in the idyllic valley of the river Lahn.

Cordially,

Siegel

Prof. Dr. Volker Nienhaus,
President of the Philipps-Universität Marburg

The host institution:

"I owe Marburg an der Lahn at least half of my hopes and perhaps all of my intellectual discipline,"

wrote Ortega y Gasset regarding his studies at the Philipps-Universität. Today, his words continue to motivate the alma mater philippina to develop and improve its scientific and scholarly profile.

Philipps-Universität, which is almost 500 years old, is the oldest and most traditional university in the state of Hessen and considers itself to be a classical university offering a full range of courses with a modern approach. Its broad range of arts and humanities, and its experimentally challenging scientific work, constitute an ideal platform for interdisciplinary cooperation.

As has always been the case, Marburg University contributes to answering the questions of its age: from nanotechnology to the life sciences. Philipps-Universität's greatest strengths in research lie in the materials sciences, optodynamics, medicine-tumor research, microbiology, the neurosciences, environmental sciences including biodiversity reseach as well as peace and conflict research, and other natural science and arts subjects.

The university's success in research is well above average, which is reflected in the fact that it ranks among the top universities in Hessen with respect to obtaining external research funds and also in the fact that its scientists have received coveted awards such as the first Nobel Prize for medicine. Currently, it also boasts ten Leibniz Prize winners. Among other things, five Special Research Areas of the German Research Foundation and six Graduate Colleges offer first rate education for the next generation of scholars.

In the city of Marburg, which is located on the banks of the Lahn river and has a population of almost 80,000 inhabitants, practically everything revolves around the university with its almost 20,000 students (thereof over 47% female students) and 3,200 employees. Those studying at Marburg can complete their studies in many subjects much quicker (saving up to two and a half terms) than is possible at other German universities. This was recently confirmed by the latest survey of the German Research Council.

Short course durations, outstanding research, qualified training for the next generation and intensive international networking – these highlights distinguish Philipps-Universität, which was founded by Landgrave Philipp in 1527 as the oldest Protestant university still in existence. But Philipps-Universität offers much more than that: companies support our researchers in the domain of knowledge and technology transfer.

And studying at Marburg is particularly easy for disabled people, especially for the visually impaired, due to a number of special aids. As a result, Marburg University has by far the greatest number of blind students. Recently, Philipps-Universität has also been concentrating on measures that provide an even more family-friendly work environment. These self-imposed commitments have been awarded the Family-Friendly University seal, which is very rare in Germany. And last but not least, Philipps-Universität also offers a wide range of leisure activities in the areas of sports, music and culture.

Welcome by the organizers

Dear Colleagues:

Welcome to our medieval city of Marburg, and to the University of Marburg!

It is a great pleasure and a honour to welcome you on the occasion of the first joint *gtö*-ATBC conference held in the centre of Germany. Concentrating the strength of two renowned international societies is an excellent opportunity to profoundly foster international collaboration in the field of tropical ecology.

"*Impacts of Global Change on Tropical Ecosystems*" was selected as the overall theme for our joint annual meeting in Marburg. Men made Global Changes whose impacts on tropical ecosystems can already be observed will significantly transform our future world. Transformations will not only affect single plants and animals or local ecosystems. They will influence the entire globe to the private human life. Consequently, we focused the conference program on four overarching topics devoted to "*interdependencies of the abiotic, biotic and human spheres*" in tropical ecosystems.

These four overarching topics are each assigned to a specific day of the conference: 1) Biodiversity and ecosystem processes (Monday); 2) Interactions in a changing world (Tuesday); 3) Consequences of land use changes in the tropics (Wednesday); 4) Ecosystem demands and services (Thursday).

With respect to the former ATBC conference places usually located in the tropics, it might be asked, why a conference on tropical ecosystems is organized in the temperate zone of middle Europe. From the perspective of the developed countries in the North, the problems of the tropics seem to be far away. One reason for this unusual location is that the actual destruction of natural tropical ecosystems and the increasing interrelations between the tropics and the outer-tropics in a globalized world affect also the developed countries (tropical diseases, invasive plants etc.).

Surinam, the breathtaking place of the last annual meeting offered the participants "*the ample diversity of life of tropical South America, more specifically the lowland rainforest flora and fauna of the Guiana Shield*" (P.M. Forget). However, tropical biodiversity, ecosystem functioning and ecosystem services are directly and indirectly threatened by a broad variety of human activities, especially by land use and global climate changes. The result of such processes how human impact can

irreversibly alter natural environments and ecosystems can be studied using examples in Europe. Keeping in mind theses adverse experiences, we should avoid the same mistakes currently getting repeated in the tropics and foster new ideas and developments saving the vast richness of natural tropical ecosystems.

Our conference is embedded into the commemorative year of Darwin´s 200 anniversary.

"*Delight*" said Charles Darwin, "*is a weak term to express the feelings of a naturalist who, for the first time, has wandered by himself in a Brazilian forest*." Everyone who visited tropical rainforests or other natural tropical ecosystems either in South America or in Africa and Asia knows the deeper meaning of Darwin's sentence. As scientists we are not in a contemplative position but try to observe and describe our world as exact as possible. Our deeper knowledge about ecological processes and interactions obligate us to publicly warn of the consequences of human acting. At the same time, we can (and should) develop and provide science-directed options for a sustainable management of threatened tropical ecoystems.

In this sense, our joint conference is an excellent opportunity to leave the ivory tower of science by presenting all our knowledge not only to colleagues but also to deciders, stakeholders and even the public. Only knowledge transfer to a broader public can help to initiate political programs for the protection of sensitive tropical ecosystems, and help to understand that protection and sustainable management is in the self-interest of every human being.

It would be a great outcome if our annual meeting in Marburg could act as an efficient multiplicator and a counsellor for the protection of natural and the rehabilitation of degraded tropical environments.

The University of Marburg will support this goal by offering their facilities to the members of the conference, bringing together scientists from 45 countries for discussions and exchange of ideas. The organizers wish all participants stimulating dialogues and lectures as well as five inspiring and fruitful days at the conference and the attractive side program.

Welcome to Marburg and Germany!

Gerhard Kost & Jörg Bendix
for the organizing committee

Meeting Organization

Chairpersons

Prof. Dr. Jörg Bendix, Prof. Dr. Gerhard Kost

Organizing committee

Michael Kirk
Prija Davidar
Nina Farwig
Elisabeth Kalko
Eduard Linsenmair
Miguel Martinez-Ramos
Pia Parolin
Hans ter Steege

Academic committee

Ellen Andresen
Jörg Bendix
Julieta Benitez-Malvido
Francis Q. Brearley
Jerome Chave
Priya Davidar
Nina Farwig
Pierre-Michel Forget
Jaboury Ghazoul
Patrick Jansen
Elisabeth K. V. Kalko
Michael Kirk
Gerhard Kost
W. John Kress
William F. Laurance
Eduard Linsenmair
Miguel Martinez Ramos
Pia Parolin
Carlos A. Peres
Emma Sayer
Hans ter Steege
Wolfgang Wilcke

Conference management, secretariat, public relation/communication

KCS Kuhlmann Convention Center (Genf), working group Prof. Dr. Jörg Bendix, working group Prof. Dr. Gerhard Kost

Chairs of symposia

Achim Bräuning
Alexandra-Maria Klein
Alves dos Santos
Ana Carnaval
Anton Weber
Barbara Rudolph
Bettina Engelbrecht
Birgit Ziegenhagen
Brigitte Fiala
C.W. Dick
Christoph Leuschner
Daniel Piechowski
David L. Erickson
Eckhard Heymann
Eduard Linsenmair
Elisabeth Kalko
Ellen Andresen
Emma Sayer
Francis Brearley
Gerhard Kost
Hans ter Steege
Heiko Faust
Herrmann Behling
Ingrid Kottke
Isabel Cristina Machado
Jana Juhrbandt
Jürgen Homeier
Klaus Riede
Laurence Culot
Lian Pin Koh
Liza Comita
Lucy Rist
Luitgard Schwendenmann
Marielos Peña Claros
Michael Lakatos
Nico Blüthgen
Nina Farwig
Norbert Cordeiro
Patrick Jansen
Perdita Pohle
Pia Parolin
Pierre-Michel Forget
Robert Gradstein
Simone Haberle
Stefan Schwarze
Susan G. Letcher
Sven Günter
Thomas Püttker
Veronika Mayer
W. John Kress
William F. Laurance
Yann Clough
Stefan Schnitzer

Plenary speakers

Elisabeth Kalko
Marcello Tabarelli
Norbert Codeiro
Kathy Willis
Damayanti Buchori
Jaboury Ghazoul
Helmut Haberl

Conference venue

The conference will be held at the University of Marburg in the Audimax "Hörsaalgebäude" at the Biegenstrasse 14. Marburg is easily approachable by train in approximately 1.5 hours travel time from Frankfurt international airport. Note that distances in Marburg are small except the way to the New Botanical Garden (and maybe to your accomodation) so that the conference locations are easily accessible by short walks. The Audimax (Hörsaalgebäude) where all oral and poster presentations will be presented is centrally located. From the main train station you can either walk (10 to 15 minutes) or take the bus (6 minutes). By bus, you can take bus numbers 2, 3, 5 and 7. Get off at "Stadthalle". The Audimax "Hörsaalgebäude" is opposite the "Stadthalle". The Audimax is also the venue for conference registration, poster setup, conference office as the main contact point, plenary talks, evening lectures, coffee breakes in the lobby of the lecture halls as well as the conference internet point in the (Leonardo Café).
Advice for Speakers and Chairpersons
The lecture rooms are fully equipped with computer facilities, LCD projector and microphones. In the installations room, all oral presentations must be uploaded and checked to/on the display system
There will be 15 min for each speaker (12 min plus 3 min discussion). Computer and beamer/ projector facilities are available at the lecture halls. Please provide the CD or memory stick to the staff in the meeting room your talk is scheduled for on Monday at registration time (10.30 am to 14.00 pm) to load the presentation to the computer. This allows us more time in case that problems should occur. It will not be possible to use your own notebooks.

Please ensure to be strictly in time! Chairpersons are kindly asked to adhere strictly to these limits in order to allow attendants to switch occasionally between the talks of parallel sessions.
Posters setup starts on Sunday at 12.00 pm. Assistance and fixing material for poster setup is available at the registration desk.

With regard to the side program, the icebreaker cocktail will be offered at the historical Landgrave Castel (“Fürstensaal”), accessible by a short walk uphill. The conference dinner is organized in the Mensa located at the eastern banks of the river with a scenic view onto the medieval old town and the castle. (See: Map of Marburg)

Meals

The following restaurants are offering a special lunch rate for participants of the *gtoe*-ATBC conference. The rate is **€ 8.90** and includes lunch and a soft drink. You just have to show your conference badge to receive the special price!

Stadthallenrestaurant Marburg (180 seats)

Biegenstrasse 15, just opposite to the conference venue

Monday, 27.7.2009

„Schnitzel“ with Assorted Vegetables and Potatoes

Tuesday, 28.7.2009

Breast of Turkey in Creamy sauce with Chives and Vegetable rice

Wedensday , 29.7.2009

Gulasch” (diced pork with sauce) Pasta and Vegetables

Thursday, 30.7.2009

Fried Fillet of Fish (Pangasiusfilet) with White Wine sauce and Rice

Restaurant MILANO (60 seats)

Biegenstrasse 19, just across the street and to the left from the conference venue

Monday, 27.7.2009

Lasagne with mixed Salad

Tuesday, 28.7.2009

Sliced Roastbeef on Rucolasalad with Balsamico Dressing
and Rosemary Potatoes

Wednesday, 29.7.2009

Crespelle misto
(Crepes (thin pancakes) with assorted fillings)

Thursday, 30.7.2009

Gratinated „Schnitzel“ with Tomato Sauce, Salad and Pasta

Ristorante Colosseo (130 seats)

Biegenstrasse 35, approx. 4 minutes walk from the conference venue

Monday 27.7.2009

CLOSED

Tuesday, 28.7.2009

Breast of chicken with Pasta and Salad

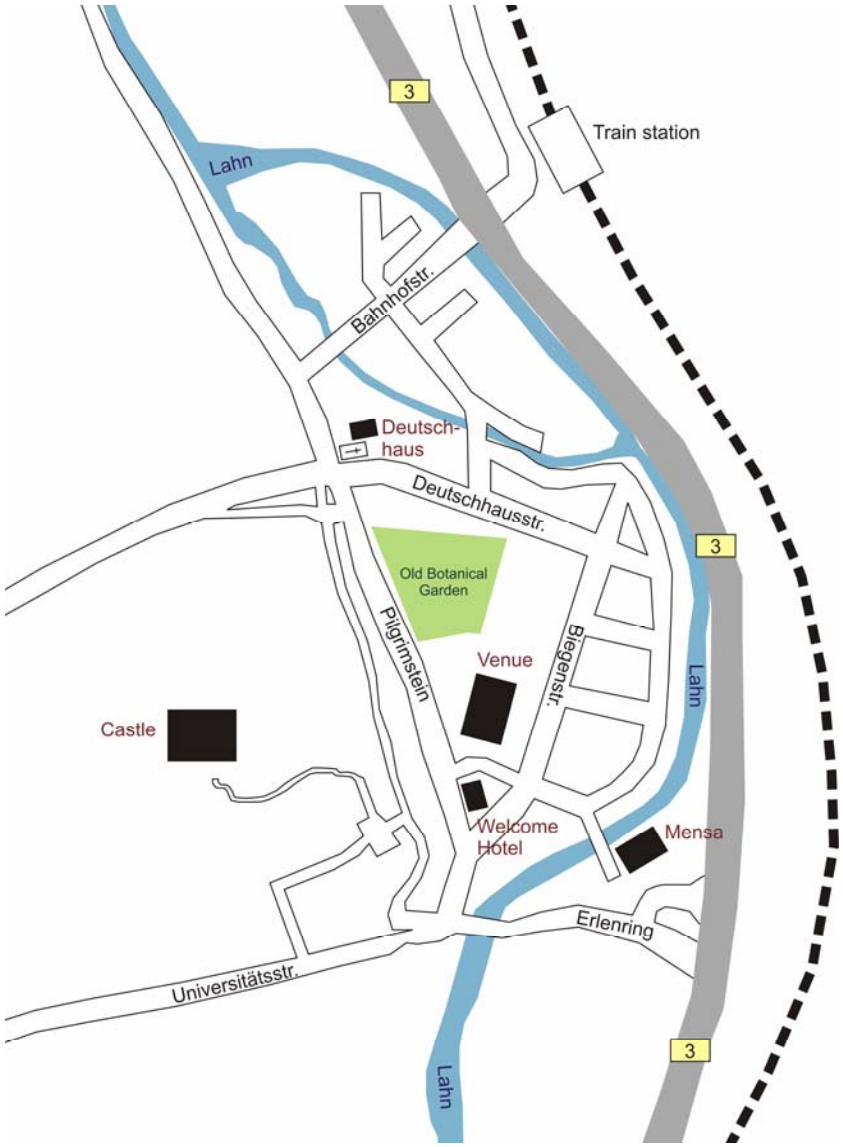
Wednesday, 29.7.2009

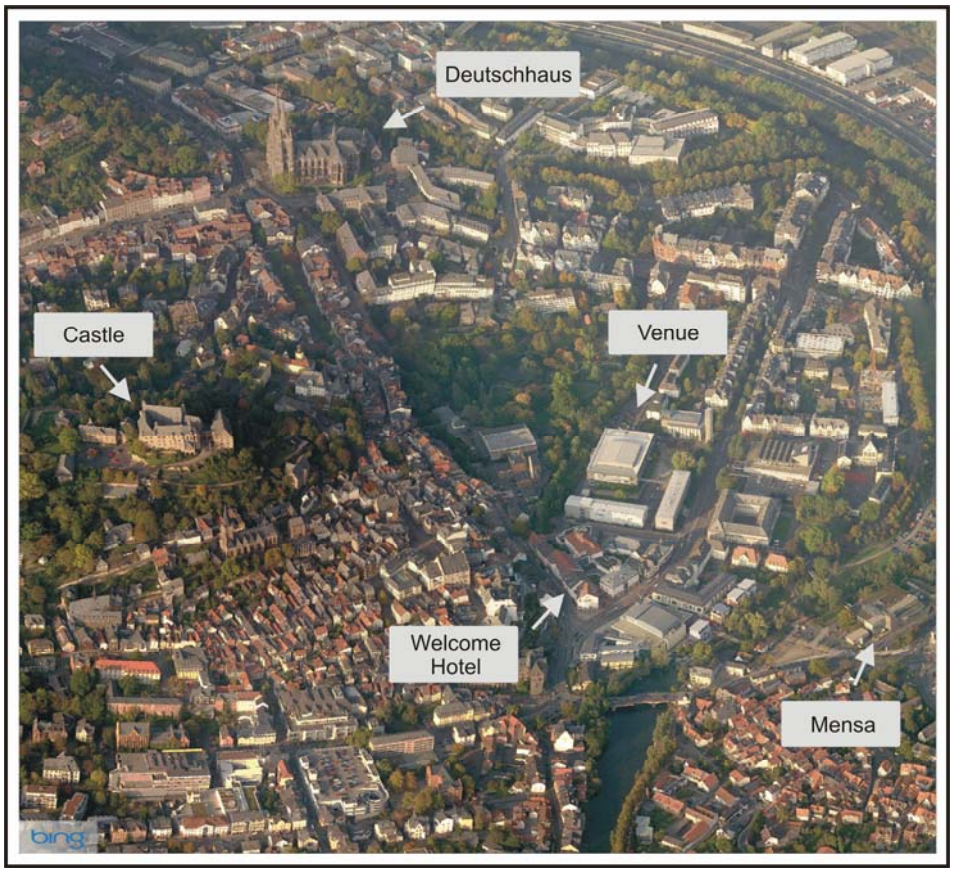
Pizza 4 Seasons

Thursday , 30.7.2009

Mediterranean Vegetables with pasta and herbal sauce

Detailed maps of the inner city of Marburg




Deutschhaus
Castle
Venue
Welcome Hotel
Mensa
bing

Scientific program

Tropical biodiversity, ecosystem functioning and ecosystem services are directly and indirectly threatened by a broad variety of human activities, especially by land use and global climate change (Thuiller 2007). Martens et al. (2003) stressed that one species goes extinct nearly every 20 minutes and that 12.5% of all plant species on the globe are severely threatened. They assumed that global economic losses due to the loss of biological resources and the related degradation of ecosystem services may add up to an order of 50 billion EUR per year.

The majority of these consequences affect tropical countries where biodiversity and its ecosystem services are high, but environmental management and conservation efforts are still annihilated by the basic needs of a dramatically increasing population. Concerning these threats, a great challenge in current ecological research is to gain a sound scientific understanding of biotic-abiotic-human interactions and feedback processes in the complex and highly diverse tropical ecosystems. Comprehensive knowledge in these fields forms the basis to halt the accelerating biodiversity loss in the tropics, and to mitigate impacts of global change on the abiotic, biotic and human spheres.

Moreover, sustainable management options particularly adapted to the vulnerable tropical ecosystems are needed to conserve biodiversity and its underlying ecosystem processes. Only this can retain and regain ecosystem goods and services, necessary to improve livelihood of local communities and to contribute to global human well-being. Recently, the controversial discussions concerning agrofuels as well as the progressive proliferation of invasive species and tropical diseases highlights the rapidly increasing interrelations between tropical ecosystems and concerns of outer tropical societies. Consequently, the joint annual meeting of gtö and ATBC hold in Marburg will provide an interdisciplinary platform for intensive discussion on the following main topics.

1. Biodiversity and ecosystem processes
2. Interactions in a changing world
3. Consequences of land use changes in the tropics
4. Ecosystem demands and services

The conference program for 2009 encompasses four days of mostly five parallel sessions where each main topic is introdued and summarized by normally two plenary lectures given by highly renowned scientists in the respective fields. We are very much appreciated that an internationally leading scientist will additionally

resume the overall objective of the conference in a specific evening lecture. Two poster sessions will compelement the scientific program. In the middle of the

meeting, we offer half-day excursions to different ecosystems even of interesting for tropical scientist. We also have encouraged NGOs to presenet their goals and programs at the conference.

The URL linkt to the scientific program is www.gtoe-atbc2009.com

Conference schedule

The order of the talks in the program table represents the status at press date. Actual changes in the session program will be announced on the day of the session at the central Info Board and at the entrance of the respective lecture hall

Room allocation

	Audimax
	HS 114
	HS 113
	HS 116
	HS 115

Time	Sunday	Monday 27.7.2009 Impacts on biodiversity and ecosystem processes				
from 8.00		Registration				
08.30-09.15		Opening Ceremony				
09.15-09.30						
09.30-09.45	Board meetings					
9.45-10.00	Board meetings					
10.00-10.15	ATBC /	Plenary lecture **Elisabeth Kalko**				
10.15-10.30	gtö					
10.30-10.45						
10.45-11.15		Coffee break				
11.15-11.30		**Session 36** Free Topics - Phylogenetic / Phylogeography	**Session 38** Free Topics - Vertebrates	**Session 26** The advantages of experimental studies	**Session 39** Free Topics - Ants	**Session 04** Tropical water ecology
11.15-11.30						
11.45-12.00						
12.00-12.15						
12.15-12.30	Start					
12.30-14.00	Registr.	Lunch				
14.00-14.45		Plenary lecture **Marcello Tabarelli**				
14.45-15.00		**Session 01** Plant-animal interactions	**Session 20** Biodiversity theories	**Session 18** Ecosystem engineers	**Session 03** Tropical dendroecology	**Session 05** Changes in liana abundance
15.00-15.15						
15.15-15.30						
15.30-15.45						
15.45-16.00						
16.00-16.15		Coffee break				
16.15-16.30						
16.30-16.45		**Session 01** Plant-animal interactions	**Session 20** Biodiversity theories	**Session 18** Ecosystem engineers	**Session 03** Tropical dendroecology	**Session 05** Changes in liana abundance
16.45-17.00						
17.00-17.15						
17.15-17.30						
17.30-17.45						
18.30	ICE BREAKER Landgrave castle	Member meetings gtö / ATBC				
19.00						
20.00- 22.00						

Tuesday 28.7.2009					**Time**
Interactions in a changing world					
					from 8.00
Plenary lecture **Norbert Codeiro**					08.30-09.15
					09.15-09.30
Session 37 Free Topics – Forest	**Session 11** Modified forest ecosystems	**Session 13** Interactions in a changing world	**Session 22** Climate effects on regeneration dynamics	**Session 02** Oilplants & oilbees	09.30-09.45
					9.45-10.00
					10.00-10.15
					10.15-10.30
					10.30-10.45
Coffee break					10.45-11.15
Session 37 Free Topics – Forest	**Session 11** Modified forest ecosystems	**Session 13** Interactions in a changing world	**Session 22** Climate effects on regeneration dynamics	**Session 02** Oilplants & oilbees	11.15-11.30
					11.15-11.30
					11.45-12.00
					12.00-12.15
					12.15-12.30
Lunch					12.30-14.00
Woman meeting					
Plenary lecture **Kathy Willis**					14.00-14.45
Introduction to Poster session I					14.45-15.00
Poster session I					15.00-15.15
Poster of the sessions of Monday & Tuesday					15.15-15.30
					15.30-15.45
					15.45-16.00
Coffee break					16.00-16.15
Session 16 Cascading effects of hunting	**Session 40** Free Topics Plant-Insect Interactions	**Session 35** Free Topics – Bats	**Session 15** Learning from the past	**Session 07** Tropical Fungi & Mykorrhiza	16.15-16.30
					16.30-16.45
					16.45-17.00
					17.00-17.15
					17.15-17.30
	New Botanical Garden				17.30-17.45
					18.30
					19.00
Evening Lecture Paul Vlek					20.00- 22.00

Time	Wednesday 29.7.2009 Ecosystem Demands and Services			
from 8.00				
08.30-09.15	Plenary lecture **Damayanti Buchori**			
09.15-09.30				
09.30-09.45	**Session 23** Struggle in the Tropics	**Session 09** Nutrient manipulation experiments	**Session 06** Consequences of animal seed dispersal	**Session 10** Session of the NGO's
9.45-10.00				
10.00-10.15				
10.15-10.30				
10.30-10.45				
10.45-11.15	**Coffee break**			
11.15-11.30	**Session 23** Struggle in the Tropics	**Session 09** Nutrient manipulation experiments	**Session 06** Consequences of animal seed dispersal	**Session 28** DNA Barcodes Session 23 Struggle in the Tropics
11.15-11.30				
11.45-12.00				
12.00-12.15				
12.15-12.30				
12.30-14.00	**Lunch**			
14.00-14.45	**Meeting FOR 816** **1/2 day Exkursions 1,2,3,4**			
14.45-15.00	**s**			
15.00-15.15				
15.15-15.30				
15.30-15.45				
15.45-16.00				
16.00-16.15				
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16.45-17.00				
17.00-17.15				
17.15-17.30				
17.30-17.45				
18.30				
19.00				
20.00- 22.00				

Thursday 30. 7.2009					Friday	Time
Consequences of land use changes (LUC)						from 8.00
Plenary lecture **Jaboury Ghazoul**						08.30-09.15
						09.15-09.30
Session 08 Applying ecological knowledge	**Session 14** Human ecological dimensions in sustainable utilization	**Session 34** Impacts of climatic change	**Session 19** Land-use change at local and landscape scales	**Session 12** Research Station La Gamba (Costa Rica)	3-4-day Post-Excursions	09.30-09.45
					3-4-day Post-Excursions	9.45-10.00
						10.00-10.15
						10.15-10.30
						10.30-10.45
Coffee break						10.45-11.15
Session 08 Applying ecological knowledge	**Session 14** Human ecological dimensions in sustainable utilization	**Session 34** Impacts of climatic change	**Session 19** Land-use change at local and landscape scales	**Session 41** Free Topics		11.15-11.30
						11.15-11.30
						11.45-12.00
						12.00-12.15
						12.15-12.30
Lunch						12.30-14.00
Plenary lecture **Helmut Haberl**						14.00-14.45
Introduction to Poster session II						14.45-15.00
Poster session II						15.00-15.15
Poster of the sessions of Wednesday & Thursday						15.15-15.30
						15.30-15.45
						15.45-16.00
Coffee break						16.00-16.15
Session 08 Applying ecological knowledge	**Session 25** Adaptation of agro forestry	**Session 17** Biofuels, biodiversity and people	**Session 19** Land-use change at local and landscape scales	**Session 41** Free Topics		16.15-16.30
						16.30-16.45
						16.45-17.00
						17.00-17.15
						17.15-17.30
						17.30-17.45
Conference Dinner and Farewell Party						18.30
Awards						19.00
						20.00- 22.00

Monday - 27.07.2009: Impacts on biodiversity and ecosystem processes						
	Time	**Audimax**	**HS 114**	**HS 113**	**HS 116**	**HS 115**
8	from 8.00	Registration				
	08:30	Opening Ceremony				
	08:45					
	09:00					
	09:15					
	09:30					
	09:45					
10	10:00	Plenary lecture Elisabeth Kalko (Linsenmair)				
	10:15					
	10:30					
	10:45	Coffee break 10.30 - 11.00 am				
11	11:00					
		Session 36: Free Topics - Phylogenetic / Phylogeography. Chaired by *C.W. Dick & Birgit Ziegenhagen.*	**Session 38: Free Topics - Vertebrates. Chaired by *Eckhard Heymann & N.N***	**Session 26: The advantages of experimental studies. Chaired by *Emma Sayer & Francis Brearley***	**Session 39 Free Topics - Ants. Chaired by *Eduard Linsenmair & Brigitte Fiala***	**Session 04 Tropical water ecology. Chaired by *Pia Parolin & Barbara Rudolph***
	11:15	T36-01: Can Pleistocene refuge theory explain within-species patterns of genetic diversity in African lowland rainforest trees?	T38-01: How do primate communities vary among sites in an intact Neotropical forested landscape?	T26-01: Trends in seedling growth and survival over eight years in a Bornean rain forest	T39-01: The waste dumps of leaf-cutting ants and their utilization in ecological research.	T04-01: Invasive freshwater invertebrates and global change: comparing Latin America and Europe
	11:30	T36-02: Reconstructing West African rainforest refugia via forest frogs	T38-02: Food abundance impacts activity patterns in the Central-American agouti	T26-02: A short-cut to measuring rhizosphere respiration in a lowland tropical forest.	T39-02: What still can be found in tropical soils – the case of Martialis heureka, the most primitive living ant!	T04-02: Quantifying the threats to tropical wetlands: a Mauritian case study
	11:45	T36-03: Pre-Pleistocene population structure of widespread tropical forest trees	T38-03: A community-wide stable isotope analysis reveals dense trophic species packing in a Malagasy primate community	T26-03: Influence of litter diversity on decomposition in tropical rainforest (French Guiana)	T39-03: Tropical parabiotic ants: an unusual partnership	T04-03: Effects of introduced rainbow trout (Oncorhyncus mykiss) on amphibian assemblages in high mountain forests from Colombia
12	12:00	T36-04: Recruitment dynamics across multiple life stages in the tropical tree Prunus africana	T38-04: Amphibian hotspots in West Africa revisited – do patterns change with finer resolution?	T26-04: Tree diversity effects on aboveground nutrient pools of trees in an experimental plantation in Panama	T39-04: Ecology and maintenance of a novel tripartite mutualistic association	T04-04: Influence of a waterfall over richness and similarity in adjoining pools of an Atlantic Rain Forest stream
	12:15	T36-05: Seed rain, gene flow and fine-scale genetic structure of a bird-dispersed dioecious under-canopy fig tree:Ficus cyrtophylla	T38-05: Habitat use and diet of capybara (Hydrochoerus hydrochaeris: Rodentia, Hydrochaeridae)in the floodplain savannas of the Orinoco, Colombia	T26-05: Species-specific response of tree xylem flux to experimental drought in Central Sulawesi	T39-05: Competition for shared mutualist ants may influence plant performance	T04-05: Trophic state of streams and reservoirs in the middle Vietnam (Khanh Hoa province)
	12:30	Lunch: 12:30-14:00 pm				
	12:45					
	13:00					
	13:15					
	13:30					
	13:45					
14	14:00	Plenary lecture Marcello Tabarelli (Pia Parolin)				
	14:15					
	14:30					
		Session 01: Plant-animal interactions. Chaired by *Alexandra-Maria Klein & Nico Blüthgen*	**Session 20: Biodiversity theories. Chaired by *N.N***	**Session 18: Ecosystem engineers. Chaired by *Rainer Wirth & Inara R. Leal***	**Session 03: Tropical dendroecology. Chaired by *Achim Bräuning***	**Session 05: Changes in liana abundance. Chaired by *Susan G. Letcher***
	14:45	T01-01: Herbivores, restricted hosts, and vanishing habitats - jeopardizing tropical interactive networks	T20-01: What is beta diversity and what have we learned about it in tropical forests?		T03-01: Climate Change Impact on Forest Area in Thailand	T05-01: Changing Liana abundance in tropical forests: introduction and overview
15	15:00	T01-02: Host-parasitoid food webs as tools for understanding tropical diversity	T20-02: Properties of alpha and beta diversity indices in communities organised by dispersal and/or niche assembly rules – a simulation study	T18-01: Alteration of soil labile organic carbon by invasive earthworms (Pontoscolex corethrurus) in tropical rubber plantations	T03-02: Reconstructing the flow of the Blue Nile River from Juniperus procera tree rings in Ethiopia	T05-02: Changes in liana and tree biomass as a consequence of increased hurricane frequencies in Cozumel, México

	15:15	T01-03: Plant-herbivore interactions in a changing world: changes in plant-herbivore networks, demographic consequences and evolutionary potential of diet expansions to exotic gingers by generalist and specialist rolled-leaf beetles	T20-03: The paradox of soil generalist tree species	T18-02: Termite impacts on soil properties and processes: improving soil hydrological function in grazing lands of semi-arid tropical Queensland, Australia.	T03-03: THE ROLE OF WOOD MASS DENSITY AND MECHANICAL CONSTRAINTS ON THE ECONOMY OF TREE ARCHITECTURE	T05-03: Land-use history and the origins of local liana species composition
	15:30	T01-04: Ant-fruit interaction networks in fragmented and continuous forests of Southeast Brazil	T20-04: Conservation and management of the biodiversity in a hotspot characterized by short range endemism and rarity: the challenge of New Caledonia	T18-03: Effects of domestic sewage on survival and bioturbation activities of mangrove fiddler crabs and gastropods; with emphasis on their role for ecosystem functioning in wastewater wetlands	T03-04: How old are trees in central Amazonia?	T05-04: Density and growth of liana regeneration in secondary and primary forests of Central Amazonia, Brazil
	15:45	T01-05: Changes over time in mutualistic ant-plant networks and biological mechanisms promoting them	T20-05: Exploring the impact of phylogeny and neutral processes on tropical ant communities	T18-04: Decomposition processes in Colombian streams: influence of invertebrate shredders, plant compounds, and hydrology	T03-05: Ecological significance of wood anatomical variation in Kenyan mangroves	T05-05: Lianas and free-standing plants during forest succession in northeastern Costa Rica
16	16:00	16.00 - 16.30 pm Coffee break				
	16:15					
	16:30	T01-06: Invasive species interfere with endemic plant-pollinator interactions: lessons from generalised pollination webs on the Seychelles	T20-06: Can spatial aggregation of tropical forests trees be predicted by species attributes?	T18-05: Diversity and functional role of termites in West Africa : case studies in Côte d'Ivoire	T03-06: Tropical tree rings reveal increased juvenile growth rates over time and preferential survival of fast-growing juveniles	T05-06: Phylogeny, distribution and abundance of a clade of Neotropical lianas (Bignonieae, Bignoniaceae)
	16:45	T01-07: The devil is in the details: modularity of mutualistic networks	T20-07: Light-dependence of growth rates across a tropical lowland rainforest community	T18-06: The legacy of termites – How ancient termite nests influence today's vegetation in South Africa	T03-07: Dry Forest versus Mountain Rainforest: A comparison of tree growth and climate variability in Southern Ecuador	T05-07: The liana community of an eastern Congo basin forest
17	17:00	T01-08: Different patterns of resource partition between plants and animals in pollination networks	T20-08: Bryophytes across the Amazon Basin	T18-07: Intensified Ecosystem Engineering in a Fragmented Forest: Soil Perturbations by Hyper-Abundant Leaf-Cutting Ants	T03-08: Long-term and age-related isotope trends in pristine tropical forests	T05-08: Lianas of the Upper Amazon: Comparison of climber communities from Los Amigos, Peru and Yasuní, Ecuador
	17:15	T01-09: Interacion patterns in a tropical semideciduosu pollination networks	T20-09: Linking tree species spatial distribution and recruitment limitation in a tropical forest	T18-08: Nucleated succession by Phoenix pusilla, an ecosystem engineer facilitates dry forest species in the arid Coromandel coast of India	T03-09: Sexual dimorphism in growth and survivorship patterns of Southeast Asian trees: a 20-year study	T05-09: What determines liana success in Neotropical forests?
	17:30	T01-10: The Restoration of Plant-Flower Visitor Networks in a South Eastern Brazilian Atlantic Forest	T20-10: Analyzing phylogenetic relationships among species: a new tool for ecology and biogeography studies.	T18-09: Does forest fragmentation turn leaf-cutting ants from 'good' to 'bad' ecosystem engineers?	T03-10: A reassessment of carbon content in tropical trees: The volatile C fraction and its variability among species	T05-10: Liana infestation and its consequences: evidence from African forests
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	18:30	Member meetings *gtö* / ATBC				
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Tuesday - 28.07.2009: Interactions in a changing world						
Time		**Audimax**	**HS 114**	**HS 113**	**HS 116**	**HS 115**
8	from 8.00					
	08:30	Plenary lecture Norbert Codeiro (Nina Farwig)				
	08:45					
	09:00					
	09:15					
		Session 37: Free Topics – Forest. Chaired by *Robert Gradstein & Patrick Jansen*	**Session 11: Modified forest ecosystems. Chaired by Nina Farwig & Norbert Cordeiro**	**Session 13: Interactions in a changing world. Chaired by *Thomas Püttker & Daniel Piechowski***	**Session 22: Climate effects on regeneration dynamics. Chaired by *Liza Comita & Bettina Engelbrecht***	**Session 02: Oilplants & oilbees. Chaired by *Alves dos Santos & Isabel Cristina Machado***
	09:30	T37-01: Comparison of different pathways of succession in the tropical dry evergreen forest on the Coromandel coast of south India: Evaluating reforestation.	T11-01: Bird dispersal and persistence affects plant recruitment in a fragmented east-African biodiversity hotspot	T13-01: How much of the Atlantic Forest is effectively conserved?	T22-01: The contribution of drought tolerance, pests, and competition in shaping species distributions along the Malay-Thai Peninsula	T02-01: Oil-Flowers and their Bees: A global Survey
	09:45	T37-02: Could the gregarious bamboo flowering modify the regeneration process of an Atlantic Forest fragment?	T11-02: The presence of howler monkeys influences the richness of the seed rain and seedling bank in tropical rain forest fragments	T13-02: Uncontrollable hunting, extinctions and the disappearance of unknown mammal species: scenario and perspectives of a hotspot's hotspot (Pernambuco Endemism Centre)	T22-02: Processes at the forest-savanna boundary in central Brazil	T02-02: Diversity and evolution of the association of oil-collecting bees with Nierembergia (Solanaceae) and Calceolaria (Calceolariaceae)
10	10:00	T37-03: Water relations of indigenous trees in a tropical mountain forest in Ethiopia	T11-03: Effects of experimental tree plantations on seed rain and recruitment in Mexican humid and dry tropical forests	T13-03: Use of wood products for domestic purposes in an Atlantic Forest area, Northeastern Brazil	T22-03: Changes in seedling dynamics and requirements within forests found along a rainfall gradient in Jamaica; how will this affect seedling establishment in a changing climate?	T02-03: Ecology, Biogeography, and Systematics of the Ctenoplectrini, an Old World Oil Bee Tribe, Specialized on the Gourd Family (Cucurbitaceae)
	10:15	T37-04: Herbivores suppress seedling growth of a dominant canopy-emergent tree in a Central African forest	T11-04: Seed dispersal syndromes and plant regeneration in highly diversified shaded coffee plantations	T13-04: Domestic dog (Canis lupus familiaris) invasion in the Atlantic Forest: which factors determine the presence and frequency of occurrence in the remnants?	T22-04: Dipterocarps and El Nino	T02-04: How oilbees find their flowers: do they use their eyes and/or antennae?
	10:30	T37-05: Impact of anthropogenic disturbance on diversity of five selected plant groups in cloud forest fragments of central Veracruz, Mexico.	T11-05: The potential of plantations for bird conservation and natural forest regeneration	T13-05: Species and functional diversity of ants in tropical secondary forests	T22-05: Partitioning of understorey light and dry-season soil moisture gradients among seedlings of four rain forest tree species in Madagascar	T02-05: Pollination networks of oil-flowers: a tiny world within the smallest of all worlds
	10:45	10.30 - 11.00 am Coffee break				
11	11:00					
	11:15	T37-06: Distribution and abundance of tree species in secondary forests: linking local, landscape, and regional scales in a Panamanian forest	T11-06: Forest recovery in abandoned tropical pastures: generalists frugivores as ecological rock stars in plant-animal mutualistic networks	T13-06: Variety matters: Immune gene diversity and parasite burden in two marsupial species from the Brazilian Atlantic forest	T22-06: Hydraulic properties of 40 dry forest tree species in relation to drought-tolerance	T02-06: Nesting biology of the Neotropical oilbees
	11:30	T37-07: Phenology of woody species in permanent plots of the Yungas mountain forest, La Paz - Bolivia	T11-07: What makes Melia azedarach a successful invader? The role of seed dispersal in the invasion process	T13-07: Litterfall, litterstock and litter decomposition in the Atlantic Rainforest of Parana State, Brazil	T22-07: Regional variation of dry season intensity affects seedling survival and tree distribution in tropical forests	T02-07: Effect of nectar concentration on foraging behavior in the nextar-feeding bat Glossophaga soricina
	11:45	T37-08: Community Dynamics of a Secondary Tropical Dry Forest: successional pathways and variability	T11-08: How is Southeast Asian biodiversity coping in human-dominated landscapes?	T13-08: Fragment size effects on Cecropia species in the seed rain of northeastern Brazilian Atlantic Forest fragments	T22-08: Seasonal and spatial variation in water availability drive habitat associations in a tropical forest	T02-08: Evolutionary versus Ecological Specialization in the Oil Flower Pollination Syndrome
12	12:00	T37-09: Succession dynamics on landslide sites in a tropical mountain forest in southern Ecuador	T11-09: Biodiversity conservation and carbon sequestration in secondary montane forests, Tanzania	T13-09: Comparing the use of species and landscape structural measures as indicators of ecological integrity	T22-09: Tree seedling regeneration in East-Africa affected by spatial distribution of abiotic factors: Three different experimental approaches	

	12:15	T37-10: Fog in the tropical lowland cloud forest of French Guiana – A frequent phenomenon with impact on microclimate and epiphytes	T11-10: Rainforest restoration and carbon sequestration in eastern Madagascar: Linking biodiversity conservation, ecological functioning and sustainable livelhoods	T13-10: The BIOTA/FAPESP Program: a well succeeded Brazilian experience to use scientific data to improve biodiversity conservation and restoration within the Atlantic Forest domain in SE Brazil	T22-10: The ticking rank clock - Species rank analysis as a tool to measure system resilience to land use and climate change	
	12:30	12.30 - 14.00 pm Lunch / Women Meeting				
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14	14:00	Plenary lecture Kathy Willis (Prya Davidar)				
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	14:45	Introduction to Poster session I				
15	15:00	Poster session I				
	15:15	Poster of the sessions of Monday & Tuesday				
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16	16:00	16.00 - 16.30 pm Coffee break				
	16:15					
		T16-01: Hunting impacts on density dependence of recruitment in a Neotropical palm	T40-01: Linking interspecific variation in vertebrate seed predation, insect seed predation, and pathogen attack to fruit traits in tropical woody plants	T35-01: Why is male philopatry adaptive in the greater sac-winged bat (Saccopteryx bilineata)?	T15-01: Origin, diversity and biogeography of the flora of the seasonally dry tropical forest in Mexico: perspectives from a biogeographic node in the Isthmus of Tehuantpec (Oaxaca)	T07-01: Seasonal microbial community composition in soil aggregate fractions from three land uses of the tropical dry ecosystem in Chamela, Jalisco, Mexico.
	16:30	T16-02: Frugivore loss and recruitment limitation in tropical trees	T40-02: Caterpillar communities on selected shrubs in the Andes of southern Ecuador – first results	T35-02: Influence of neotropical bats on germination parameters of free-standing and strangler figs (Ficus sp., Moraceae)	T15-02: Upper Forest Line reconstruction based on modern vegetation structure and composition in the Andes of northern Ecuador	T07-02: Species-rich but distinct arbuscular mycorrhizal communities in reforestation plots on degraded pastures and in neighboring pristine tropical mountain rain forest
	16:45	T16-03: Too many animals and not enough animals in African parks	T40-03: A tale of three islands, two plants and their pollinators: Understanding geographic variation in plant-pollinator interactions and pollinator-mediated genetic structure in two Eastern Caribbean Heliconia (Heliconiaceae)	T35-03: Colonization, dispersal and extinction: the hard life of bat phoretic flower mites	T15-03: Altitudinal migration of Ecuadorian montane forest during the last 3000 years; is afforestation a correct carbon sink?	T07-03: Defining biologically meaningful molecular operational taxonomic units
17	17:00	T16-04: Hunting and seed dispersal in Tropical East Asia	T40-04: Reproductive isolation by floral scent in three sympatric euglossine-pollinated Araceae species	T35-04: Density Response to Habitat at Different Scales: A Case Study in The Tent-Roosting Bat Uroderma bilobatum	T15-04: Vegetation, biodiversity and fire dynamics on the southern Brazilian highland and their implication for conservation and management of modern Araucaria forest and grassland ecosystems	T07-04: Inocybaceae ectomycorrhizal fungi associated with the endemic Pakaraimaea dipterocarpacea in Guayana, Venezuela: ecological importance and relationship with Africa.
	17:15	T16-05: The hunting footprint of Amazonian forests	T40-05: Resin collection in a tropical stingless bee community	T35-05: Nectar resources of chiroptherophilic flowers and their influence on Leptonycteris yerbabuenae abundance in a tropical dry forest	T15-05: Drivers of peatswamp development in the Malay Archipelago: implications for ecosystem stability and carbon sequestration	T07-05: How leaf cutting ants defend their fungus garden against the fungal pathogen Escovopsis

	17:30	T16-06: Do large vertebrates generate unique ecological patterns that change when species go extinct?	New Botanical Garden	
		New Botanical Garden		
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	20:00	Evening Lecture Paul Vlek (Jörg Bendix)		
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Wednesday - 29.07.2009: Ecosystem Demands and Services					
Time		**Audimax**	**HS 114**	**HS 113**	**HS 116**
8	from 8.00				
	08:30	Plenary lecture Damayanti Buchori (Teja Tscharntke)			
	08:45				
	09:00				
	09:15				
		Session 23: Struggle in the Tropics. Chaired by *Pia Parolin & Michael Lakatos*	**Session 09: Nutrient manipulation experiments. Chaired by *Jürgen Homeier & Christoph Leuschner***	**Session 06: Consequences of animal seed dispersal. Chaired by *Laurence Culot & Ellen Andresen***	**Session 10: Session of the NGO's. Chaired by *Klaus Riede***
	09:30	T23-01: Struggle of plants with crassulacean acid metabolism (CAM) in tropical environments under the action of dynamic networks of stressors	T09-01: Chronic N addition to a tropical lowland forest: leaching losses, soil chemical changes, and tree nutrient status	T06-01: Size-dependence of seed dispersal by a scatter-hoarding rodent	T10-01: Who saves the rainforest?
	09:45	T23-02: Shade tolerance through resistance and resilience	T09-02: Nutrient dynamics along an elevation transect in the Peruvian Andes	T06-02: Tapirs are effective long distance seed dispersers: a reciprocal transplant experiment in a precipitation gradient in Mexico	T10-02: Progress and Potentials of Community-based Conservation and Development in South Asia
10	10:00	T23-03: Leaf traits of dry and moist forest tree species and the importance of the leaf economics- and leaf size spectrum	T09-03: Response of plant communities to nutrient and water addition at the forest-savanna boundary in central Brazil	T06-03: Bird diversity and seed dispersal of the native tree species Celtis africana along a disturbance gradient in coastal scarp forest in South Africa	T10-03: Rainforest conservation on tribal land: lessons from Papua New Guinea
	10:15	T23-04: Leaf traits of woody species with wide distribution in the Cerrado and Amazonian savannas: convergence or divergence of adaptive traits?	T09-04: Rapid effects of nutrient addition on aboveground producitvity of Ecuadorian montane forests	T06-04: Seed size selection by a primate seed disperser and potential effects on post-dispersal seed fate	T10-04: Saving the Rainforest-strategies and approaches of WWF
	10:30	T23-05: Research struggles in the tropics - some ideas and experiences	T09-05: Leaf litter decomposition in a tropical mountain rain forest as affected by nutrient addition and elevation	T06-05: From tamarins to seedlings: seed survival and seedling recruitment in a gradient of forest disturbance	T10-05: Those who act upon our territories - Socio-cultural approach to the diversity of human intervention in ecological processes
	10:45	10.30 - 11.00 am Coffee break			
11	11:00				
					Session 28: DNA Barcodes Session 23 Struggle in the Tropics. *Chaired by W. John Kress & David L. Erickson*
	11:15	T23-06: Ecological filters in a fragmented forest: Plant recruitment on and around leaf-cutting ant nests	T09-06: Chronic nitrogen addition causes a quick reduction in soil carbon dioxide efflux from a tropical montane forest but no response from a tropical lowland forest in decadal scale	T06-06: Matrix and edge effects on ecological processes in tropical forest	T28-01:Tropical Tree Community Turnover: How DNA Barcode Community Phylogenies and Functional Traits Can Help Elucidate Cryptic Patterns and Mechanisms.
	11:30	T23-07: Do leaf-cutting ants go undetected? Evidence for delayed induced defence following cumulative herbivory by Atta colombica in lima bean plants.	T09-07: Trace gas fluxes react on elevated nitrogen input in tropical mountain forests of southern Ecuador	T06-07: Plant – Animal – InteractionParkia and Saguinus as a model system for seed dispersal	T28-02: Relevance of DNA barcoding in community-wide analysis of leaf functional traits with strong and weak phylogenetic signals

	11:45	T23-08: Patterns of Floristic Differentiation among Atlantic Forests and the Influence of Climate II: The Southern Scenario	T09-08: Is potassium in throughfall an indicator for forest growth?	T06-08:Effect of human disturbance on seed and seedling distribution patterns of the Andean oak (Quercus humboldtii Bonpl.)	T28-03: Application of DNA barcodes to community phylogenetics and ecological forensics on Barro Colorado Island, Panama
12	12:00	T23-09: Plasticity and survival of tropical corticolous non-vascular plants at forest fragments		T06-09: Simulation of seed dispersal by two neotropical tamarin species	T28-04: DNA barcodes as a tool for tree species discovery in diverse tropical forests
	12:15	T23-10: Responses to flooding stress in tropical trees		T06-10: Seed dispersal modes of woody species of young secondary forest compared to old-growth fragments in the Atlantic Forest of NE Brazil – where might succession lead to?	T28-05: Collaborative biodiversity informatics: increasing the rate of tropical plant inventory and description
	12:30	12.30 - 14.00 pm Lunch			
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14	14:00	Meetings FOR 816 1/2 day Exkursions 1,2,3,4			
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Thursday - 30.07.2009: Consequences of land use changes (LUC)						
Time		**Audimax**	**HS 114**	**HS 113**	**HS 116**	**HS 115**
8	from 8.00					
	08:30	Plenary lecture Jaboury Ghazoul (Bill Laurance)				
	08:45					
	09:00					
	09:15					
	09:30	**Session 08: Applying ecological knowledge. Chaired by *Marielos Peña Claros & Sven Günter***	**Session 14: Human ecological dimensions in sustainable utilization. Chaired by *Perdita Pohle & Heiko Faust***	**Session 34: Impacts of climatic change. Chaired by *William F. Laurance & Ana Carnaval***	**Session 19: Land-use change at local and landscape scales. Chaired by *Yann Clough & Jana Juhrbandt***	**Session 12: Research Station La Gamba (Costa Rica). Chaired by *Anton Weber & Veronika Mayer***
		T08-01: Silviculture in seasonally dry tropical forests	T14-01: The use of Traditional ecological knowledge in forest management: an example from India	T34-01: Global warming and the vulnerability of tropical biota: Where do the thermal specialists live?	T19-01: Biodiversity conservation on a crowded planet: reconciling agriculture with ecology	T12-01: Impact of climate change on the performance of tropical lowland forests in SW Costa Rica
	09:45	T08-02: Effect of silvicultural treatments on the structure and dynamics of tropical moist forests - Examples from French Guiana and Central Africa	T14-02: Ecosystem management and sustainable development in the southwest of Mexico City.	T34-02: Range-shift Gaps and Lowland Biotic Attrition in a Warming Tropical Climate	T19-02: Biodiversity conservation, yield and economic incentives in cocoa agroforestry intensification in southern Cameroon	T12-02: The Tropical Station La Gamba/Costa Rica ("Tropenstation La Gamba") – a place for scientific studies in the Neotropics
10	10:00	T08-03: Ecological basics for reforestation with native species in the Ecuadorian Andes	T14-03: The value of local biodiversity to communities in Madang Province, Papua New Guinea	T34-03: Comprehensive assessment of species vulnerability to global climate change: vertebrate biodiversity of the Australian tropical rainforests	T19-03: Chocolate and biodiversity: mission possible	T12-03: The importance of small gallery forest strips for maintaining biodiversity – case studies from a human-dominated landscape in southern Costa Rica
	10:15	T08-04: Silvicultural treatments in neotropical montane forests-growth reactions and economical evaluation	T14-04: Carapa crop and oil production: to be or not to be sustainable and equitable.	T34-04: Uphill movements of moth assemblages in response to global warming in Mt Kinabalu, Borneo	T19-04: Tobacco farming and ecosystem impacts	T12-04: Neotropical Rainforests: Nutrient Export by Rainforest Streams
	10:30	T08-05: Functional characteristics determine growth responses of timber species to logging and silvicultural treatments	T14-05: Dioscorea divaricata Burk. (Dioscoreaceae) as a cultural keystone species of the Magbukún Ayta community of Morong, Bataan, Philippines: implications for biocultural diversity conservation	T34-05: Factors influencing species responses to climate change and our ability to predict these responses	T19-05: Ecological and social interactions in sustainable agroforestry management: Cocoa in Ghana	T12-05: Mycelial carton galleries of Azteca brevis (Formicidae) in Southern Costa Rica and the impact of global change
	10:45	Coffee break				
11	11:00					
	11:15	T08-06: Growth-Oriented Logging (GOL): The use of species-specific growth information for forest management in central Amazonian forests	T14-06: Social Stratification, Village Institutions, and Deforestation in Central Sulawesi (Indonesia)	T34-06: Climate change and conservation on Borneo: promoting landscape connectivity.	T19-06: Drivers of intensification in smallholder cacao agroforestry in Central Sulawesi, Indonesia	
	11:30	T08-07: Silviculture contributions towards sustainable management of plantation forests in the highlands of Ethiopia.	T14-07: The social-ecological focus in the mexican conservation: case study	T34-07: Impacts of climatic variability and hurricanes on lemur demography in Madagascar	T19-07: Yield gap and intensification of tropical grain production	
	11:45	T08-08: Can we use of pre-felling inventories for assessing tree diversity at local and regional scales?	T14-08: Impact of harvesting practices and traditional protection actions on the population dynamics of Adansonia digitata L. in West African savanna areas	T34-08: Indirect impacts of global climate change on mangrove -associated biodiversity.	T19-08: Managing trade-offs between agriculture and the environment in West African agro-forestry ecosystems	
12	12:00	T08-09: Role of immigration in population dynamics of harvested understorey tropical palm populations.	T14-09: Fire as a common agricultural tool in the tropics favours the growth of tropical bracken, an extremely aggressive weed	T34-09: The rainfall distribution at forest and pasture areas in Amazônia: present and future	T19-09: Conservation at the landscape level: the role of the agricultural matrix	

	12:15	T08-10: A remote sensing approach to assessing forest recovery 15 years after logging: comparing conventional and reduced impact logging	T14-10: How do tropical forest people respond to flood and how do they use the forests?	T34-10: Long-term tree community dynamics in a Mexican tropical rain forest: global warming sings?	T19-10: Agricultural intensification and the breakdown of autonomous ecosystem function	
	12:30	Lunch / Women Meeting				
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14	14:00	Plenary lecture Helmut Haberl (Mosandl)				
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	14:45	Introduction to Poster session II				
15	15:00	Poster session II				
	15:15	Poster of the sessions of Wednesday & Thursday				
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16	16:00	Coffee break				
	16:15	T08-11: Demography of rattan species in Vietnam			T19-11: An ecosystem service approach to coffee production in a landscape mosaic	
	16:30	T08-12: Not all fragmented neotropical moist forests melt down at forest-pasture edges: spatial patterns and temporal dynamics of forest structure and functional composition in northern Costa Rica			T19-12: Biodiversity in primary forest and different natural forest land use types in Nabanhe Natural Reserve, China	
	16:45	T08-13: Demography of the Brazil nut tree (Bertholletia excelsa) in central Amazonia: implications for the management of an important NTFP			T19-13: Profitability of land-use options for smallholders in Southern-Ecuador	
17	17:00	T08-14: Influence of climate and soil on the dynamics of tropical lowland forests			T19-14: Addressing connectivity for multiple species in multiple landscapes allows better predictions of species sensitivity to fragmentation: an example from birds of the Atlantic Forest, Brazil	
	17:15	T08-15: Do canopy disturbances drive forest plantations into more natural conditions? – A case study from the UNESCO biosphere reserve Can Gio, Vietnam			T19-15: Spider web density in cacao agroforestry in relation to different management strategies on tree, plot and landscape scale	

	17:15	T08-15: Do canopy disturbances drive forest plantations into more natural conditions? – A case study from the UNESCO biosphere reserve Can Gio, Vietnam			T19-15: Spider web density in cacao agroforestry in relation to different management strategies on tree, plot and landscape scale	
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	18:30	Conference Dinner and Farewell Party				
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	20:15	Awards				
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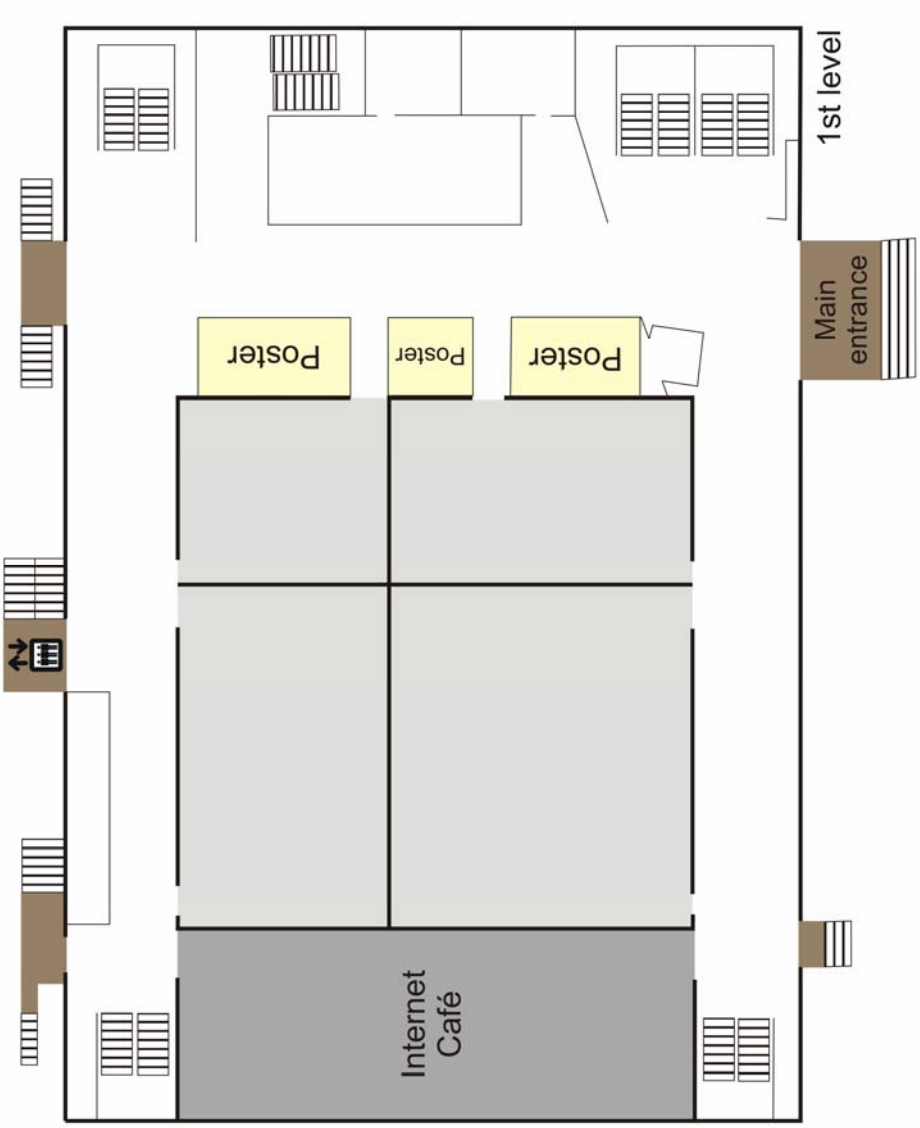
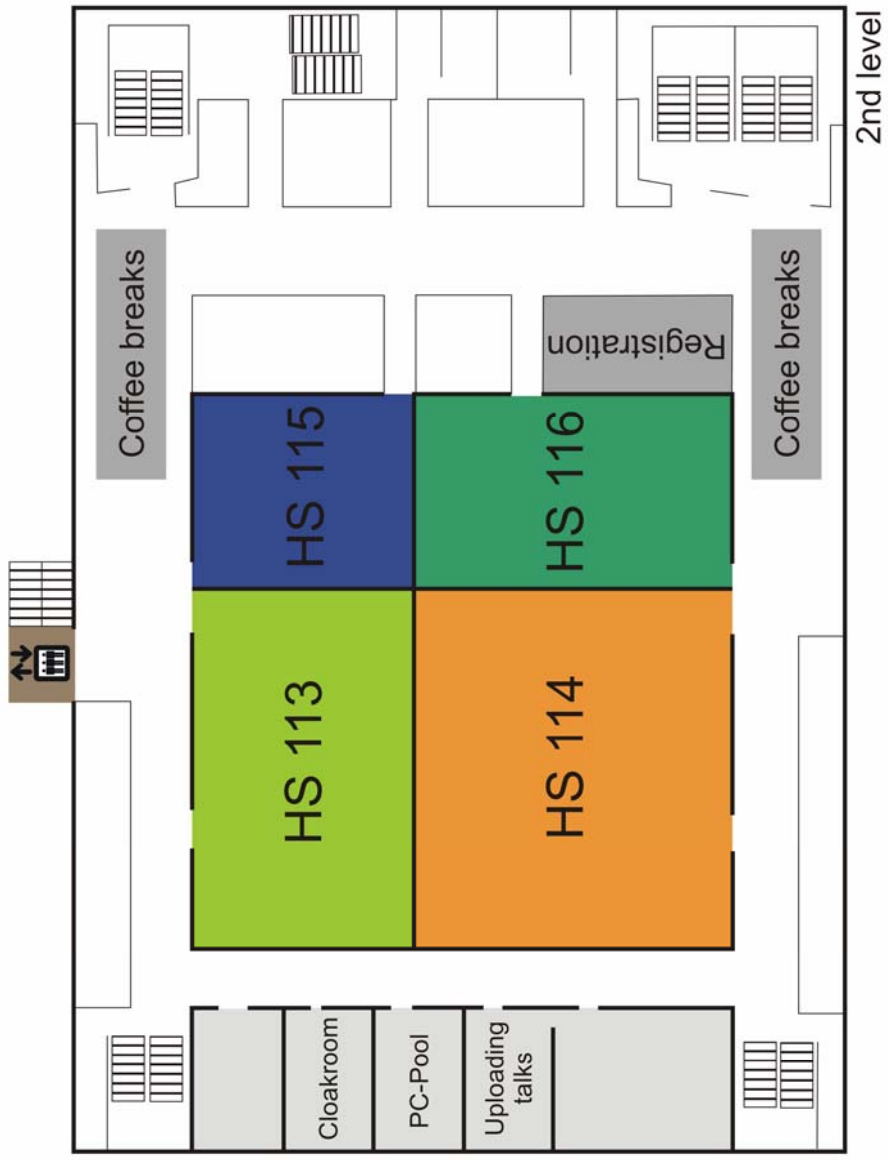
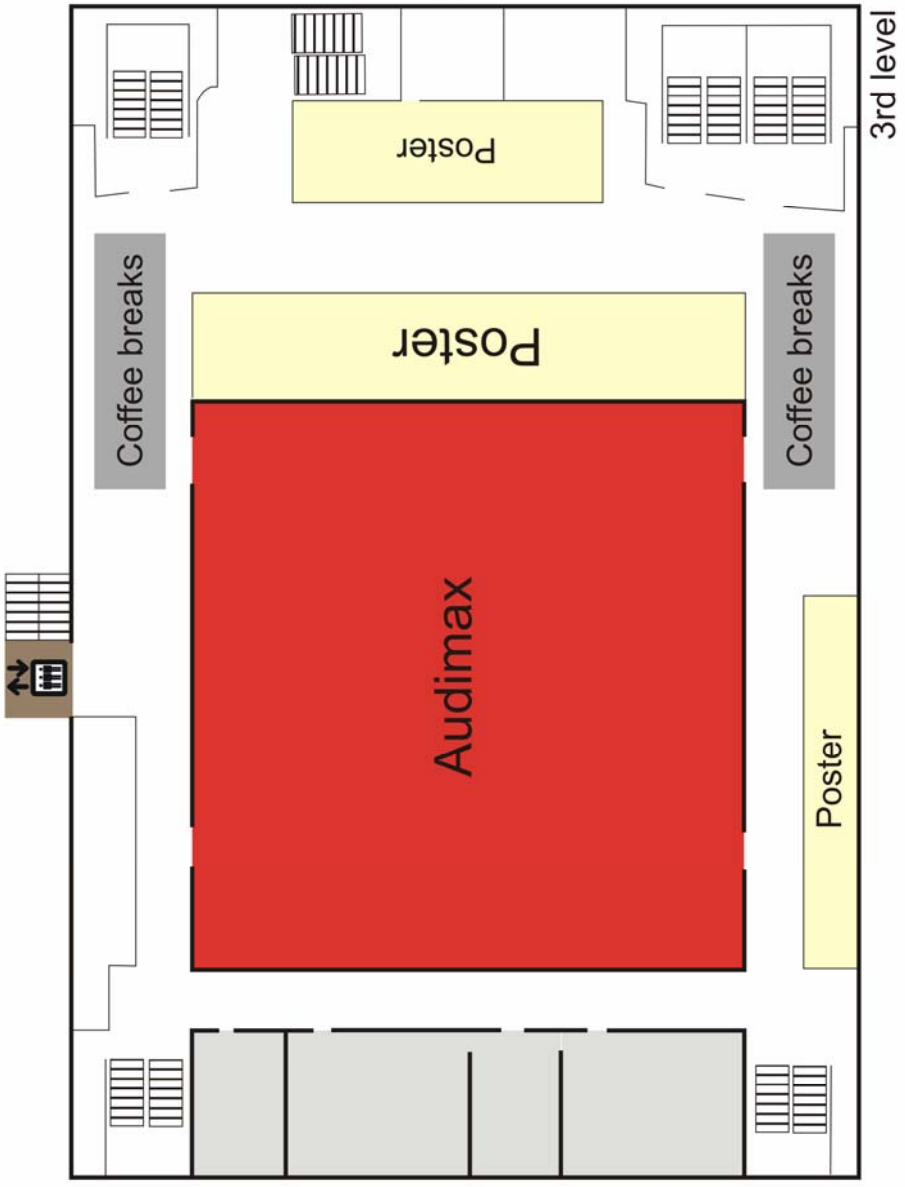
Main lecture Hall building – 1st level



Main lecture Hall building – 2nd level



Main lecture Hall building – 3rd level



Awards

Merian Award (gtö)

In honour of Maria Sibylla Merian the best three oral presentations and posters will be awarded a prize. Eligible candidates are students and PhDs who finished their dissertation less than three years ago. Please subscribe for participation using the on-line registration/submission form. Orals and posters participating in this competition will be marked in the program displayed in front of each Lecture Halls. You will find your ballot paper in your conference bag. The deadline for posting your ballots is Thursday (30 July) at 2 pm. The award ceremony takes place during the Farewell Party on Thursday evening.

Alwyn Gentry Student Awards and Luis F. Bacardi Advances in Tropical Conservation Award (ATBC)

1) Only members of the ATBC are eligible for the awards;
2) Only one award per candidate can be applied for;
3) Only a single presentation or poster per candidate will be judged;
4) Candidates must indicate their desire to be considered for any of these awards on the conference registration site as well as inform Dr. Susan Laurance (laurances@si.edu).
5)To subscribe on-line please log in to your registration by using your password and username and check the appropriate box in the paper submission section of the form.After you have entered your application on the on-line registration form please always click the submit button at the bottom of the form to save the changes.

Alwyn Gentry Student Awards for Best Oral or Poster presentation

The Alwyn Gentry Award was established to recognize outstanding student presentations at the annual meeting of the Association for Tropical Biology and Conservation.
Eligibility is open to all individuals who have been students of Masters and Ph.D. programs within the previous 12 months, including those who will complete the Ph.D. in 2009.
The winners will receive a year's subscription to Biotropica, a cash award from ATBC, and a book grant from the University of Chicago Press.

Luis F. Bacardi Advances in Tropical Conservation Award (ATBC)

This Award is designed to foster high-quality conservation science in the tropics and is awarded to the individual who gives the best oral presentation.
Eligibility is limited to those who have received their Ph.D. within five years before the conference date.
The winner receives a certificate from the ATBC, a 1-year subscription to *Biotropica*, book grant from from the University of Chicago Press and a $300 award provided by the Lubee Bat Conservancy, an international organization based in Gainesville, Florida, founded in 1989 by the late Luis F. Bacardi that is devoted to the preservation of fruit- and nectar-feeding bats.

Photo Award 2009 (ATBC)

During the Conference, awards will be hand out for the best photos, which optimal reflects the topic of the Conference "Impacts of global change". Please select your favourites among the photos presented at the information desk or among the conference posters. Fill in the number of your favourite photo in your personal ballot you will find in your conference documents. The ballots are collected in a box at the conference information desk.The deadline for posting your ballots is Thursday (30 July) at 2 pm.
The award ceremony takes place during the Farewell Party on Thursday evening.

Keynote Speaker - Talk

How to Integrate Science, Knowledge and Empowerment into the Conservation Agenda: A view from the South

D. Buchori

The development of conservation is very much effected by the science of ecology, whereas the development of ecology and conservation sciences are very much impacted by conservation practices on the ground. From this point of view, conservation is a powerful tool that can engage scientists across different field of sciences, whether they are biologists, mathematicians, modelers, sociologists and public policy advocates. In the last decade, conservation has evolved from a practice of species preservation based on single, biological discipline into practices that are based on multidiscipline science; from preservation approach that exclude people, to community approach that integrates people and animals and the landscape – ecosystem as one unity. Hence, the evolution of conservation practices from pure biological approach into development approach and lately, empowerment of local community has happened in many parts of the world. During the early stage of conservation movement, the emphasis to use top down, centralistic approach, based on sciences developed in the Western/Northern world were dominant. This approach does not necessarily fit with local situation in developing/Southern countries. In fact, there are many examples of projects where innovations are needed on the ground to make conservation work and endorsed by all stakeholders. This usually needs the integration between PRA approach of community development programs along with the implementation of western sciences that can be blended with much of local wisdom and traditional knowledge. A voice from the South, is the experiences of conservation practices from Indonesia, that will focus on the interaction between conservation practices and conservation sciences. Analysis and discussion will center on the development of conservation movement and conservation science in Indonesia, of the push and pull of different approach and its impact on conservation. Specific focus will be put into the role of science and knowledge in the conservation agenda of Indonesia, and of the importance of integrating empowerment in conservation agenda as a whole.

Damayanti Buchori, Bogor Agricultural University, dami@indo.net.id

Keynote Speaker - Talk

Sexy or not-so-sexy mutual partners in the face of habitat disturbance

N. Codeiro

Mutualisms define inter-specific interactions between partner species where cooperation leads to expected mutual benefits. In plant-animal mutualisms, such as those between pollinators or seed dispersers and their dependent plants, these interactions are predicted to be affected in different ways when their habitats are altered by humans. While the effects of habitat disturbance, loss or fragmentation are generally predicted to have negative consequences on mutualistic interactions, direct and indirect consequences still remain poorly understood. Despite so many unknowns, many authors surmise that widening spheres of extinctions are possible in the tropics where highly diverse forests are probably characterized by numerous mutualistic relationships. In this talk, I will critically examine empirical evidence borrowed from temperate and tropical studies to assess how habitat disturbance affects plant-animal mutualisms. In particular, I will address the plethora of outcomes from animal and plant perspectives, and integrate these findings within conceptual frameworks revolving around breeding systems, trophic cascades and the specialist-generalist continuum. A number of new ideas will be developed to guide future research in this field.

N. Codeiro, Department of Biological, Chemical, and Physical Sciences , Roosevelt University, - ncordeiro@roosevelt.edu

Keynote Speaker - Talk

Prioritising conservation: a personal reflection

J. Ghazoul

At a time of global economic crisis conservation of biodiversity may seem a less than urgent priority than the conservation of livelihoods. Yet individual, corporate and state responses to the current economic conditions give reason for thought regarding what priorities we do, and should, attach to conservation of biodiversity compared to other urgent demands. I seek to explore this from a personal perspective that I hope will stimulate the ATBC community to consider how, as scientists and researchers, we should deal with the 'C' in ATBC.

J. Ghazoul, Department Enviromental Sciences, - ETH Zurich, jaboury.ghazoul@env.ethz.ch

Keynote Speaker - Talk

The global human appropriation of net primary production: patterns, drivers and consequences

H. Haberl

Land use fundamentally alters the flows of trophic energy in terrestrial ecosystems. This process is captured by a comprehensive socioecological indicator termed "human appropriation of net primary production", abbreviated HANPP. HANPP is defined as the aggregate effect of (a) human-induced changes in the productivity of terrestrial ecosystems and (b) harvest of biomass, including destruction of biomass and human-induced vegetation fires. HANPP is an indicator for land-use intensity that shows how much of the productive potential of ecosystems is already used by humans. Global HANPP amounts to approximately one quarter of the potential productivity of the earth's continents, mostly resulting from agricultural activities such as cropland farming and grazing (approximately three quarters of global HANPP). Forestry, conversion to built-up land and human-induced fires account for the remaining quarter. Global maps show that HANPP is unevenly distributed across the globe. This presentation discusses natural and socioeconomic determinants that influence the global pattern of HANPP in the year 2000 as well as the current state of research on the ecological effects of HANPP, above all its impacts on biodiversity and ecological stocks and flows of carbon.

H. Haberl, Institute of Social Ecology, Faculty for Interdisciplinary Studies, Alpen-Adria Universität Klagenfurt - Graz - Wien, helmut.haberl@uni-klu.ac.at

Keynote Speaker - Talk

Change - chances and challenges for tropical forests

Elisabeth Kalko

Research in the tropics has undergone major shifts in the past decades. Starting with the naturalist's fascination of tropical diversity that has layed the foundations of research in the tropics and continues to be an indispensable component of our discipline we all came to the recognition that tropical habitats are highly threatened, driven by massive changes in land use associated with high demographic pressure and an ever increasing need for timber, food and fuel. But what will be the future of this development? Sustainability has been put forward as a buzz word, suggesting that ways can be found to "use" tropical ecosystems and at the same time maintain their diversity and functionality. Furthermore, mitigation has become another key issue. There, one might ask, whether and what can be learned from the multitude of studies investigating causes and consequences of fragmentation. Are there workable ways to promote defragmentation of landscapes? Are there realistic scenarios that permit maintenance and recuperation of ecosystem goods and services, both crucial for human well-being, on the local as well as on the global scale? Integrating the various facets of current topics in tropical biology, I am presenting an overview on current chances and challenges and critically evaluate future perspectives. What questions need to be asked and answered, what are the most pressing needs, where should future research be directed at, what is our responsibility and, finally, what are our abilities to contribute?

E. Kalko, University of Ulm, Elisabeth.Kalko@uni-ulm.de

Keynotes - Talk

Human disturbance drive tropical forests to hyper-fragmented landscapes of limited conservation value

Marcello Tabarelli

The future of tropical forest biodiversity and the invariably undercompensated environmental services provided by this ecosystem, such as carbon storage, are inextricably tied to our ability to understand persistent, ecosystem-level changes triggered by human disturbances. Both empirical and theoretical evidence suggest that edge effects combined with logging, wildfires and hunting (the most frequent human disturbances affecting tropical forests) trigger a rapid successional process that effectively drive most remaining forest fragments towards a persistent, early-successional system. This altered ecosystem emerges and then persists as these human-induced disturbances consistently favor a small set of functionally-redundant light-demanding plant species to the detriment of a highly diverse pool of species typical of old-growth forests. Ecosystem performance in increasingly older forest fragments approaching full relaxation conditions converge with those observed in patches of early- to middle-aged secondary forests (< 40-50 yrs old) following prolonged cultivation or pastures. By edging towards early-successional systems, significant portions of neotropical hyper-fragmented landscapes will likely fulfil a limited value in terms of environmental services, biodiversity conservation, and are unlikely to serve as effective sources for large-scale forest recovery in former agricultural lands, which clearly impairs their eligibility as future conservation targets. Moreover, aging, hyper-fragmented landscapes are likely to provide only limited economic opportunities, and goods and services to operate as working forests to ensure sustainable rural livelihoods without prohibitive capital investments focused on forest restoration. In synthesis, it becomes increasingly difficult to reverse landscape degradation and the associated human poverty beyond a threshold of both habitat loss and time elapsed since hyper-fragmentation. We hope that this essay can instigate a more comprehensive assessment of the forces driving the nature of human-modified tropical ecosystems as the scenario described here already predominates across many previously forested tropical lands. Crucially, this is a timely step towards the consolidation of land-use regulations designed to guarantee the full potential of anthropogenic landscapes in terms of their biodiversity conservation and environmental services.

M. Tabarelli, Universidade Federal de Pernambuco, -mtrelli@ufpe.br

Keynotes - Talk

Impacts of Global Change on Tropical Ecosystems – what can we learn from the past?

K.J. Willis, K.D. Bennett

This talk will highlight the potential of using longer-term ecological records (>50 years) for understanding tropical ecosystem responses to future climate change and human impact. To assess the impacts of future climate change on tropical ecosystems, the talk will focus on intervals of time in the fossil record when the magnitude and/or rate of climate change matched or exceeded predicted rates for the next century. For each of these intervals in time, case-studies of biotic responses will be presented to demonstrate the scale and impact of these climate changes on biodiversity. What emerges from these records is evidence for rapid community turnover, migrations, novel ecosystems and thresholds moving from one stable ecosystem state to another – but evidence for large-scale extinction due to a warming world, is equivocal. We argue, based on this long-term ecological evidence, that land-use change due to population growth, still poses a far greater threat to tropical biodiversity in the future than climate change.In contrast to climate change, there are no past analogues comparable to the current rate of anthropogenically-driven land use change in the tropics. So what lessons can be learnt from long-term ecological records relating to land-use change and human impact? An important point that emerges from examining long-term ecological datasets is that there are many examples where so-called 'virgin rainforest' has undergone some form of clearance in the past – and yet the rainforest has recovered. How quickly the forest recovered once the area was left fallow, and also what is missing (if anything) from this 'secondary' forest formation are questions that are critical to future conservation, management and restoration of disturbed land including land currently being converted into oil-palm plantations. There is also a more fundamental question and that is determining the baseline vegetation and natural disturbance regime. For example, there are cases where the assumption that forested vegetation is 'natural' and grasslands represent an anthropogenically degraded state is incorrect – but without a temporal record of the natural baseline vegetation, its natural disturbance regime (e.g. through fires) and its variability through time, management of these ecosystems will be misguided and in some instances, detrimental to its long term survival.

Keynotes - Talk

In contrast to many shorter-term datasets and models, we suggest that these long-term ecological records provide a more positive outlook on the future of tropical ecosystems – and emphasises their potential resilience to the impacts of global change.

K.J. Willis, University of Oxford, kathy.willis@ouce.ox.ac.uk

Session 01: Plant-animal interactions: antagonistic versus mutualistic networks in changing tropical environments - TalkT01-01

Herbivores, restricted hosts, and vanishing habitats - jeopardizing tropical interactive networks

T.M. Lewinsohn & P.I.K.L. Prado

Conservation biologists recognize that species with restricted geographic ranges or with smaller population sizes are at greater risk than others. When these factors are correlated, species are at double jeopardy. This is compounded for specialized species, when their key habitat or resource is restricted or under threat. Here we examine geographical and association patterns for Asteraceae and their endophagous flowerhead-feeders in four regions in southern and southeast Brazil. We examine the interplay of geographical ranges and of biotic associations among host plants and their herbivores, to evaluate the individual and aggregated consequences of rarity, geographical restriction and specialization. The preliminary assessment in this assemblage of risks of herbivore coextinction driven by host loss, compared to potential effects of habitat loss, should prove useful in predicting how some of the most diverse non-forest ecological communities in the Neotropics may respond to major global change drivers.

Thomas Lewinsohn, Universidade Estadual de Campinas, thomasl@unicamp.br

Session 01: Plant-animal interactions: antagonistic versus mutualistic networks in changing tropical environments - TalkT01-02

Host-parasitoid food webs as tools for understanding tropical diversity

O.T. Lewis

Networks of trophic interactions (food webs) may provide a useful tool for understanding the processes generating, organising and threatening biodiversity. I will describe empirical studies of tropical forest food webs (involving plants, insect herbivores and their parasitoids) that are fully quantified in terms of the abundance of interacting species and the frequency of each interaction. I will discuss how these quantitative food webs may be informative about (1) the dynamic processes structuring and organising diversity in the tropics and more widely, (2) the consequences of species extinction or invasion, and (3) the effects of humans on ecosystem organisation and functioning.

O.T. Lewis, University of Oxford, owen.lewis@zoo.ox.ac.uk

Session 01: Plant-animal interactions: antagonistic versus mutualistic networks in changing tropical environments - TalkT01-03

Plant-herbivore interactions in a changing world: changes in plant-herbivore networks, demographic consequences and evolutionary potential of diet expansions to exotic gingers by generalist and specialist rolled-leaf beetles

C. Garcia-Robledo & C.C. Horvitz

Diet expansion to novel hosts by insect herbivores is a fundamental process involved in species diversification, generating tropical diversity. Climate change and introductions of exotic plants are affecting species distributions at an unusual rate. At La Selva Biological Station, Costa Rica, a community of rolled-leaf beetles is expanding their diets from neotropical to exotic paleotropical gingers. This research experimentally tests the effects of introducing exotic plants on the structure of native plant-herbivore networks and the demography of specialist and generalist herbivores. We also estimated the available genetic variation for potential adaptation of herbivores to novel hosts. The structures of plant-herbivore networks before and after the introduction of novel hosts were similar. Therefore, generalist and specialist herbivores are equally capable of diet expansions. Demographic data show that diet expansions to novel hosts negatively affect larvae and adult survival of specialists. In contrast, longevity of generalists increased when using novel hosts. Quantitative genetics results show little genetic variation expressed by specialists expanding their diets to novel hosts. Generalist herbivores displayed substantial genetic variation, especially for traits related to host selection. Our results suggest that diet expansions to novel hosts might be more challenging for specialist than for generalist insect herbivores.

Carlos Garcia-Robledo, University of Miami, carlos@bio.miami.edu

Session 01: Plant-animal interactions: antagonistic versus mutualistic networks in changing tropical environments - TalkT01-04

Ant-fruit interaction networks in fragmented and continuous forests of Southeast Brazil

A.G.D. Bieber, P.S.D. Silva, S. Sendoya & P. S. Oliveira

In addition to presenting reduced and isolated populations, tropical forest fragments are frequently occupied by non-pristine, secondary vegetation. As species composition and abundance change with habitat fragmentation, one also expects alterations in interspecific interactions. Here, we present preliminary data on how network structure of ant-fruit interactions changes with forest fragmentation in Southeast Brazil. The study was conducted in four forest remnants and four continuous areas of Atlantic rainforest. During one year, ant-fruit interactions in each site were sampled monthly along three 300m-transects. In the first nine months (April to December 2008), we found 597 ant-fruit interactions, over 60% of which were registered in continuous forests. With respect to the fruits involved, continuous forests presented greater numbers of interacting species and of species with high degrees of connectivity. Differences in ant species numbers were less evident, and one single species of Solenopsis presented the highest number of interactions in all networks. Forest fragments seem more vulnerable than continuous areas because one or two diaspore species account for the majority of the interactions observed. Our findings suggest that even facultative and opportunistic interactions, such as ants exploiting fallen fleshy fruits, are negatively affected by forest fragmentation. (Supported by Fapesp, CNPq).

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Session 01: Plant-animal interactions: antagonistic versus mutualistic networks in changing tropical environments - TalkT01-05

Changes over time in mutualistic ant-plant networks and biological mechanisms promoting them

C. Díaz-Castelazo & V. Rico-Gray

We analyzed the structure of a multispecific network of interacting ants and extrafloral nectary-bearing plants in 1990 and again in 2000 in coastal Mexico. Number of links among species was compared between networks (periods) and whether there had been changes in network structure associated with appearance of introduced species.Our results show that between sampling periods, the nested topology was similar, group dissimilarity increased, mean number of interactions for ant species increased and distribution of standardized degrees reached higher values for plants species. Ants are becoming more important core components of the network while plants are becoming less important; generalist species appeared to maintain the stability of the network, since the new species were linked to this core of generalists.The presence of introduced species increased while their contribution to nestedness remained the same, thus, even though invasions occurred during the decade between surveys, the overall network structure remained unmodified. Multidimensional scaling allow us to investigate the biological mechanisms promoting the changes in the position of species at the most recent network, namely the morphology and distribution within plant organs of extrafloral nectaries (disperse vs. circumscribed glands), ant dominance behavior and body size, and abundance of plant and ant species.

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Session 01: Plant-animal interactions: antagonistic versus mutualistic networks in changing tropical environments - TalkT01-06

Invasive species interfere with endemic plant-pollinator interactions: lessons from generalised pollination webs on the Seychelles

C.N. Kaiser-Bunbury, J. Ghazoul

Introduced species on oceanic islands have displaced critically endangered plants from their natural habitat and created fragmented, small populations of endemics. On the Seychelles, such populations are mostly confined to granitic inselbergs where harsh abiotic conditions and isolated environment have provided some natural protection against introduced species. Inselberg species, however, may encounter strong reproductive constraints through disruption of their pollinator mutualisms by invasive plants. We investigate plant–pollinator interactions within inselberg communities to determine the likelihood of such reproductive constraints. We link the structure of fully quantified networks of six sites that have varying degrees of invasion to the reproductive performance of endemics and invasives. Using such approaches, we assess the suitability of network parameters for detecting ecological processes and further our understanding on vulnerabilities of rare endemics.

C. N. Kaiser-Bunbury, ETH Zurich, ch.kaiser@env.ethz.ch

Session 01: Plant-animal interactions: antagonistic versus mutualistic networks in changing tropical environments - TalkT01-07

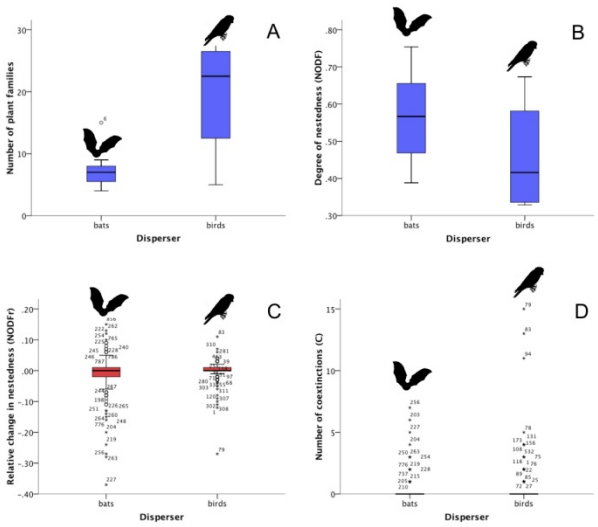
The devil is in the details: modularity of mutualistic networks

M.A.R. Mello

Mutualisms are vital for ecosystem structuring. The combination of ecological and network theory resulted in the discovery of invariant properties of mutualisms. Now it is the time to move the focus from the general topology to the fine structure of these systems. Modularity is an important property that provides information on the hierarchical structure, and consequently on the functioning of ecosystem services. Here I make the case for studying modularity by presenting the findings from two studies: (1) seed dispersal by Neotropical bats and birds, and (2) pollination of oil-flowers. In the comparison between bats and birds, it was evidenced that two modules of the same ecological service may differ in important aspects, as bat-fruit subwebs were more homogeneous both in structure and resilience. Thus, pioneer plants are provided with a more reliable service than late-successional plants. In the other study, oil-collecting bees and oil-flowers of the Malpighiaceae formed a tiny and strong world, more cohesive and resilient than whole pollination networks. These findings reinforce the hypothesis of mutualistic modules, what suggests that an ecosystem service is a complex enterprise with different breaking points. Thus, details should not be overlooked.

Session 01: Plant-animal interactions: antagonistic versus mutualistic networks in changing tropical environments - TalkT01-07

Figure 1: Differences in structure and fragility of seed dispersal networks of bats and birds.



M.A.R. Mello, Universidade Federal de Sao Carlos, marmello@gmail.com

Session 01: Plant-animal interactions: antagonistic versus mutualistic networks in changing tropical environments - TalkT01-08

Different patterns of resource partition between plants and animals in pollination networks

S. Sakai & Y. Toquenaga

Resource partition among species has been one of the major topics of ecology, and intensively studied for various types of resources. In the case of pollination, partition of resources, i.e. pollination services for plants and floral resources for flower visitors, structure plant-pollinator interaction networks. Usually a group of flower visitors selectively visit a group of plants sharing common characteristics known as pollination syndrome.In this study, we focus on the evenness of the numbers of the partner species among plant (Ep) and animal species (Ea) in pollination networks. We used 43 pollination networks collected at various sites. They are binary matrices with 7-118 plant and 12-873 animal species, which have 1 where interactions of a plant species and an animal species were observed, and 0 where interactions were absent. Quantitative measurements of interaction frequencies were available for 22 matrices, and were used for randomization.Our analyses showed that Ep and Ea were negatively correlated. Ea was higher than expected from random interactions, while Ep was lower. Different specialization patterns may be partly responsible for the difference between plants and animals. In addition, there were significant variation of evenness across biogeographical regions, possibly reflecting different strength of organization.

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Session 01: Plant-animal interactions: antagonistic versus mutualistic networks in changing tropical environments - TalkT01-09

Interacion patterns in a tropical semideciduosu pollination networks

J. Genini, P. Guimarães Jr. & L P.C. Morellato

In pollination networks frequent efficient pollinators interact more strongly than rare visitors or frequent inefficient visitors, indicating that the degree of biological association between partners may affect network organization. We explored the structure of two seasonal tropical forest plant-pollinator networks in Southeastern Brazil with respect to nested and modular patterns, and we assess weather the structure of the network was affected by different degrees of association among interacting partners. We tested for modular and nested patterns for Bignonicaceae and Malpiguiaceae networks creating sub-networks including just main pollinators, thieves or all floral visitors. In Bignoniaceae network we found nestedness for main pollinator-plant or all floral visitors-plants sub-network, and neither nestedness nor modulatrity for thieves. We find modularity only for all floral visitors-plant sub-network. Malpighiaceae sub-networks showed both patterns independently of including main pollinators or all visitors. Network size may be more related to the modularity observed in Bignoniaceae than the degree of association among partners. Similar patterns among main pollinator or all visitors in Malpiguiaceae indicate morphological adaptations and foraging behavior of pollinators that may not differ as much to influence networks organization.

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Session 01: Plant-animal interactions: antagonistic versus mutualistic networks in changing tropical environments - TalkT01-10

The Restoration of Plant-Flower Visitor Networks in a South Eastern Brazilian Atlantic Forest

S.V. Bazarian, J. Memmott & S. Buzato

In addition to considering the habitat composition and structure the evaluation of restored areas needs to consider the restoration of ecological processes. Ecological networks can provide a useful tool for this purpose as the patterns of the interactions among species within restored areas can be compared to control areas or areas restored by others means. This study uses ecological networks to compare plant-flower visitor communities in restored, naturally regenerated and native forest areas in the Brazilian Atlantic Forest. The three types of community had few species of plants and animals in common. Hymenoptera had the highest number of interactions in the three habitats. After Hymenoptera, Diptera were the order with the highest number of interactions in naturally regenerated areas and Lepidoptera in native forest. The restored forest has the highest number of interactions per plant species, however the distribution of both the number of visitor species per plant species and the number of plant species per visitor species showed similar patterns of generalization in restored forest and naturally regenerated areas.

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Session 01: Plant-animal interactions: antagonistic versus mutualistic networks in changing tropical environments - PosterP01-01

Flower visitor networks in a fragmented landscape in Western Kenya

M. Hagen & M.Kraemer

Up to a certain degree, bees seem to be resistant to fragmentation of natural land, as they need a variety of different habitats in their lifecycle anyway and cannot cope with too monotonous landscapes. We compared the composition of flower visitor networks in the Kakamega Forest and its highly structured surrounding agricultural lands to investigate the overlap as well as distinctions between these networks. Furthermore, we focused on single species, their distribution patterns and involvement in the networks in the different habitats. Only 24% (20 species) of flower visiting bees occurred in all habitat types, while 51% were more habitat specific, found in only one out of three habitat types. Flower-visitor-generalists were found to be also habitat-generalists, while rare species tended to be restricted to single habitat types. Connectance between different habitats was much smaller than expected, which has new implications for conservation of the ecosystem service pollination in the area.

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Session 01: Plant-animal interactions: antagonistic versus mutualistic networks in changing tropical environments - PosterP01-02

Interactions between seed dispersers and fruiting plants in an East-African rainforest: specialization and dependences

M. Schleuning, N. Bluethgen, M. Flörchinger, J. Braun, H.M. Schaefer, and K. Böhning-Gaese

The dependence in the interactions among plants and fruit-eating animals is contentious, but little is known about seed-dispersal networks in tropical forests. We observed frugivores in 33 plant species in a Kenyan rainforest with a standardized sampling design (924 observation hours). We analysed specialization of animals and plants (H2', di', dj'), interaction strength of frugivores, and plant dependence in relation to type of frugivory (obligate, partial, opportunistic frugivores) and forest stratum (understory, subcanopy, and canopy). We recorded 3447 frugivore visits of 88 species (83 birds, 4 monkeys, 1 squirrel); 15 species were obligate, 25 partial, and 48 opportunistic frugivores. Specialization was similar to other seed-dispersal networks (H2'=0.30). Plant specialization on frugivores decreased with plant height. Obligate and partial frugivores were less specialized than opportunistic frugivores. The importance of a frugivorous species increased with its abundance and specialization, and was higher for obligate frugivores. Understory plants mostly depended on opportunistic frugivores, subcanopy plants on partial frugivores, and canopy plants on obligate frugivores. Thus, obligate frugivores are crucially important for seed dispersal in the canopy of tropical forests where specialization is low. In contrast, frugivores that opportunistically feed on fruits are important in lower forest strata where plant-frugivore relationships are more species-specific.

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Session 01: Plant-animal interactions: antagonistic versus mutualistic networks in changing tropical environments - PosterP01-03

Decomposition processes in Colombian streams: influence of invertebrate shredders, plant compounds, and hydrology

G. Rueda-Delgado, K. M. Wantzen

The influence of shredders, characteristics of hydrology and chemical leaf composition on decomposition of terrestrial leaf litter was studied in Colombian stream. Leaf breakdown rates, content of total C, N, P and polyphenols, and leaf-associated aquatic invertebrate assemblages were compared among leaf types in typical 1st-order streams of the Amazonian whitewater floodplain forest near Leticia and a mountain stream at the Sierra Nevada de Santa Marta in the Caribbean cost. In this latter system we also used exotic Eucalyptus camandulensis leaves. The stream hydrograph was influenced by regular rainfall throughout the year and by seasonal backflooding from the Amazon River. In the Amazonian stream, stream discharge was more variable when the Amazon was low (flashy-discharge phase, FDP) than during the high-water period (backflooded phase, BFP) and breakdown rates were significantly higher during FDP than during BFP. In the Caribbean stream, rainfall caused permanent irregular pulses and the burial of small leaves of E. camandulensis and other native species reducing significantly breakdown rates compared to the other system. In both systems most of the benthic invertebrates invertebrate taxa (60%) were collectors in all leaf species, whereas shredders were very scarce (0–5%) irrespective of time, place and experiment date. In the Amazon stream experiment the slowest-decomposing species S. paniculata and Myrcia, showed high (R2= 0.999 and R2= 0.994 respectively) and significant (F = 37937, p= 0.003 and F = 186.97, p = 0.046, respectively) correlations between leaf dry mass loss and TP concentrations. These results indicate that shredders were of lower importance for decomposition in these streams.

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Session 01: Plant-animal interactions: antagonistic versus mutualistic networks in changing tropical environments - PosterP01-04

Different specialization patterns in plant and animals in pollination networks

S. Sakai & Y. Toquenaga

Resource partition among species has been one of the major topics of ecology, and intensively studied for various types of resources. In the case of pollination, partition of resources, i.e. pollination services for plants and floral resources for flower visitors, structure plant-pollinator interaction networks. Usually a group of flower visitors selectively visit a group of plants sharing common characteristics known as pollination syndrome.In this study, we focus on the evenness of the numbers of the partner species among plant (Ep) and animal species (Ea) in pollination networks. We used 43 pollination networks collected at various sites. They are binary matrices with 7-118 plant and 12-873 animal species, which have 1 where interactions of a plant species and an animal species were observed, and 0 where interactions were absent. Quantitative measurements of interaction frequencies were available for 22 matrices, and were used for randomization.Our analyses showed that Ep and Ea were negatively correlated. Ea was higher than expected from random interactions, while Ep was lower. Different specialization patterns may be partly responsible for the difference between plants and animals. In addition, there were significant variation of evenness across biogeographical regions, possibly reflecting different strength of organization.

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Session 01: Plant-animal interactions: antagonistic versus mutualistic networks in changing tropical environments - PosterP01-05

Are Neo-tropical savanna trees seed limited? A study case in the Brazilian Cerrado

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Seed production and dispersal are critical processes in population dynamics because failure of seeds to reach all potential suitable (seed limitation) constrains recruitment and population growth rates. We studied seasonal variation in seed rain in the tropical savannas of Central Brazil. We assessed seed rain with traps located in three savanna types differing in tree density along shallow topographic gradients. We also studied post dispersal processes such as seed removal and predation as well as changes in seed viability in field and laboratory experiments. Neither the average number of species nor the average seed density differed significantly among the three savanna types; however, the total number of seeds was lower in open than in closed savannas. Consistent with a strong seasonal pattern of variation in precipitation, more seeds were dispersed during the late dry season and early wet season. Estimated seed and dispersal limitations tended to be higher in open savannas than in the closed savannas. Seeds of most trees were preyed upon and were highly and quickly removed. Seeds of savanna trees lost rapidly their viability during dry storage conditions. Low seed availability, predation, high removal and rapid loss of seed viability highly constrain potential recruitment of Brazilian savanna trees.

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Session 01: Plant-animal interactions: antagonistic versus mutualistic networks in changing tropical environments - PosterP01-06

Relative terrestrial mammal abundances and contrasting seed defense strategies impact neotropical seed fates

E.K. Kuprewicz

In neotropical forests, mammals are major seed dispersers and predators. To prevent seed predation and promote dispersal, seeds may exhibit physical or chemical defenses. Central American agoutis (Dasyprocta punctata, Rodentia) gnaw through hard-walled seeds, but cannot consume some chemically-defended seeds. Collared peccaries (Tayassu tajacu, Artiodactyla) cannot eat some hard seeds, but can digest many chemically-defended seeds. The goals of this study were to determine relative mammal abundances within a lowland wet forest and to assess how these frugivores affect the survival of seeds that have no defenses (Iriartea deltoidea), physical defenses (Astrocaryum alatum), or chemical defenses (Mucuna holtonii) against mammal seed predators. I determined relative mammal densities over three years using motion-detecting cameras. Using semi-permeable exclosures, camera traps, and thread-marked seeds, I recorded predation and dispersal for each seed species. Relative abundances of peccaries were up to 6x higher than those of agoutis for all years. Only 23% of physically-defended seeds were eaten by agoutis; A. alatum benefited from dispersal by peccaries. Non-defended seeds and chemically-defended seeds suffered high levels of predation, mostly by peccaries. This study shows that the effectiveness of physical and chemical seed defenses relates to the relative abundances and seed handling capabilities of frugivores.

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Session 01: Plant-animal interactions: antagonistic versus mutualistic networks in changing tropical environments - PosterP01-07

A specialized seed dispersal system in epiphytes: the genus Rhipsalis (Cactaceae)

A. C. Guaraldo & M. A. Pizo

Fruits of the epiphytic cactus Rhipsalis have a quite similar morphology with those of Santalaceae mistletoe, which are well known for their specialized seed dispersal system involving predominantly birds in the genus Euphonia as the main seed dispersers. Scattered published records and unpublished field observations suggest that a similar specialized seed dispersal system may occur in Rhipsalis. This study was designed to access this possibility. The fruit consumers and the reproductive phenology of respectively six and three species of Rhipsalis were studied in the Atlantic Rainforest and an urban park in southeastern Brazil. Published records and unpublished data were also used to describe the assemblage of fruit consumers and potential seed dispersers of Rhipsalis, totaling 99 records. Rhipsalis species showed a seasonal fruiting phenology. However, the genus as a whole produced ripe fruits year round. Twenty-eight bird species and three primates were recorded eating fruits. Euphonias were the main fruit consumers (63,6% of feeding visits), followed by the bananaquit Coereba flaveola (13,1%). The mechanisms leading to the apparent specialized relationship between euphonias and Rhipsalis are still unknown, but the parallel with Santalaceae mistletoes should shed light on the evolutionary pathways leading to the always rare specialized seed dispersal systems.

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Session 01: Plant-animal interactions: antagonistic versus mutualistic networks in changing tropical environments - PosterP01-08

Comparisons of food body production, ant activity and herbivory in three coexisting species of Piper ant-plants at Las Cruces Biological Station, Costa Rica

K.R. Gastreich, J.A. Duay & J. Mooteb

We compared three species of _Piper_ ant-plants coexisting in primary and secondary premontane forest at Las Cruces Biological Station in Costa Rica. _Piper obliquum_, _Piper fimbriulatum_ and _Piper sagittifolium_ all participate in a mutualism with the ant _Pheidole bicornis_. They also house the spider _Dipoena schmidti_, which preys on ants. The coexisting _Piper_ species showed no difference in density of resident ant colonies or in distribution among microhabitats. However, _P. fimbriulatum_ consistently exhibited greater levels of folivory. We identified behavioral factors that may contribute to this difference. _D. schmidti_ were more likely to build webs on _P. fimbriulatum_ and spider densities were highest on _P. fimbriulatum_ in the forest. The removal of _D. schmidti_ webs from plants resulted in increased ant numbers on leaves of _P. obliquum_ and _P. sagittifolium_, but not on _P. fimbriulatum_. Unlike _P. fimbriulatum_, both _P. obliquum_ and _P. sagittifolium_ bear food bodies on their youngest leaves. Removal of food bodies from young leaves of _P. obliquum_ decreased in ant numbers on the leaf. Together, these observations indicate that the presence of spiders and food bodies interact to influence ant activity, which in turn can affect herbivory on the plants.

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Session 01: Plant-animal interactions: antagonistic versus mutualistic networks in changing tropical environments - PosterP01-9

Inbreeding and mating structure in a dioecious - fig pollinating wasp

M. Katabuchi, J. Yokoyama & T. Nakashizuka

Ceratosolen constrictus is a fig pollinating wasp of a small dioecious fig tree Ficus fistulosa. The number of foundress per fig fruits effects both on figs and fig wasps reproduction, and thus plays a key role in the fig - fig wasp interaction. Small foundress number per fruits causes strong local mate competition due to regular sib mating. Here, we describe the foundress distribution patterns and how degree fig wasps suffer inbreeding depression under natural condition. The relatively high inbreeding levels were maintained irrespective of high foundress number, indicating sister foundresses had entered the same fig inflorescence. No significant relationship was found between inbreeding levels and morphological traits measured at female offspring. Therefore, inbreeding depression has little effect on this species.

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Session 01: Plant-animal interactions: antagonistic versus mutualistic networks in changing tropical environments - PosterP01-10

The relation of hummingbirds and their food plants along a precipitation gradient in Bolivia

S. Abrahamczyk, M. Kessler

Hummingbirds are the most specialized nectar feeding birds worldwide. In combination with their food plants, they are often seen as a classical example of co-evolution. Many authors have found correlations between floral measurements and hummingbird bill length, but it is also frequently reported that hummingbirds visit flowers with much longer or shorter corollas than expected. Between November 2007 and October 2008 we observed hummingbird-flower interactions along a 660 km latitudinal and precipitation gradient in Bolivian lowland forests. The gradient consisted of six study sites that were visited twice, once in the rainy season and once in the dry season. We found no correlation between the number of food plant species and the number of hummingbird species. In contrast, the number of hummingbird individuals was correlated with the number of flowers, but not with the number of food plant species. Indeed, some diverse hummingbird assemblages were periodically supported by only two food plant species. Thus, the overlap in feeding niche between hummingbird species at a given locality changed strongly between the seasons. This overlap of niche space was significantly negatively correlated with the number of flowering plant species. These results indicate that hummingbirds are more opportunistic than previously appreciated, and that they separate their foraging niches when numerous different flowers are available but can all persist on the same few flowers if only these are available.

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Session 01: Plant-animal interactions: antagonistic versus mutualistic networks in changing tropical environments - PosterP01-11

Plant-hummingbird interaction webs in distinct phytogeographic domains

L. Freitas & T.V. Campbell

Plant-pollinator webs may be compartmented because some plants are only pollinated by specific groups of animals. Similar characteristics of those sub-webs may represent either intrinsic proprieties or the expression of environmental and historical affinities. We analyzed ten assemblages of plants pollinated by hummingbirds from distinct phytogeographic domains in Tropical America. All webs were asymmetric and nested, and their density was negatively correlated to the species richness. Such traits seem to be intrinsic to any mutualistic web. From seventeen species found in the five areas of Atlantic Forest in southeastern Brazil (4 to 12 species in each area), only two Phaethornithinae acted as central pollinator, which answered for 32 to 39% of interactions in each web. Such hummingbirds have a long beak and are able to visit a wide range of flowers. The other five webs also presented central pollinators, which answered for 25 to 35% of interactions (except one case with 69%). Hummingbirds belonging to both subfamilies played that role. We suggest that species displacements on central roles in the interaction webs are possible, because P. eurynome acted as central pollinator only in Atlantic Forests that R. naevius does not occur. Such a possibility would provide higher resilience after disturbances.

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Session 01: Plant-animal interactions: antagonistic versus mutualistic networks in changing tropical environments - PosterP01-12

Do nectar robbers compromise fruit-set in the highly threatened endemic Jacaranda rugosa (Bignoniaceae)?

P. Milet-Pinheiro & C. Schlindwein

Nectar robbers access floral nectar in illegitimate flower visits without performing pollination service. Nevertheless, their effect on fruit set can be positive if nectar removal increases the frequency of effective pollinators. We studied the effect of nectar robbers on the reproductive fitness of Jacaranda rugosa, an endemic shrub of the Catimbau National Park, Brazil. The flowers of the steady state flowering plant produced nectar during the day at a rate of 1 µL per hour. Bees of Euglossa melanotricha were the main pollinators. Nectar robbers damaged 99% of the flowers: while carpenter bees (Xylocopa) produced only a longitudinal slit in the nectar chamber, workers of Trigona spinipes damaged the gynoecium in 92% of the flowers, causing an outstanding low fruit set (1.5%). Experimental addition of sugar water prolonged the duration of flower visits of the mainly pollinators (euglossine bees), while nectar removal, simulating the impact of robbers, resulted in shorter visits of these bees. Thus, nectar robbers may increase flower visits of effective pollinators. Low fruit set caused by destructive flower visits of T. spinipes, however, together with the destructive human impact in the Park and local endemism make Jacaranda rugosa one of the most threatened species from Brazilian Caatinga.

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Session 01: Plant-animal interactions: antagonistic versus mutualistic networks in changing tropical environments - PosterP01-13

Pollen processing behaviour of Heliconius butterflies: A derived cleaning behaviour?

A.L. Hikl, H.W. Krenn, S.H. Eberhard and L. E. Gilbert

Pollen feeding behaviour of Heliconius and Laparus (Nymphalidae) represents a key innovation in the advanced life-history of these butterflies. Although flower-visiting nectar-feeding butterflies regularly come in contact with pollen, only Heliconius and Laparus actively collect pollen with the proboscis and process it subsequently. This study focuses on the behaviour of pollen processing and compares the movement patterns with proboscis cleaning behaviour. By using video analysis with The Observer XT 2007 software (Noldus IT), a comparison of behaviours between different butterfly species, pollen feeders and non-pollen feeders, was made. The pollen processing behaviour and proboscis cleaning behaviour was analysed and described for first time in detail. As expected, repeated coiling and uncoiling of the proboscis occurs in both pollen processing and proboscis cleaning behaviour in all studied species. A higher number of repetitions and total durations were recorded of this movement for pollen processing behaviour. The release of a digestive body-fluid, similar to saliva, was observed frequently in both behaviours. The proboscis cleaning behaviour included a characteristic sideways movement which was expressed in both pollen feeding and non pollen feeding butterflies. We propose that pollen processing behaviour is a derived character from proboscis cleaning behaviour coupled achieved through the loss of the sideways movements and by adding performing coiling-uncoiling movements in continuously repeated and longer total durations.

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Session 01: Plant-animal interactions: antagonistic versus mutualistic networks in changing tropical environments - PosterP01-14

The Fifth International Symposium-Workshop on frugivores and seed dispersal

P.M. Forget

In 1985, Ted Fleming and Alejandro Estrada called an international meeting in Mexico of about 50 scientists studying the interactions between frugivores (fruit-eaters) and the seeds they disperse. The 2nd and 3rd Symposium-Workshop, in Mexico (1991) and Brazil (2000), respectively, demonstrated the growth in research on this important topic. The 4th International Symposium-Workshop on Frugivores and Seed Dispersal was held in 2005 at the Nathan campus of Griffith University, Brisbane, Australia. The poster announce the 5th International meeting on Frugivores and Seed Dispersal meeting that will be held at Montpellier, 13-18 June, 2010. The organizers call for oral papers, postral and poster, as well as callf or symposia and workwhop. Dealine for registration is 14 March 2010. The number of presentations is limited to 396 but a greater number of participants is welcomed to attend and celebrate the 25 years anniversary of the symposium-workshop. Website : http://www.fsd2010.org

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Session 01: Plant-animal interactions: antagonistic versus mutualistic networks in changing tropical environments - PosterP01-15

Influence of an invasive generalist predator on feedbacks between above- and belowground subsystems of a tropical forest

A.E. Dunham

Pathways linking above- and belowground subsystems of terrestrial ecosystems are important for ecosystem processes and function, but remain poorly understood. Understanding these links has recently become a central challenge of terrestrial ecology. We used 19 separate invasion fronts of a non-native generalist predator (little red fire ant Wasmannia auropunctata) in the rainforest of Gabon as an opportunity to explore the effects of predation on communities and ecosystem processes through above- and belowground subsystem linkages. In addition to altering herbivore regimes and plant damage in the grazing web, path analysis suggests that invasive ants also indirectly alter litter decomposition and nutrient cycling in the soil by suppressing important microbivore and detritivore populations with consequences for leaf chemistry. These results demonstrate that generalist predators can be major drivers of both above- and belowground subsystems by inducing strong shifts in adjacent communities that ultimately affect ecosystem processes and feedbacks.

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Session 01: Plant-animal interactions: antagonistic versus mutualistic networks in changing tropical environments - PosterP01-16

Effects of colour change and nectar robbing in mass-flowering Tabebuia impetiginosa (Bignoniaceae)

P. Milet-Pinheiro

C. Schlindwein

Tabebuia impetiginosa is a mass-flowering tree with mellitophilous flowers. Attractive nectar guides change from yellow, orange to pink during anthesis. In the Catimbau National Park, Brazil, we studied pollination, the function of nectar guide colour changes and the impact of nectar robbers on fruit set. Obligate outcrossing T. impetiginosa was pollinated mainly by Centris bees (Centridini). These bees differentiated first, second and third day flowers, indicated by differences in nectar guide colours. Post-colour change flowers indicate ceased nectar production for the bees, and were avoided by pollinators. Colour change, thus, diminishes geitonogamy and permits a high floral display for long distance attraction. Furthermore, it increases foraging efficiency of Centris pollinators raising their flights between individual plants. This is particularly important in this species, because stigmas closed definitively after deposition of any conspecific pollen. Xylocopa and Trigona spinipes bees, the main primary nectar robbers, affected two thirds of the flowers. Flowers experimentally protected against nectar robbers showed duplicated fruit set when compared to control flowers. Destructive nectar robbing of T. spinipes and the high rate of geitonogamy associated with definitive stigma closure after deposition of conspecific pollen of neighboring flowers were responsible for the low fruit set in the studied population.

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Session 01: Plant-animal interactions: antagonistic versus mutualistic networks in changing tropical environments - PosterP01-17

Insect aquaplaning: Wetness-based activation of traps in Nepenthes pitcher plants

U. Bauer, W. Federle

Nepenthes pitchers are highly specialised leaves for attracting, capturing, retaining and digesting arthropod prey. Specialised trapping structures include a viscoelastic digestive fluid, slippery wax crystals and downward-pointing cells on the inner pitcher walls, as well as the pitcher rim (peristome) which is slippery when wet. While most species possess functional peristomes and downward-pointing cells, wax crystals are absent in a number of species, and viscoelastic pitchers fluids are rare. We investigated the relevance of the different structures in the field by comparing two varieties of N. rafflesiana with opposite combinations of pitcher traits. 'Knock-out' manipulations of individual structures confirmed peristome aquaplaning as the most important capture mechanism in the absence of wax crystals. Combined measurements of capture efficiency, meteorological data and peristome surface wetness showed that capture efficiency varied dramatically from 0% (dry) to 80% (wet) and was determined by rain, condensation, and nectar secreted from peristome nectaries. Our results confirm the importance of the peristome for prey capture and underline the dependence of trapping success on environmental factors.

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Session 02: Oilplants & oilbees: 40 years after Stefan Vogel find – TalkT02-01

Oil-Flowers and their Bees: A global Survey

Stefan Vogel

The four existing oil-flower domains of the world: the holarctic, paleotropic, capensic and neotropic, have evolved almost independently and show little overlap. They represent an instructive example of conconvergency. Most oil-collecting bees as well as their oil- producing plant-hosts of the Old World are not related to those of the New World. Nevertheless, all participants of this mutualism have characteristics in common: The plant hosts are melittophilous and constitute a special group that lacks nectaries and produces instead a liquid high energy reward consisting uniformly of one class of relatively hydrophilic acyloxy fatty acids with carbon chain lengths of 14–18. They are secreted by particular floral gland fields (elaiophores). Certain bees collect the oil with their specially equipped legs or the ventral metasoma. The lipid mixed with pollen is used as provision for the larvae and as a solidifying material for sealing the brood cell. Oil flower systems are rare compared to other floral guilds and its origin probably dates back to the early tertiary. The evolution of the neotropical system may perhaps have started from the mainly woody Malpighiaceae, later followed by herbaceous taxa. The controversial ecological aspects of some oil- bearing taxa systematically connected with their Old World relatives are discussed.

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Session 02: Oilplants & oilbees: 40 years after Stefan Vogel find - TalkT02-02

Diversity and evolution of the association of oil-collecting bees with Nierembergia (Solanaceae) and Calceolaria (Calceolariaceae)

A. A. Cocucci; A. N. Sérsic & A. Cosacov

Recent molecular phylogenies let us draw conclusions on the origin and diversification patterns of these two genera which are among the most specious plant clades bearing oil-flowers in temperate South America. In both genera the acquisitions of elaiophores, which is traceable back to the earliest ancestors, represent key innovations associated with strong speciation relative to sister genera. Elaiophores have been presumably co-opted for pollination service from trichomes of vegetative organs or petal outside involved in other functions such as herbivore deterrent. Reports of extrafloral oil-collection further suggest a non nuptial origin of the oil-based association. In Nierembergia, the transition to oil-flowers involved the loss of nectaries and the exaptation of the corolla tube from a nectar container to an exposition organ. Primary association was probably with Centridines in Calceolaria or with smaller Tapinotaspidines in Nierembergia. Shifts from large to small oil-collecting bees (Calceolaria) and vise versa (Nierembergia) have occurred. In both genera studies on multiple populations show that in a single species the locally predominant oil-bees changes between Centridines and Tapinotaspidines, suggesting that these shifts may still be occurring.Elaiophore loss, which is marked in tropical zones, is linked to shifts to selfing, pollination by pollen-collecting bees or non-nectarivorous birds.

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Session 02: Oilplants & oilbees: 40 years after Stefan Vogel find - TalkT02-03

Ecology, Biogeography, and Systematics of the Ctenoplectrini, an Old World Oil Bee Tribe, Specialized on the Gourd Family (Cucurbitaceae)

H. Schaefer

In 1990, Stefan Vogel published the third book in his series on oil flowers and oil foraging bees, in which he described a completely new system: Momordica, Thladiantha (Cucurbitaceae) and oil bees of the tribe Ctenoplectrini. This tribe comprises the two genera Ctenoplectra with nine species known from tropical Africa and ten in Asia and Australia, and Ctenoplectrina with three probably kleptoparasitic species. All species of Ctenoplectra visit exclusively Cucurbitaceae where they collect floral oil from the female flowers and oil, pollen, and nectar from the male flowers. Recent fieldwork has shown that the host plants include at least six different cucurbit genera: Momordica, Thladiantha, Baijiania (incl. Sinobaijiania), Indofevillea, Siraitia (incl. Microlagenaria), and Telfairia, but each of them is pollinated by two or more different Ctenoplectra species. Molecular phylogenetic analyses combined with molecular clock approaches suggest that Ctenoplectrini originated in Africa in the Early Eocene and that Ctenoplectra dispersed twice from Africa to Asia, sometime in the Late Eocene, 30-40 my ago, from where one species reached the Australian continent via Indonesia and New Guinea in the mid-Miocene, c. 13 my ago. The evolution of the mutualism between Ctenoplectra and oil-offering Cucurbitaceae is best explained by a scenario of gradual evolutionary host niche broadening from the Momordica clade to the distantly related Indofevillea, Thladiantha, Siraitia and Telfairia clades. This is somehow in contrast to Vogel's hypothesis of a Laurasian origin of both, bees and cucurbits followed by range expansion to Africa and Australia.

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Session 02: Oilplants & oilbees: 40 years after Stefan Vogel find - TalkT02-04

How oilbees find their flowers: do they use their eyes and/or antennae?

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Many flowers advertise their presence by visual and/or olfactory cues, and the pollinators use their eyes and/or antennae to find the flowers. In the oilplant-oilbee pollination system however, nothing is known about the cues used by the bees to find their host-plants. Here, we describe the visual (colour) and olfactory advertisements of Lysimachia oilplants in more detail, and show that both cue modalities are important for attraction of the Macropis oilbees, the only pollinators of Lysimachia. Olfactory cues are essential for flower-inexperienced bees, which do not respond to visual cues when decoupling them from the olfactory ones. During their life, however, bees learn the visual cues of the plants, and vision gets more important for host-plant finding in flower-experienced bees. In a next step, the specific chemical compounds used by Macropis to find Lysimachia need to be identified.

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Session 02: Oilplants & oilbees: 40 years after Stefan Vogel find - TalkT02-05

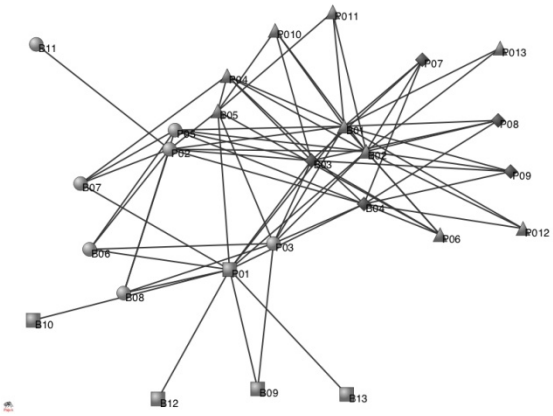
Pollination networks of oil-flowers: a tiny world within the smallest of all worlds

E.L.S. Bezerra, I.C.S. Machado, M.A.R. Mello

In the Neotropics most plants depend on animals for pollination, forming 'small-world' mutualistic networks. In a specialized relationship, Centridini bees depend on oil from flowers to feed their larvae. This could result in a subweb ('tiny world') with higher nestedness, shorter path lengths, lower modularity and higher resilience. In the present study, we contrasted structure and fragility of a network of oil-flowers and their visitors from a Brazilian steppe to whole pollination networks from all over the world. The oil-flower network studied was more nested than all of the whole pollination networks studied. Average path lengths in the two-mode network were shorter and modularity was lower than in all of the whole pollination networks. Extinctions had no or small effects on the network structure, and only two species caused coextinctions. The higher the degree of the removed species, the stronger the effect and the higher the probability of a decrease in nestedness. We conclude that the oil-flower subwebs are more cohesive and resilient than whole pollination networks. Our findings reinforce the hypothesis that each ecological service is in fact a mosaic of different subservices with a hierarchical structure ('webs within webs').

Session 02: Oilplants & oilbees: 40 years after Stefan Vogel find - TalkT02-05

Figure 1: The modular structure of the oil-flower pollination network.



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Session 02: Oilplants & oilbees: 40 years after Stefan Vogel find - TalkT02-06

Nesting biology of the Neotropical oilbees

I. Alves-dos-Santos

There are about 330 species of bees that use oil collected from flowers to feed the larvae and to surface the brood cells. In the Neotropical they belong to the tribes Centridini, Tapinostapidini and Tetrapedini. The oilbees are most solitary, but some nest aggregated. The ground nesting species use flat soil or banks (like Epicharis, Monoeca, Lanthanomelissa) and some use nest of termites (like Ptilotopus). The wood nesting species use pre-existing cavities, like Tetrapedia and Centris of the subgenera Hemisiella, Heterocentris and Xanthemisia. Usually they nest in beetle burrows in dead trunks but they also use artificial cavities. The females mix soil and sand grains with the lipid turning the cell wall more resistant and smooth inside. The same material is used for the partitions and close. Natural enemies are wasps (Chalcidoidea, Leucospis, Mutillidae), bugs (Meloidae, Tetraonyx) and other bees, in this case performing as cleptoparasites (Coelioxys, Coelioxoides, Mesoplia, Mesocheira, Protosiris, Paraepeolus, Rhathymus). Many host-parasite specific associations were record. The parasite female oviposite inside the brood cell and its larvae kill the host egg and feed on the provision. Probably the volatile compounds of the oil have an attractive effect and help the parasites to localize the nest.

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Session 02: Oilplants & oilbees: 40 years after Stefan Vogel find - TalkT02-07

Effect of nectar concentration on foraging behavior in the nextar-feeding bat Glossophaga soricina

Jorge Ayala-Berdon, Nelly Rodríguez peña and Jorge E. Schondube

Nectar feeding bats face changes in the quality of food content in the flowers they visit. In the new world, nectar consumed by bats varies from 3 to 33% of sugar content. To confront this change in concentration, bats increase food consumption (named intake response), attempting to obtain proportional energy intake (named compensatory feeding). However, intake response can be constrained by physiological traits of individuals (i.e. rate of sugar digestion and absorption and/or rate of water processing), affecting bat's energetic budget and consequently their behavior. Here, we evaluated the effect of concentration of nectar in foraging behavior of long tongued bat Glossophaga soricina. We measured intake response and foraging behavior when bats fed at different solutions of sucrose (from 5 to 35% w/w). The intake response analysis indicated that bats obtained ~20% less energy when they fed at lowest concentration, indicating the presence of a physiological constraint. As response, bats increased feeding and resting time when fed at lower concentrations. When bats fed at higher concentrations, they increased flying time. The results indicate that bats modulated their activity patterns in response to energy acquisition, but energy acquisition is modeled by physiological traits of organisms.

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Session 02: Oilplants & oilbees: 40 years after Stefan Vogel find
- TalkT02-08

Evolutionary versus Ecological Specialization in the Oil Flower Pollination Syndrome

S.C. Cappellari, R. Tidon, J.L. Neff and B.B. Simpson

Several morphological and behavioral characteristics of species involved in the oil flower pollination syndrome indicate evolutionary specialization illustrated by adaptations in both bees and plants as a result of co-evolutionary processes. However, surveys of oil flower and oil-collecting bee interactions show high overlap in both floral host and pollinator use indicating a lack of ecological specialization in this system. How specialized is the oil flower pollination syndrome? Is there a correspondence between the different concepts of specialization between plants and their pollinators? To answer these questions, we studied 34 sympatric species of oil flowers in the Malpighiaceae and their interactions with oil-collecting bees during the wet and dry season of a Cerrado area near Brasilia, Brazil. We evaluate the correspondence between evolutionary and ecological specialization in this system considering data on plant phenology, habit, and abundance as well as oil-collecting bees, their visitation frequency and behavior on flowers. Based on these data we highlight partitioning strategies that may support the great diversity of oil flowers found in the Cerrado of Brazil.

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Session 02: Oilplants & oilbees: 40 years after Stefan Vogel find - PosterP02-01

Conservation of the oil-producing Angelonia (Plantaginaceae) species and their pollinators

A. C. Martins, A. J. C. de Aguiar & I. Alves-dos-Santos

Angelonia presents 26 species exclusive to Neotropics, offering oil as the main reward for oil-collecting bee pollinators. Its species are endemic to the xeric areas, like Caatinga, Chaco and highlands of Espinhaço Range. Five species are present in the redlist of the Brazilian flora. The vulnerability was related to the small populations and restricted distributions. A third factor was not suggested before: the specialized pollination system. To evaluate the conservation status of the pollinators of Angelonia, four species were studied with complementary review of other five species. To Angelonia integerrima, A. goyazensis and A. eriostachys the pollinators seems not to be limit factor, because they are bees of wide distribution and not high specialized on Angelonia flowers. Angelonia salicariifolia and A. cornigera are mainly pollinated by specialist bees of Caenonomada genus and Centris group hyptidis, both with restricted distribution. In this case, the threat for the Angelonia species is also a threat for their pollinators. The high specialization and restricted geographical distribution indicate the degree of threat. Because of the neglected conservation of the xeric biomes, these plants and pollinators are mutually endangered. Our results reinforced the importance of evaluating both pollination partners on conservation the programs.

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Session 02: Oilplants & oilbees: 40 years after Stefan Vogel find - PosterP02-02

Basistemon silvaticus (Plantaginaceae) and the relationships with oil-collecting bees in Brazilian Chaco

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Basistemon presents four species that were inferred to produce floral oil as a pollination reward. Basistemon silvaticus was studied on Chaco, in southwestern Brazil, in January 2008. The solitary bilateral sympetalous flowers are white or lilac, about 6 mm deep, slightly saccate, with trichomatic elaiophores. Six visiting bee species were reported: one pollen robber, Dialictus sp., and five oil-collecting species. Centris hyptidoides, Caenonomada bruneri and Caenonomada aff. unicalcarata behave as legitimate pollinator, collecting oil with forelegs and touching the fertile organs with the face. The first two are the most frequent visitors and present elaiospathes specialized to collect oil on trichomatic producing glands. These elaiospathes are mainly composed of numerous flat leaflike setae on the fore basitarsus and tarsomeres. Arhysoceble aff. huberi and Tetrapedia sp. are occasionally pollinators and their elaiospathes are generic used to explore epithelial (Malpighiaceae) and trichomatic elaiophores. The species of Basistemon with oil flowers present a high geographical overlap with the reported pollinators. The effective pollinators are also related with Angelonia, sister-group of Basistemon, suggesting mutual evolution of these bees with the oil-producing Plantaginaceae. The specialized association between B. silvaticus and its legitimate pollinators allow a new discussion about the coevolution and dependence of these partners.

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Session 02: Oilplants & oilbees: 40 years after Stefan Vogel find - PosterP02-03

Momordica foetida (Cucurbitaceae): its generalist and specialist pollinators along a forest distance gradient in Western Kenya

J. Binkenstein, M. Hagen & M. Kraemer

Oil-collecting bees are not only specialised on specific nesting requirements, as many other bees are, but also on the floral reward oil, to feed their offspring. In this study the pollination biology of the oil producing plant species Momordica foetida (Cucurbitaceae) was investigated concentrating on (1) the degree of specialization of pollinators and (2) the effect of increasing distance to forest habitats on the composition of flower visitors as well as on the reproductive success of the plant. Results revealed that there are several visitor species apart from the semi-specialized oil collecting bee genus Ctenoplectra visiting flowers of M. foetida. These are nearly exclusively bees and most of them belong to the genus Lasioglossum. Furthermore the number of Ctenoplectra bees decreased significantly with increasing distance from the forest revealing the dependency of these bees on the forest. Although numbers of specialised flower visitors decreased, seed set of Momordica foetida did not decrease, indicating the independence of the plants reproductive success from specialised Ctenoplectra species.

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Session 02: Oilplants & oilbees: 40 years after Stefan Vogel find - PosterP02-04

Bionomy of the non-tropical oil bee Macropis fulvipes

I. Schäffler, S. Dötterl

Most of the circa 420 bee species, which use the fatty floral oil of oil-producing plants as provision for their offspring, occur in the Neotropics. In the Holarctic there is only one oil bee genus, i.e. Macropis, which collects oil, and also pollen only from Lysimachia oil plants. To learn more about the bionomy of this ground nesting oil bee, we established a population in a flight cage making an observation of individually marked bees possible. In detail, we determined the hatching phenology over three years, as well as the provisioning of cells. The hatching phenology differed among the years, and we found that the date of hatching seems to be dependent on the temperatures and the duration of the previous winter. The behavioral observation revealed that female bees visit oil flowers for two purposes: 1) to collect oil for the cell lining, and 2) to collect oil together with pollen as provision for the larvae. Oil vs. oil+pollen is collected in different collection trips. The duration and the number of flowers visited differed between these collection trips. Based on latter data we are able to estimate the number of flowers needed to build and provision one cell.

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Session 03: Tropical dendroecology - Talk T03-01

Climate Change Impact on Forest Area in Thailand

Nathsuda Pumijumnong and Jassada Techamahasaranont

Climate is probably the most important determinant of vegetation patterns globally and has a significant influence on the distribution and structure of forest ecosystems. Global warming is a serious environmental issue world wide. Natural resources such as forest ecosystems are both directly and indirectly most beneficial to human beings and all living creatures. Therefore impact of climate change to natural resources would impact human beings and other creatures as well. This research aims to assess how climate change impacts the forest area in the upper Chao Phraya river basin, the most important watershed basin for Thai people. Forest type models (hill evergreen forest, dry evergreen forest, mixed coniferous forest, mixed-deciduous forest, and dry dipterocarp forest) are established and verified using characteristics of each forest type and a climate data set (1960-2007). A progronostic climate data set for the future from 2010-2019, 2020-2029, 2030-2039, 2050-2059 and 2080-2089 asssuming double CO2 (740 ppm) than at present then was applied to predict the future forest types. The results are discussed and mitigation options recommended.

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Session 03: Tropical dendroecology - Talk T03-02

Reconstructing the flow of the Blue Nile River from Juniperus procera tree rings in Ethiopia

T.H.G. Wils, I. Robertson, Z. Eshetu, R. Touchan, M. Koprowski, U.G.W. Sass-Klaassen & N.J. Loader

In the face of global warming, it is important to extend the instrumental record of environmental variables using proxy records. Tree rings are particularly suitable for this purpose and have been used in large parts of the world. However, the absence of a cold and dark winter in subtropical and tropical regions has complicated the development of tree-ring records. In these regions, tree-ring formation depends on less regularly occurring phenomena, such as droughts. We present a study from Northwest Ethiopia, where annual tree rings could be identified in cores from Juniperus procera trees. Variations in wood anatomy, tree-ring width and stable isotope ratios are closely related to water availability at the stand, which is in turn reflected by river discharge records from the Blue Nile. These relationships allowed the development of the first, preliminary reconstruction of Blue Nile baseflow.

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Session 03: Tropical dendroecology - Talk T03-03

The role of wood mass density and mechanical constraints on the economy of tree architecture

Niels PR Anten and Feike Schieving

Low wood dry mass density (D) is assumed to be competitively advantageous in terms of growth as less energy is expended per unit volume, but also mechanically more risky as tissue strength is positively correlated with D. But both the economy of crown design and whole-plant mechanical stability also depend on stem and branch traits other than mass density. Applying engineering theory, we derived that in order to achieve a certain degree of mechanical stability, expressed as the ability of the vertical stem to either support a plant's weight (in terms of a buckling safety factor, BSF) or resist lateral wind forces without rupture (Fmax), trees with low D need to produce thicker stems but invest less mass per unit stem length (Ms) than those with high D. This contradicts the general notion that trees with low D are necessarily mechanically less stable. Among 81 tropical tree species we indeed found that Ms increased while BSF was not correlated with D. Fmax however, also increased with D. For horizontal branches we predicted that high density wood can be more efficient in terms of the mass needed to produce a branch of given length and resistance to rupture, which was consistent with literature data, but contrary to the results for stems. Apparently differences in scaling rules associated with vertical self loading, resistance to external forces and the production of stable horizontal branches have important implications for the way in which different crown traits determine the balance between economy of design and mechanical stability.

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Session 03: Tropical dendroecology - Talk T03-04

How old are trees in central Amazonia?

J. Schöngart

Tree age is a key indicator for tropical forest dynamics, linked to the discussion on sustainable management, conservation and carbon cycle. However, information on tree ages in central Amazonian forest ecosystems is controversial due to the different methodological approaches applied for age determination or estimation such as tree-ring analysis (dendrochronology), repeated diameter measurements and radiocarbon dating. Trees subjected to annual long-term flooding in the central Amazonian nutrient-poor igapó and nutrient-rich várzea form annual tree rings as a consequence of the flood-pulse, while the growth rhythm of species in upland forests (terra firme) is triggered by seasonal variation in precipitation. This has been indicated by several independent dendrochronological methods. Age determinations based on tree rings of more than 1.500 trees of several species from várzea, igapó and terra firme are used to develop a multiple regression model for each forest type predicting tree age by diameter and wood density. The models explain between 67% and 83% of the variability of tree age and are a powerful instrument for tropical forest research and development.

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Session 03: Tropical dendroecology - Talk T03-05

Ecological significance of wood anatomical variation in Kenyan mangroves

N. Schmitz, H. Beeckman & N. Koedam

Since plants colonized land, water uptake and transport against gravitational forces are amongst the major challenges. To study the relationship between the structure of the water transport system of trees and their ecological distribution, mangroves are a good choice. Mangrove trees are growing along (sub)tropical coast lines and are permanently threatened by water stress because of water shortage during neap tides and/or because of highly saline soil water. Mangroves are a phylogenetically diverse group and each species grows at a specific position in the zone between sea and land although species mixes occur. In this study we search for patterns in the wood anatomical adaptations of the different mangrove species by comparing species and trees, subjected to environmental conditions with different demands for the water transport system. Next to structural variations of the xylem vessels, we will focus on the variation in the anatomy of the intervessel pits since it is at this level that the water transport experiences its highest resistance. In this way we will help to clarify the functional relevance of the anatomical characteristics of the water transport system under relatively high risk for drought-induced cavitation of the water column.

Session 03: Tropical dendroecology - Talk T03-05

Figure 1: Sonneratia alba at Gazi Bay, Kenya.

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Session 03: Tropical dendroecology - Talk T03-06

Tropical tree rings reveal increased juvenile growth rates over time and preferential survival of fast-growing juveniles

D.M.A. Rozendaal, R.J.W. Brienen, C.C. Soliz-Gamboa & P.A. Zuidema

Growth patterns of juvenile tropical trees were evaluated to test two hypotheses: (1) fast-growing juvenile trees have a higher chance to attain the canopy ('juvenile selection effect'), and (2) juvenile tree growth has increased over the last century. Tree ring analysis was applied to test these hypotheses for five tree species from three moist forest sites in Bolivia, using samples from 443 individuals with widely ranging diameter. Basal area increment was calculated for juvenile tree rings (<10 cm diameter). For three out of five species, a juvenile selection effect was found in rings formed by small juveniles. Thus, extant adult trees of these species have had higher juvenile growth rates than extant juvenile trees. Rings formed by somewhat larger juveniles showed the opposite pattern in three species, with juvenile growth rates increasing over time. This finding is consistent with a CO2-fertilization effect, in particular for two species for which the increase was limited to the 20th century. A cautious interpretation of the observed growth patterns is required. Sample size before the 20th century was low, and the observed increase in juvenile growth over time may be a consequence of sampling bias.

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Dry Forest versus Mountain Rainforest: A comparison of tree growth and climate variability in Southern Ecuador

Franziska Volland-Voigt, Thorsten Peters, Oswaldo Ganzhi & Achim Bräuning

Since Beginning of 2007 we carry out measurements of tree growth dynamics and climate in two different tropical forests in Southern Ecuador: a dry forest (bosque seco) and a mountain rainforest. Tree growth dynamics is studied with the help of high-resolution electronic dendrometer measurements taken in 30 min. intervals and with wood anatomical microsections collected every four weeks. Results of cumulative growth curves indicate a great difference in the seasonal growth dynamics between trees at the two sites. In the mountain rainforest, where annual precipitation amounts to ca. 2500 mm, trees grow more or less continuously. However, cambial activity is occasionally interrupted during short dry periods which provoke a synchronous shrinkage of the stems, irrespective of tree species and life form. Daily stem diameter variations correlate with the length of the dry period and with maximum vapour pressure deficit during the day. In the dry forest, trees show a pronounced cambial dormancy during the dry season. Growth is restricted to the short rainy period during January to April. At the beginning of the rainy period, tree diameters increase as a consequence of stem rehydration, whereas the active growing period is restricted to a time window of ca. 2 months only. After middle of May, stem diameters are decreasing as a consequence of water loss during the day which is not compensated by water uptake during the night. The study demonstrates the great variety of tree growth behaviour as a result of local climate conditions in tropical mountain environments.

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Session 03: Tropical dendroecology - Talk T03-08

Long-term and age-related isotope trends in pristine tropical forests

P. Hietz, C. Nock, A. Leis, W. Wanek

Various drivers of global change can affect tree growth and forest dynamics, but these effects are poorly known for tropical forests. Because isotopes from tree-rings indicate long-term changes but can also be affected by tree age, we distinguish between long-term changes (decadal) related to the environment and changes related to the trees' ontogeny in istopes from a tropical rainforest in Brazil and a monsoonal forest in Thailand. Cellulose δ13C trends reflect the rise in atmospheric CO2 that has resulted in increases in tree water use efficiency, somewhat stronger in trees from the rainforest than in those from the Thai forest. Wood nitrogen concentrations increased in most species and δ15N increased independent of tree age. These trends in forests rather remote from N emissions suggest a trend towards a more open nitrogen cycle and higher N availability. Whether these are related to increased N input or indirect effects of CO2 on the N cycle, remains unknown. δ18O showed little long-term trend, but δ18O as well as δ13C increased with tree age in monsoon forest species and decreased in rainforest species and δ15N declined with age in some species. Interpretation of these trends in terms of long-term changes and changes during tree ontogeny will be discussed.

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Session 03: Tropical dendroecology - Talk T03-09

Sexual dimorphism in growth and survivorship patterns of Southeast Asian trees: a 20-year study

S.C. Thomas

Although dioecy is ubiquitous in tropical forests, few data exist on sexual dimorphism in growth and demography of dioecious tropical trees. Populations of 26 tree species were surveyed for sex expression from 1989-1992, and the growth and mortality of these populations followed from 1985-2006 in primary lowland forest in Peninsular Malaysia. Male-based sex ratios were common (mean M:F ratio 1.8); however, the genus Garcinia (Clusiaceae) showed a tendency toward female bias. Sexual dimorphism in growth rates varied among taxa: in the Euphorb genera Aporosa and Baccaurea growth rates averaged 15% higher in staminate than pistillate trees. However, Diospyros (Ebenacae) and Garcinia showed no general trend, and some species exhibited pronounced “reverse” sexual dimorphism in growth. In Diospyros cauliflora, high growth among pistillate trees was associated with their preferential occurrence on termite mounds of Macrotermes carbonarius. Sexual dimorphism in survivorship also varied qualitatively among species, with instances of staminate trees showing either higher or lower rates than pistillate trees. Garcinia scortechinii, for which only female trees occur at the study site, showed a mortality rate double the average. I speculate that the large quantitative and qualitative variation in sexual dimorphism observed is principally due to strong sex-linked influences of biotic interactions.

Session 03: Tropical dendroecology - Talk T03-09

Figure 1: Staminate (left) and pistillate (right) individuals of Baccaurea parviflora.

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Session 03: Tropical dendroecology - Talk T03-10

A reassessment of carbon content in tropical trees: The volatile C fraction and its variability among species

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Currently, nearly all forest carbon models assume woody tissues of trees consist of 50% C on a weight/weight basis. However recent studies indicate that total wood C content amongst species deviates significantly from 50%, due to variation in the volatile C fraction; low molecular weight C-based compounds which are lost upon heating. To date neither total wood C nor volatile C fraction has been accurately quantified in tropical trees, limiting the accuracy of forest C models. We assayed and compared freeze- and oven-dried wood samples to quantify total and volatile C fraction in 15 Panamanian hardwood species. Preliminary analysis suggests the volatile C fraction in tropical treesis substantial, averaging 1.44% and varying between 0.78-2.79% amongst species. Total wood C content excluding the volatile fraction averaged 45.99%, and varied between 42.05-47.92%. Inclusive of the volatile fraction, total wood C averaged 47.43%, and ranged between 44.42-49.12%. We observed a weak positive relationship between wood density and total C content. Variation in the volatile C fraction showed strong phylogenetic patterns, indicating that inclusion of higher taxon-specific wood C values will enhance the accuracy of forest C accounting models. Failure to include such values will likely bias forest C stock estimates by ~2-11%.

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Session 03: Tropical dendroecology - PosterP03-01

Seasonal growth dynamics of different tree species in Munessa forest (Ethiopia) and their climatic control

J. Krepkowski, A. Bräuning & A. Gebrekirstos

The seasonal wood increment of nine different tree species including different life forms was studied in the Munessa forest with the help of high-resolution electronic dendrometers. Studied tree species include evergreen native and introduced conifers (Podocarpus falcatus, Juniperus procera, Pinus patula), evergreen broadleaved trees (Prunus africanus, Hagenia abyssinica, Celtis africana, Aningeria adolfo-friedericii, Syzygium guinneense) and deciduous trees (Croton macrostachyus). Measurements of radial stem diameter were registered in 30 min intervals. Daily amplitudes of stem diameter variations and daily and monthly net growth rates were determined and related to climatic variables measured at local climate stations. Wood microcores were collected in monthly intervals and microscopic thin sections were produced that document the formation of different anatomical types of wood tissue. Cambial dynamics and seasonal formation of wood of the nine investigated species was studied. Since the study was initiated in March 2008, seasonal patterns of growth dynamics and wood formation over one complete annual cycle are discussed. Daily stem diameter variations are related to climatological factors like precipitation and vapour pressure deficit. Absolut growth rates between species and individuals of identical species are compared.

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Session 03: Tropical dendroecology - PosterP03-02

Wood density and its radial variation in six canopy tree species differing in shade-tolerance in western Thailand

C. A. Nock, D. Geihofer, M. Grabner, P. J. Baker, S. Bunyavejchewin and P. Hietz

Wood density is a key variable for understanding life history strategies in tropical trees. We related differences in wood density and its radial variation to the shade-tolerance of six canopy tree species in seasonally dry tropical forest in Thailand. Using tree ring measurements we also analysed the influence of tree size, age and annual increment on radial density gradients. Average wood density generally reflected differences in shade-tolerance, varying by nearly a factor of two. Radial gradients occurred in all species and ranged from an increase of (~70%) in the shade-intolerant Melia azedarach to a decrease of ~13% in the shade-tolerant Neolitsea obtusifolia but were generally unrelated to shade-tolerance. For Melia azedarach, radial increases were most parsimoniously explained by log-transformed tree age and annual increment rather than by tree size. Our results suggest that average wood density reflects differences in shade-tolerance in seasonally dry tropical forests, however, inferences based solely on wood density could be misleading for species with complex life histories. Our findings also suggest that a "whole-tree" view of life history and biomechanics is important for understanding patterns of radial variation in wood density. Finally, accounting for wood density gradients could improve biomass estimates of tropical trees.

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Session 03: Tropical dendroecology - PosterP03-03

Quantifying and understanding variation in vessel characteristics of tropical trees

C.C.Soliz-Gamboa & P.A. Zuidema

Tree-ring vessels contain valuable climatic and ecological information. The density, size distribution and lumen area of vessels in a given tree ring are correlated with the size (crown area, diameter), growth rate and growing conditions (water and light availability) of a tree. These vessel characteristics therefore provide valuable information on historical characteristics and growing conditions of trees. To date, little is known about vessel characteristics of tropical trees, partly due to the limited amount of dendrochronological work there. Here we report on a study on vessel characteristics of three rainforest species in the Bolivian Amazon: Peltogyne cf heterophylla, Clarisia racemosa, and Cedrelinga catenaeformis. We collected five samples from tree discs of juvenile trees per species and took histological sections from these. We characterized tree rings anatomically, measured their widths, and verified their annual nature using 14C bomb peak dating. We then quantified density, size distribution and lumen area of vessels over the entire lifetime of all sampled trees. We related vessel characteristics to tree ring width, tree diameter and rainfall. In addition, we also evaluated changes in vessel size and density within tree rings. We discuss our results in relation to the light requirements of our study species.

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Session 03: Tropical dendroecology - PosterP03-04

Successive cambia in woody plants: an indicator of water stress?

T. Driessens, N. Koedam & N. Schmitz

Though secondary growth via successive cambia occurs in a minority of species, it has been intriguing researchers for decades. This anomalous growth form is mainly present in lianas and vines, but can also be observed in woody shrub and tree species. In the present literature study the relationship between species growing via successive cambia and their habitat was investigated, taking into account the different growth habits. The aim was to obtain a better insight in the ecological and functional significance of secondary growth via successive cambia. Therefore information about growth habit, biogeography and habitat of different species growing via successive cambia, was collected. From our results we conclude that growth via successive cambia is a beneficial ecological strategy for different growth habits under two contrasting environmental conditions: scandent growth related to humid-wet conditions versus tree and shrub growth habit related to water stress conditions. For vines and lianas an improved mechanical flexibility of the stem is probably the major functional advantage of this anomalous growth pattern. In contrast, successive cambia in trees and shrubs may offer a big advantage under xeric environmental conditions, because of the enhanced potential to store water and refill embolized vessels.

Session 03: Tropical dendroecology - PosterP03-04

Figure 1: Avicennia marina in Vanga, Kenya.

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Session 03: Tropical dendroecology - PosterP03-05

Growth dynamics and their climatic control in new world (Ecuador) and old world (Ethiopia) Tropical Mountain forest trees of the Podocarpaceae family

A. Bräuning, A. Gebrekirstos, J. Krepkowski, F. Volland-Voigt & O. Ganzhi

When do tropical mountain forest trees exhibit growth boundaries? We compare seasonal growth characteristics and the climatic seasonality of two study areas in Ecuador and Ethiopia. Elevations of both study regions are between 2000-2300 m a.s.l. but differences occur in rainfall seasonality. While the Ecuadorian site only shows short dry periods of few weeks, climate at the Ethiopian site is characterized by a pronounced dry season lasting from December to March. We compare the effects of climate seasonality on two species of the Podocarpaceae family, i.e. Prumnopitys montana in Ecuador and Podocarpus falcatus in Ethiopia. Both species show the same wood anatomical structures, but growth at the Ethiopian site is characterized by cambial dormancy during the dry season. Profiles of high-frequency wood density analyses in both regions reveal intra-annual variations of wood density that are related to the intra-seasonal variations of precipitation. We conclude about the required seasonality of rainfall required to provoke cambial dormancy and the formation of distinct growth boundaries in tree species of the same family.

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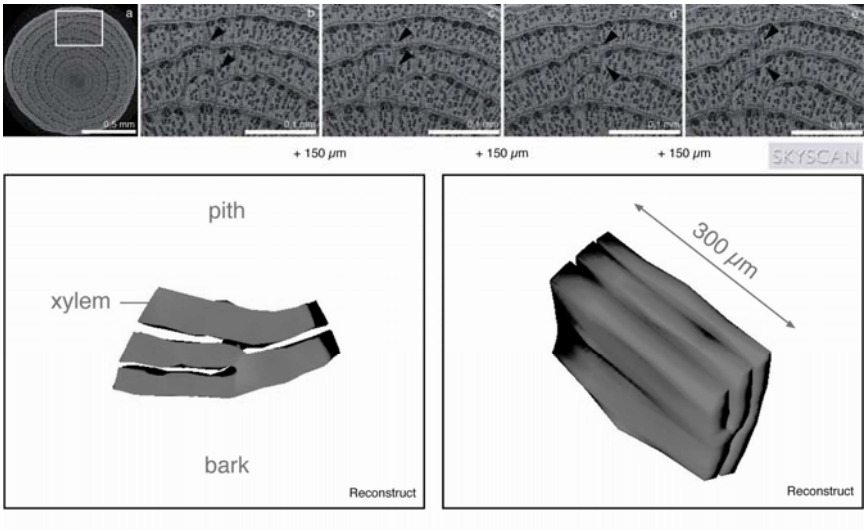
Session 03: Tropical dendroecology - PosterP03-06

Successive cambia in three dimensions: the mangrove Avicennia inside

E.M.R. Robert, N. Schmitz, H. Beeckman & N. Koedam

Successive cambia are a rarity in nature. Only a few number of plants, although out of different phylogenetic clades, have secondary growth by more than one vascular cambium. The mangrove genus Avicennia is one of the tree genera for which successive cambia are described since years. However, a three-dimensional description of the internal structure is still lacking, as is insight in the development and ecological implications of successive cambia. This study wants to elucidate the phenomenon of successive cambia by a three-dimensional description and an ecological interpretation of the hydraulic architecture of Avicennia, creating herewith more insight in the growth of trees in general.



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Session 03: Tropical dendroecology - PosterP03-07

Wood density variation in secondary tropical rainforests

S. Becker, D. Braun, R. Gliniars, W. Musila, M. Oesker, H. Todt & H. Dalitz

This study analyses the influence of anthropogenic disturbances, climate and growth rate on wood density in tropical rainforests. During a six-week field study, woodcores from the most abundant tree species in two tropical rainforests Budongo Forest (Uganda) and Kakamega Forest (Kenya) were taken. The two forests have been subjected to different disturbance regimes. Tree species occurring in both forests were compared. Woodcores are thin and long cylindrical samples obtained without destroying a tree. Thus it is possible to take further samples from the same trees in future. Woodcores were taken from trees growing in different environmental conditions and used to calculate wood densities. The selected trees are also monitored regularly for their growth rate. The study compares variations in wood densities with tree species and size classes. In addition, the study examines the relationship between wood density of different tree species, climate data and the degree of forest disturbance. Such information is important in understanding rates of carbon gain in secondary tropical rainforests and their role in carbon sequestration.

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Session 03: Tropical dendroecology - PosterP03-08

Pinus kesiya response to monsoon climate in Thailand and myanmar

Nathsuda Pumijumnong and Nyi Nyi Kyaw

Tree-ring chronologies of pine (Pinus kesiya) from Thailand and Myanmar were compiled from 240 core samples taken from 120 trees covering the area of the north and north-east of Thailand and north-east of Myanmar. A quantitative evaluation of the climate-growth relationships of the trees indicated a similar response pattern across the two countries. February-May (pre-monsoon) rainfall turned out to be the most significant influencing factor. Thus, there is some promise that the pine chronologies in Thailand and in Myanmar can contribute to a climate reconstruction over at least three centuries.

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Session 04: Aquatic invasive tropical species - TalkT04-01

Invasive freshwater invertebrates and global change: comparing Latin America and Europe

K. M. Wantzen

Increasing navigation and globalization have brought upon an enormous transfer of species between formerly disjunct habitats, especially so in freshwater ecosystems. Here I compare the histories of aquatic invaders in Latin America and in Europe, and present some prominent examples. Among the molluscs, the freshwater clam genus Corbicula is one example for a global invader to both temperate and tropical systems, whereas the byssus-fixed zebra mussel Dreissena spp. and the golden mussel Limnoperna fortunei cause "vicariant" patterns of problems in Europe and Latin America, respectively. Strongly altered, "homogenized" ecosystems such as the European waterways suffer much stronger impacts by invaders than natural systems, where the natural variability of habitats and the wide range of abiotic factors (floodpulse, temperature pulse) favors native over exotic species. Special attention must be given to exotic invaders as vectors for diseases that affect native species, including human beings. Climate change increases the risk of spread of thermophilic, exotic species, such as the tiger midge (vector of Dengue fever) which is currently advancing in Europe.

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Session 04: Aquatic invasive tropical species - TalkT04-02

Quantifying the threats to tropical wetlands: a Mauritian case study

S.G. Laurance, D.H. Hammond, C. Baider & V. Florens

Coastal wetlands are one of the most threatened habitats on earth. Most research into wetland loss has focused upon quantifying the areal change in wetlands, with little attention being paid to causal factors. In an analysis of >200 wetlands on the island of Mauritius, we examined the different types of disturbances that threatened wetland function, survival and conservation value. Wetland conservation value was determined through a rapid assessment of floral and faunal composition. Most of the wetlands in Mauritius are found in coastal areas, which are being subjected to intense pressure from urban and residential developments. The process of backfilling along wetland borders had degraded about 90% of the wetlands that occurred in urban areas. This type of disturbance was found to be one of the principal causes of biodiversity loss due to the destruction of the wetland ecotonal area. We briefly discuss different compositional and structural characteristics of Mauritian wetlands and our ranking strategy for identifying conservation priorities.

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Session 04: Aquatic invasive tropical species - TalkT04-03

Effects of introduced rainbow trout (Oncorhyncus mykiss) on amphibian assemblages in high mountain forests from Colombia

J.Urbina, J. Duivenvoorden

Amphibian populations around the world are declining dramatically due to human activities such as the introduction of non-native species. In Colombia the rainbow trout was introduced in 1930 in lakes and dams at high elevations where temperature and water conditions provided an advantage for this species, recognized as a highly effective predator, able to establish self sustaining population and competent enough to colonize new habitats. Although aquaculture practices have increased in Colombia granting economic benefits to communities, the impact generated on the ecosystems is unknown. We assessed the effect of trout presence on the species richness and abundance of amphibians from high elevation forests. To do so, we sampled 15 sites where we measured environmental and habitat characteristics, and sampled frogs during 2 wet and 2 dry seasons. Amphibian composition and abundances differ according to transect position relative to fisheries. Transects located downstream of trout fisheries have fewer species and individuals than transects upstream. This response suggests an important influence of downstream forest degradation on frog communities. We characterized the water quality coming in and out of trout fisheries. Conductivity, pH, and solids in solution are not different which reduces the possibility that changes in water quality are affecting amphibians.

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Session 04: Aquatic invasive tropical species - TalkT04-04

Influence of a waterfall over richness and similarity in adjoining pools of an Atlantic Rain Forest stream

C. R. Jonck & J. M. R. Aranha

We compared fauna in substrate samples from two pools separated by a waterfall in an Atlantic Rain Forest stream located at Guaraqueçaba, Paraná, Brazil. The main goal of the study was to determine the effect of the waterfall presence in the richness and composition of the pools' animal community.The diversity did not present significant differences, showing 72 taxa in the upstream pool and 65 taxa in the downstream one. On the other hand, the composition between the pools was poorly similar, reaching just 36.5% similarity by the Sorensen Index.The different results assessed on richness and similarity data indicate that the effect caused by the waterfall can be considered as a partial discontinuity that maintains the energy flux continuous throughout the study sites but break the temporal sequence of synchronized species replacement.This partial discontinuity results from the selective action of the waterfall, which prevents organisms that do not present a terrestrial phase over their span of life to disperse to the upstream pool. In addition, organisms that were able to colonize these environments could evolve with less predatory pressure, since the organisms screened by the waterfall are mainly top consumers on lotic food webs.

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Session 04: Aquatic invasive tropical species - TalkT04-05

TROPHIC STATE OF STREAMS AND RESERVOIRS IN THE MIDDLE VIETNAM (KHANH HOA PROVINCE)

E.S. Gusev, Nguyen Thi Hai Thanh

Four reservoirs (Ho Suoi Dau, Ho Suoi Trau, Ho Da Ban, Cam Lam), river Cai and its tributaries (streams Khe, Cau, Dau) have been investigated from January to June in 2008. The chlorophyll a (Chl a) concentrations in plankton and benthos, photosynthesis rate (PP), total phosphorus (TP), total nitrogen (TN) and hydrological parameters were measured monthly. Maximal planktonic Chl a and PP were found in slightly eutrophic reservoir Ho Suoi Trau: 10.0±1.7 mkg/l and 548±81 mgC/(m3•day) respectively. Other reservoirs were mesotrophic and similar by Chl a and PP: 6.4±0.8 mkg/l and 157±44 mgC/(m3•day) in Da Ban, 5.8±1.2 mkg/l and 202±55 mgC/(m3•day) in Cam Lam, 3.5±0.4 mkg/l and 171±37 mgC/(m3•day) in Ho Suoi Dau. Values of planktonic Chl a in streams were low (0.5-1.3 mkg/l) except stream Dau (4.2±0.6 mkg/l). Chl a concentra-tions in benthos of streams were low too: 6.0±1.4 and 13.1±4.4 mg/m2 in up-stream and downstream of Cai river respectively, 3.4±1.7 mg/m2 in Cau, 11.8±1.0 mg/m2 in Khe and 17.7±3.9 mg/m2 in Dau. On the contrary, values of TP and TN in streams and reservoirs were high as in eutrophic waters and varied from 51 to 79 mkgP/l and from 615 to 745 mkgN/l in average. There were no any correlations found between biogenic elements and Chl a and PP.

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Session 04: Aquatic invasive tropical species - PosterP04-01

Rise and decline of Pistia stratiotes in a shallow tropical lake

L. C. Davenport, J. W. Terborgh

Water lettuce (Pistia stratiotes) is a floating aquatic plant that naturally occurs on shallow oxbow lakes in the Manu Biosphere Reserve, Peru. At Cocha Cashu, Pistia is typically present in small numbers along lake edges in all years. Beginning in 2004, however, the plant began a process of exponential growth, eventually covering approximately 1/2 the lake's surface area. A flood in 2003 preceded the rise of Pistia, and here we report on limnological data taken during the Pistia's rise. In July 2008, the Pistia was rapidly replaced by floating islands of Scirpus cubensis, over approximately 2-3 months in the dry season. We discuss the possible causes and consequences of the alternative lake states achieved with Pistia's rise and fall on Cocha Cashu.

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Session 04: Aquatic invasive tropical species - PosterP04-02

Invasion pathways of the Southern American Eichhornia crassipes into the worldwide tropics

B. Rudolph, S. Bartel and P. Parolin

The water hyacinth Eichhornia crassipes (Mart.) Solms originated from tropical freshwaters of South America has been nominated as among 100 of the world's worst invaders. Introduced into worldwide countries, E. crassipes is able to spread out into tropical freshwaters. It proliferates aggressively mainly by means of vegetative reproduction destroying the water ecosystem. AFLP analyses of individuals within their native range show two separated populations with a western (Peruvian) population being separated from the main South American population. This differentiation is supported by different chloroplast haplotypes. Several independent anthropogenic introductions of worldwide samples into the tropics worldwide could be detected. Samples from botanical gardens of Europe cluster within worldwide samples suggesting a distribution pathway via Europe. The role of botanical gardens and of other anthropogenic migration factors, such as missionaries or colonists in the past and tourists, nurseries, private and commercial internet trade as initiators of invasions must be taken seriously. The dangers linked to the expansion of this highly aggressive species with high growth rates and the lack of local enemies should not be underestimated, especially in view of a further increase of its expansion and favourable growth conditions in formerly non-suited habitats as a consequence of climatic changes.

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Session 04: Aquatic invasive tropical species - PosterP04-03

A landscape approach for the wetland classification in the Casanare region at the Colombian Orinoco river basin

L.F. Ricaurte, L.F. Vega & K.M. Wantzen

The Orinoco basin is among the most important wetland systems of South America. It is characterized by a flat relief, where floodpulse-dynamics and tropical climate determine the composition and distribution of the aquatic ecosystems. There are several types of wetlands such as esteros, flooded savannas and oxbows lakes associated to rivers and streams. In the framework of our PhD studies on “Ecology of shallow water bodies in Neotropical floodplains” (L.F. Vega) and "Classification of Colombian wetlands" (L. Ricaurte) we establish a wetland classification for the Casanare region at the Colombian Orinoco river basin, to simplify large complex data sets in order to improve the understanding of ecosystem functions and to validate ecosystem services. The wetland types will be defined by a hierarchical landscape approach where a) water type, b) vegetation type, and c) landscape unit, will be integrated into the classification and transferred into a GIS based on multi-temporal satellite imagery. In field we will sample vegetation, landscape and water quality, applying a Rapid Assessment Approach to establish the ground truth and to validate the final wetland classification. The results will support the classification of Neotropical wetlands and the development of the sustainable management concept for the Casanare region.

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Session 05: Changes in liana abundance in tropical forests - TalkT05-01

Changing Liana abundance in tropical forests: introduction and overview

S. A. Schnitzer, Susan G. Letcher

Lianas (woody vines) are an important component of tropical forests, constituting up to 40% of woody stems and woody species richness. They interact strongly with trees, competing both aboveground and belowground, causing physical damage, and altering gap-phase dynamics. Lianas respond positively to increased carbon dioxide, often to a greater degree than co-occurring trees. Lianas may also have superior drought resistance compared to trees. Evidence from long-term plots shows an increase in liana biomass over the past several decades, and models suggest that positive feedback loops could develop between liana abundance and forest disturbance, ultimately reducing tropical forest biomass as CO2 levels rise. Despite their importance in tropical forests and their strong effects on stand dynamics, lianas have received relatively little attention compared to trees. The goal of this symposium is to bring together researchers from diverse fields to address the causes and consequences of increasing liana abundance in tropical forests. We have assembled some of the leading scholars who work on lianas, as well as young scientists beginning their careers. Presentations will cover topics from ecophysiology, biogeography, and community ecology: what are the environmental tolerances of lianas? What physiological adaptations allow lianas to be successful? how do lianas respond during forest succession? What is the abundance distribution of lianas at a landscape to continental scale, and how is it changing?

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Session 05: Changes in liana abundance in tropical forests - TalkT05-01

Changes in liana and tree biomass as a consequence of increased hurricane frequencies in Cozumel, México

Pérez-Salicrup, D. R.Patiño-Conde, P.

Hurricanes are major disturbances which, historically, have affected Caribbean islands every 10-15 years. One apparent effect of climate change is an increase in frequency (i.e., a reduction in the return interval) of hurricanes in this part of the world. In this study we evaluate the relative resilience of trees and lianas to hurricane damage, and project changes in the proportion of tree and liana biomass as a consequence of modified hurricane frequencies. After 17 years of recovery after the last hurricane, Cozumel had a density of 3,110 trees ≥ 5 cm DBH, and 4,164 lianas ≥ 0.5 cm DBH, which accounted for a tree biomass of 196.52 Tons/ha, and liana biomass of 10.61 Tons/ha. After the combined effect of hurricanes Emily and Wilma in 2005, 9% of trees died, and surviving trees had negative growth rates for one year. Liana density and basal area were reduced to half of their original values. Proportional liana biomass in relation to tree biomass was highest at return intervals of 6 – 10 years. Return intervals of hurricanes above or below these values apparently would not change the proportion of liana and tree biomass considerably.

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Session 05: Changes in liana abundance in tropical forests - TalkT05-03

Land-use history and the origins of local liana species composition

E.I. Garrido-Pérez

Comparative liana anatomy shows that some lianas have “typical stems” with abundant, narrow and compact xylem vessels while others have wide vessels, more parenchyma and other live tissues (“anomalous growth”). Lianas re-sprout vigorously after cutting, but in slash-and-burn agriculture lianas are cut, resulting in embolisms, and burned, which kills tissues otherwise able to re-sprout. Other land uses only cut lianas, allowing them more chances to regenerate. Such land-use differences may explain why the typical-stem liana Dalbergia glabra (Papilionoideae) comprises 51.3% (SE=5.0, n=6 plots 20m x 20m) of all liana individuals in 10-18y-old abandoned milpas. Its compact wood and thick bark make it relatively fire-resistant. Meanwhile, the sum of anomalous-growth lianas Arrabidaea, Cydista, Melloa (Bignoniaceae) and Serjania (Sapindaceae) comprises 83.4% (SE=2.7, n=6 plots) of all liana individuals in a ≥55y-old stand used for selective logging, latex extraction from Manilkara zapota, liana-cutting for basketry and other “no-fire” land uses in North-eastern Yucatán Peninsula, México. Such “accidental experiments” made by farmers, as well as “scientifically planned” ones, can determine the origins and dynamics of current liana populations and communities, facilitating management decisions in a world of increasing liana abundance.

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Session 05: Changes in liana abundance in tropical forests - TalkT05-04

Density and growth of liana regeneration in secondary and primary forests of Central Amazonia, Brazil

Roeder M., Hölscher D., Ferraz I D K.

Density and growth of liana saplings and established lianas were studied in primary and two secondary forest types near Manaus, Brazil. Secondary forests plots were divided in two categories according to previous land use: after burning and usage as pasture, Vismia dominated the secondary forest, whereas after clear-cuts and absence of intensive fires, Cecropia-dominated secondary forests developed. Eight to ten plots were studied per forest type. Liana sapling density in the primary forest was twice as high as in each type of secondary forest. Lianas made up on average 11% of total woody regeneration, and this portion did not differ among forest types. Relative growth rate of saplings was highest in Vismia secondary forest. Tall, canopy-ascending lianas of small diameter (0.5-5 cm) were most abundant in Cecropia forest. We assume that sapling abundance was controlled by seed rain and vegetative sources, which are most abundant in the primary forest. The high density of thin established lianas in the Cecropia secondary forest was most likely from resprouting. Our results suggest that liana regeneration dynamics differ not only between primary and secondary forests but also within secondary forests of different land use history.

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Session 05: Changes in liana abundance in tropical forests - TalkT05-05

Lianas and free-standing plants during forest succession in northeastern Costa Rica

S.G. Letcher

Secondary forests in northeastern Costa Rica recover rapidly in terms of biomass, species richness, and species composition, but lianas and free-standing woody plants respond differently during succession. Total aboveground biomass of all woody species reaches old-growth levels in as little as 15-20 yrs, species richness recovers in 30-44 yrs, and species composition in secondary forests converges with old-growth forest over time. Tree biomass shows a hump-shaped relationship with forest age, with the highest values in forests 30-44 yrs of age, while liana biomass shows a monotonic increase during succession. Depending on the method of assessment, liana species richness shows no change or a slight decline with forest age. The increase in species richness during succession is driven by tree species. Liana species composition does show concerted changes during succession, though, and the changes in the liana species composition are strongly related to changes in the tree community. I discuss the advantages and constraints of the liana growth form, and how plant architecture leads to the differences between tree and liana responses to successional change.

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Session 05: Changes in liana abundance in tropical forests - TalkT05-06

Phylogeny, distribution and abundance of a clade of Neotropical lianas (Bignonieae, Bignoniaceae)

L.G. Lohmann

Bignonieae is a conspicuous component of the neotropical flora. This large (376 spp.) angiosperm clade contains more species of lianas than any other neotropical clade. Representatives of Bignonieae are abundant in many of the major ecological zones in the neotropics and exhibit considerable diversity in morphological features. The ecological importance of Bignonieae, combined with its broad distribution and morphological diversity make this an excellent model for investigating patterns of distribution and abundance in the Neotropics. Here, I use broad-scale molecular phylogeny to evaluate geographic distribution and species abundance, exploring biodiversity at differing geographical scales and possible evolutionary explanations for current patterns. The phylogenetic framework provides important historical insights into the development of current distribution and abundance patterns. For instance, although the group is currently most diverse in Amazonia, it seems most likely that Bignonieae arose in the coastal forests of eastern Brazil and that there have since been multiple, independent transitions between ecological zones; these independent events are temporally asynchronous. Similarly, species abundance is, in some cases, correlated with specific habitat types. These insights suggest that considerable evolutionary complexity underlies contemporary patterns.

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Session 05: Changes in liana abundance in tropical forests - TalkT05-07

The liana community of an eastern Congo basin forest

C.E.N. Ewango, F. Bongers, J-R. Makana, M. Sosef & L. Poorter

We examined diversity and distribution of lianas in two 10-ha mixed forest plots located in the Ituri rainforest, Eastern DR Congo, using complete censuses of individuals with stem diameter ≥ 2 cm. We asked whether liana composition, diversity, abundance and distributions relate to habitat, topography and canopy openness. Topography (slope) and canopy openness were measured in three classes, habitat was classified as terra firme or swamp/streamside. In 20 ha we found 190 liana species and 17620 individuals. We found that all three factors affected the liana community. Closed-canopy forest had clearly more liana individuals and higher diversity than open forest. Swamp forest had fewer liana species and lower liana abundance than terra firme. Several species had preference for specific habitats and environments. We compare these findings with those of other liana communities.

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Session 05: Changes in liana abundance in tropical forests - TalkT05-08

Lianas of the Upper Amazon: Comparison of climber communities from Los Amigos, Peru and Yasuní, Ecuador

R. J. Burnham

Yasuní, Ecuador has one of the highest species diversities in lianas reported, and yet there are few species-level characterizations of liana communities across large areas of Amazonian forest. This study evaluated two half-hectare plots from the Peruvian Amazonian at Los Amigos Biological Station (CICRA) in Peru and compared those forests to 10 one-hectare plots studied earlier in Amazonian Ecuador. Species diversity is comparable, although lower by about 10-20% in Peru. Species densities of the most common species in Peru differ from the dominants in Yasuní, Ecuador. Even though the two forests are separated by 1500 km, many species are shared across the expanse of upper Amazonian forests. Two questions are raised: What is the geographic extent of dominant Amazonian liana species? and Are the dominant species distributions predictable using species-level characteristics, geological age, or dispersal characteristics? A summary of the present knowledge of dominant lianas across Amazonia is presented.

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Session 05: Changes in liana abundance in tropical forests - TalkT05-09

What determines liana success in Neotropical forests?

G.M.F. van der Heijden & O.L. Phillips

Woody climbers (lianas) are an important and characteristic structural component of tropical forests. The recently reported increases in liana dominance, the possible causes, and the implications for tropical forests, underline the need to determine what controls liana success in order to improve our ability to predict the impacts of climate change on tropical forests as a whole. Using 65 standardized samples of lianas (≥2.5 cm diameter) from across the Neotropics, both characteristics of the environment and the forest are accounted for in explaining macro-ecological variation in liana success in Neotropical forests. Both liana density and basal area were unrelated to climate or soil variables, except for a weak effect of mean annual precipitation on liana basal area. Structural characteristics of the forest explained more of the variation in liana density and basal area than the physical environment. The availability of host trees and their characteristics may be more important than the direct effects of the physical environment in controlling the success of lianas in Neotropical forests. Changes to the tropical climate in the coming century may not strongly affect lianas directly, but could have very substantial indirect effects via changes in tree community structure and dynamics.

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Session 05: Changes in liana abundance in tropical forests - TalkT05-10

Liana infestation and its consequences: evidence from African forests

F. Bongers, C.E.N. Ewango & M.P.E. Parren

Lianas (woody climbing plants) are claimed to be increasing in importance (abundance, basal area) compared to trees. As lianas need trees to grow up in the forest an increase in liana infestation is expected. This study analyses tree infestation by lianas, major factors that determine the level of infestation, and the consequences thereof in terms of tree development. Data are used from a series of studies in West African forests, notably in Côte d'Ivoire, Ghana, Cameroon and DR Congo. Liana infestation of trees increases with tree size and is only partly species-dependent. The number of lianas on individual trees varies from zero to over 50. Infestation rates vary among forests. Repeated measurements show that liana abundance has increased over the last 15 years. Logging positively affects liana infestation, both as a result of multiple sprouting stems, and as a result of increased light availability and thus prolific liana development. Tree growth is strongly affected by lianas, and for seedling and saplings it is shown that belowground interactions play a stronger role than aboveground ones. For larger trees such data are not available yet. Liana cutting on large trees results in increased tree growth, probably as a result of increased light levels on the trees. Consequences are discussed in the context of forest degradation and climate change.

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Session 05: Changes in liana abundance in tropical forests - PosterP05-01

The structure of liana-tree interaction is not random: evidence of nestedness in three distinct vegetation formations

J. C. Sfair, A. L. C. Rochelle, A. A. Rezende, J. van Melis, V. L. Weiser & F. R. Martins

A recent paper concluded that the network structure of interaction between lianas and host trees (phorophytes) is random. We used the network approach to understand whether liana-phorophyte association has a compartmented, checkerboard, random or nested structure. We sampled three different vegetations: a tropical wet forest, a tropical seasonally dry forest and a woodland savanna, all in Southeastern Brazil. After constructing the networks of liana-phorophyte interactions, we used Correspondence Analysis to check for compartments and the c-score index to test for checkerboard matrix structure. We did not find compartments in all three networks. However, the c-score values indicated a positive co-occurrence, thus implying a facilitation process among lianas species. We also calculated three nestedness metrics: NT, a corrected metric from NT, and NODF. All three indices confirmed a strong nestedness in liana-phorophyte network structure. Nestedness may be explained by the phorophyte characteristics and sequential colonization of trees by lianas. The nested structure of liana-phorophyte network we found is quite different from the random structure found by other authors in a recent paper. We propose that, according to different variables related to site and liana-phorophyte characteristics, the structure of the network may be nested or random.

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Session 05: Changes in liana abundance in tropical forests - PosterP05-02

Liana seedling growth strategy and its influences on liana species distribution and abundance

E. Manzane

Lianas are an important component of tropical forests. Liana seedlings can use two different strategies to grow: either start climbing almost immediately after germination (climber seedling), or grow like a shrub and remain in that stage for long period of time (free-standing seedling). Liana species that grow as climber seedlings usually grow faster and need a small stem diameter as a trellis, while free-standing seedlings can support themselves for a period of time. Climber seedlings can be more common in gaps, because they can grow faster and there is more support availability. Liana seedlings with this habit act like pioneer trees. Free-standing seedlings cannot compete with climber seedlings in gaps, but because they have a slow growth rate and can stay as shrubs for a long period of time, this group can thrive in the understory, thus behaving like an understory tree. At a local level we found more free-standing seedlings in the understory and more climbers in gaps. In a wider context, we expect to find more free-standing seedlings in forests with the high, closed canopy typical of wet forest, and more climber seedlings in forests with the low, open canopy typical of dry forest.

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Session 05: Changes in liana abundance in tropical forests - PosterP05-03

Variation in liana abundance and biomass along an elevational gradient of tropical moist forest (Brazil)

L.F. Alves, M.A. Assis, J. van Melis, A.L.S. Barros & S.A. Vieira

Lianas are structurally important in most tropical forests, representing a small but important component of total aboveground biomass. On large spatial scales, the abundance and mass of lianas may be driven by the environmental factors related to water availability and soil nutrients, but at local scale lianas have been shown to increase in dominance in response to canopy disturbance and support availability. To understand general patterns of liana abundance and biomass along an elevational gradient (0-1,100m a.s.l.) of Atlantic Forest in Brazil, we carried out a standard census protocol for woody lianas ≥1 cm in five 1-ha plots across different forest types: coastal, lowland, submontane, and montane forests. On average, we found a two-fold variation in abundance and biomass between lowland forests and other forest types. Large lianas (≥ 10 cm) accounted for 26-30% of total biomass at lower elevation (< 400m), but large lianas were not recorded in montane forests. Differences found among lowland and montane forests might be related to high canopy openness in lowland forests, and a more recent colonization in montane forests. Therefore, canopy disturbance and time since colonization may play an important role in the organization of liana communities in the Atlantic Forest.

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Session 05: Changes in liana abundance in tropical forests – PosterP05-04

Lianas versus trees : analysing liana abundance in an Australian tropical rainforest nine years after hurricane disturbance

P. Hietz, U. Hietz-Seifert, M. Liddell

Lianas are main competitors for trees and disturbance is known to favour the growth of lianas. Quantifying the abundance of liana stems is difficult, but competition for light takes place at the top of the canopy, where liana cover has never been quantified for an entire forest. We studied liana cover at the location of the Australian canopy crane in Cape Tribulation, NE Queensland, where the forest was hit by a cyclone in 1999 and has since been recovering. Photos of the canopy covering most of the 1-ha plot and detailled enough to identify many liana and tree species were taken from the canopy crane and the proportion covered by different lianas and tree species was evaluated with image analysis. This allows us not only to quantify the abundance of lianas at the top of the canopy, but also to analyse the pattern of their distribution and how different trees are affected.

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Session 06: Context-specific consequences of animal seed dispersal: the importance of considering gradients - TalkT06-01

Size-dependence of seed dispersal by a scatter-hoarding rodent

P.A. Jansen, F.J. Sterck, L. Hemerik & F. Bongers

Plant species dispersed by scatter-hoarding animals tend to have much larger seeds than species with other dispersal modes. This may be adaptation to scatter-hoarders' preference for storing and hence dispersing larger, more nutritious seeds, yet preference tests so far have produced variable results. We reasoned that the response of scatter-hoarding animals to seed size should be non-linear: animals prefer larger seeds but cannot handle ever-larger seeds because of physical limitations. We studied size-discrimination by the Red acouchy (Myoprocta exilis) in a French Guianan rain forest. We established stations with tagged Carapa surinamensis seeds that widely ranged in seed mass, video-recorded which seeds were removed, retrieved removed seeds, and recorded seed fate and dispersal distance. We fitted a hierarchical set of models to determine whether relationships showed the predicted optimum. The probability of seed removal increased with seed mass, and the probability of scatter-hoarding and the dispersal distance showed an optimum, as predicted. When we compared animal body mass and preferred seed size in published studies of scatter-hoarding and found that the seemingly variable results reflect two-way size discrimination. Our study indicates that selection for dispersal by scatter-hoarding animals can act against small seeds, large seeds, or both extremes, depending on the size of the scatter-hoarder.

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Session 06: Context-specific consequences of animal seed dispersal: the importance of considering gradients - TalkT06-02

Tapirs are effective long distance seed dispersers: a reciprocal transplant experiment in a precipitation gradient in Mexico

G.X.O'Farrill, A. Gonzalez and C. Chapman

The Baird's tapir (Tapirus bairdii) is the largest neotropical terrestrial mammal and as such may have significant consequences for plant fitness in heterogeneous landscapes through their seed dispersal activities. We studied the effect of bidirectional seed movement by tapirs around the Calakmul Biosphere Reserve (Yucatan, Mexico) where there is a clear northwest- southeast precipitation gradient. We carried out a zapote (Manilkara zapota) seed and seedling reciprocal transplant experiment between two sites located 15km from each other within this humidity gradient. Out of 626 zapote seeds 57.12% germinated. We found a significant home-site advantage ($X^2=6.91$, $p=0.008$) for seeds originated from the humid site resulting in a 16% decline in germination success when planted in the dry site (69% vs. 53%). However, seeds from the dry site showed a slight, non-significant, increase in germination success when planted in the humid site (59% vs. 61%). Only 11.5% of the transplanted seedlings survived which precluded further analysis. These results confirm that tapir movement can have important effects on seed germination at a landscape scale. Combined with previous results they indicate that tapir may function as mobile link species within this heterogeneous landscape.

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Session 06: Context-specific consequences of animal seed dispersal: the importance of considering gradients - TalkT06-03

Bird diversity and seed dispersal of the native tree species Celtis africana along a disturbance gradient in coastal scarp forest in South Africa

E.L. Neuschulz, A. Botzat & N. Farwig

Fragmentation and disturbance are major threats to forest ecosystems modifying species diversity and ecological processes. We assessed the overall bird diversity and seed dispersal by counting fruit removal of the native tree species Celtis africana in differently disturbed costal scarp forests in KwaZulu-Natal, South Africa. Levels of disturbance ranged from 1) large protected forests, 2) natural and undisturbed forest fragments to 3) isolated forest islands in agricultural matrix, 4) game reserves and 5) gardens to 6) timber plantations.
Overall bird diversity varied significantly along the disturbance gradient with highest bird species numbers in intermediate disturbed sites. However, forest specialists declined along the disturbance gradient (26% in the undisturbed forest to 2% in plantations). High species numbers in intermediate disturbed sites comprised forest birds as well as shrubland and open-country species. Numbers of frugivorous and insectivorous birds showed no clear pattern along the disturbance gradient but numbers of granivorous birds increased with higher disturbance level. However, by investigating seed dispersal of Celtis africana we detected that fruit removal by frugivorous birds was higher in intermediate disturbed sites than in undisturbed forests or plantations. Consequently, recruitment of animal dispersed tree species in disturbed areas may benefit from the mobility of birds and at the same time isolated forest patches represent important food sources.

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Session 06: Context-specific consequences of animal seed dispersal: the importance of considering gradients - TalkT06-04

Seed size selection by a primate seed disperser and potential effects on post-dispersal seed fate

B.K. Kunz, K.E. Linsenmair

Seed size is an important plant fitness trait that can influence several steps between fruiting and the establishment of a plant's offspring. Despite considerable variation in seed size within many plant species, the relevance of the trait for fruit choice by primates has received little attention. We tested whether seed size affects intra-specific fruit choice by olive baboons (Papio anubis) in each of ten plant species the pulp of which is commonly eaten and intact seeds dispersed by baboons at Comoé National Park, Ivory Coast.Baboons were seed-size selective in nine of the species, dispersing smaller seeds than available in six species, but larger ones in three species. In Drypetes floribunda (Euphorbiaceae) the baboons performed two different modes of dispersal according to the size of the seeds: they swallowed the smallest seeds and dispersed them (over larger distances) in their faeces, and spat out the largest seeds (over shorter distances).We discuss the effects of fruit type, pulp-to-seed ratio and fruit availability upon fruit choice in baboons and argue how intra-specific seed size selection by a primate seed disperser may affect post-dispersal fate of seeds.

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Session 06: Context-specific consequences of animal seed dispersal: the importance of considering gradients - TalkT06-05

From tamarins to seedlings: seed survival and seedling recruitment in a gradient of forest disturbance

L. Culot, F.J.J. Muñoz Lazo, E.W. Heymann & M.-C. Huynen

Maintenance of forest structure and regeneration process highly depend on the seed dispersal by vertebrates. The efficiency of seed dispersers does not only result in the quantity of seeds dispersed but also in the quality of the dispersal determining the probability of a seed to become adult. Many post-dispersal events occur between seed dispersal stage and tree establishment and the gradient of responses can differ according the life history stage of the plant species. We evaluated the efficiency of two tamarins' species as seed dispersers in the Amazonian forest of Peru in terms of quantity and quality of dispersal. Specifically, we tested the effect of habitat disturbance (primary vs. secondary forest) and seed burial by dung beetles on seed predation rate, seed survival, seedling emergence and establishment. Seeds dispersed by tamarins were marked directly in faeces and checked once a month between May 2004 and May 2008. This is the first attempt to evaluate the long-term impact of seed dispersal by small primate species. The capacity of tamarins to use young secondary forest, the high diversity of species they dispersed, the scattered distribution and low density of seeds in their faeces suggest that tamarins might be efficient seed dispersers.

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Session 06: Context-specific consequences of animal seed dispersal: the importance of considering gradients - TalkT06-06

Matrix and edge effects on ecological processes in tropical forest

B.A. Kaplin, Y.P. Gakunde, P. Gatete & R.M. Martino

Recent studies indicate that edge effects on forest are reduced when surrounding landscape (matrix) structure is similar to adjacent forest. We explored the relationship between matrix type and edge effect on two determinants of seed dispersion pattern, tree distribution and phenology, in a tropical montane forest. We sampled three matrix types surrounding Nyungwe National Park, Rwanda. Matrix types represented a gradient from low to high contrast with forest: tea, banana, and pine plantation. To examine matrix and edge effects on tree distributions we placed transects perpendicular from edge 500m into the forest interior. We found secondary tree species more abundant along the tea matrix than the pine. Edge effects were detected for both matrix types: overall tree DBH was smaller at the edge and increased towards the forest interior. Lianas were more abundant at the edge, and overall more abundant along tea matrix. We also sampled matrix and edge effects on fruiting for two matrix types, banana and pine plantation. For the species we studied, we found more fruits at the pine than banana matrix. Edge effects on fruiting penetrated further at the banana matrix. Our findings have implications for seed dispersal processes and the maintenance of biodiversity in protected areas.

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Session 06: Context-specific consequences of animal seed dispersal: the importance of considering gradients - TalkT06-07

Plant – Animal – InteractionParkia and Saguinus as a model system for seed dispersal

K. Luettmann, R. Bialozyt, B. Ziegenhagen, E.W. Heymann

In an interdisciplinary project (primate ecology – plant genetics – conservation biology), the role of the two sympatric New World monkeys, the tamarins Saguinus mystax and Saguinus fuscicollis, as seed dispersal agents for the plant species Parkia panurensis, one of their most important food resources, is examined. In a field study in Peruvian Amazonia, the dispersal pattern produced by the spatial behaviour of the tamarins, as well as the spatial structure of the Parkia population are determined. Additionally, the spatial-genetic structure of the Parkia population on different levels (adult trees, saplings and seedlings) and of the seed shadow are examined through DNA-fingerprinting. Through this study we want to contribute to the understanding of plant–animal–interactions within a tropical ecosystem, and we also expect results that are relevant for conservation biology. In particular, we want to obtain evidence on the genetic consequences of primate seed dispersal for a given plant population.

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Session 06: Context-specific consequences of animal seed dispersal: the importance of considering gradients - TalkT06-08

EFFECT OF HUMAN DISTURBANCE ON SEED AND SEEDLING DISTRIBUTION PATTERNS OF THE ANDEAN OAK (Quercus humboldtii Bonpl.)

S.A. Guerrero, E.A. Paz & A. Parrado

Animals affect the spatial occupation patterns of tropical forest plants throughout the seed dispersal they perform. Therefore, decrease in vertebrate populations by human disturbance might affect regeneration dynamics of plant species. We studied the differences in the spatial distribution patterns of seeds and seedlings of the Andean oak (Quercus humboldtii) between two forests with different densities of seed dispersers as a consequence of anthropogenic influence. Density and spatial distribution of seedlings were evaluated in 490 and 484 1 m2 plots located in a 28 ha area, in a high and a low disturbed site, respectively. Density and spatial distribution of seeds were evaluated in 0.25m2 subplots placed in the same plots described above. Results show a higher number of seedlings, higher density and an aggregated pattern in the most disturbed site, as well as a marked decrease in seedling density as age increases. Although seed predation is similar in both sites, predation by invertebrates becomes more important in the most disturbed site. It seems that human disturbance results in a higher density and aggregation due to a reduction of vertebrate seed dispersers, seed predators and herbivores. Considering that the Andean oak usually occurs in groves, it is discussed whether or not the aggregated pattern resulting from a limited seed dispersal compromises the regeneration process of the species. Additionally, in order to maintain plant populations in the long term, presence and viable populations of seed dispersers should be also maintained.

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Session 06: Context-specific consequences of animal seed dispersal: the importance of considering gradients - TalkT06-09

Simulation of seed dispersal by two neotropical tamarin species

S. Flinkerbusch, E. Heymann, M. Niggemann & R. Bialozyt

The spatial pattern of endozoochorous seed dispersal depends strongly on the movement patterns of the disperser and the gut transit times. In this study, we developed an individual-based simulation model for the seed dispersal of the tropical tree Parkia panurensis by two primate species (Saguinus mystax & Saguinus fuscicollis), based on data collected at the Estación Biológica Quebrada Blanco in north-eastern Peruvian Amazonia. Within the study region there exist a gradient from primary to secondary forests. Understanding and modelling the movements of seed dispersers will also help to analyse the effects of seed dispersal over short and long distances.

First, we identified factors determining the movement patterns of the tamarins. We assumed that the need for food and energy is the driving force for movement. The final movement pattern is mainly an interplay between directional travelling towards fruit trees, semi-directional searching for prey, and stationary resting phases. A sensitivity analysis on several parameters of our simulation model revealed the following parameters to be most important to produce the daily movement pattern: the amount and position of sleeping and feeding trees, the energy gained from the selected food-type, and energy loss caused by their travelling activities.

Simulated and field data converge at very similar target values for daily path length and home-range size. We conclude that our model simulates the movement patterns of tamarins adequately.

Finally, we implemented gut-transit times of Parkia-seeds and factored a specific defecation habits of the tamarins. This allowed us to examine how the Parkia seed shadow is affected by the movement patterns of the tamarins.

The seed shadow of individual fruiting trees are patchy. The clumping of these dispersal events might be explained by the location of resting sites.

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Session 06: Context-specific consequences of animal seed dispersal: the importance of considering gradients - TalkT06-10

Seed dispersal modes of woody species of young secondary forest compared to old-growth fragments in the Atlantic Forest of NE Brazil – where might succession lead to?

T. M. Kimmel, L. M. Nascimento, D. Piechowski, E. V. S. B. Sampaio, M. J. Nogueira Rodal, G. Gottsberger

We studied the seed dispersal modes of woody species of two 12-year-old secondary forest patches, beforehand used for sugarcane cultivation. Sixty plots were installed with a total area of 0.6 ha. A total of 61 woody species were encountered. Although the study sites were isolated from old-growth forests by sugarcane matrix, the array of dispersal modes was the same as in old-growth forest fragments and the percentage of vertebrate-dispersed species was similar (83.6%). The percentage of large-seeded species was even larger than expected (18%), despite the local extinction of large-bodied mammals and birds. However, in well-preserved forests the percentage is about two times as high. Conspicuous is also that individuals belonging to species with typical ant-dispersed seeds are ten-times less abundant at regenerating sites. Besides the dispersal of large seeds mainly by rodents and bats, more than half of the large-seeded species are consumed by humans and may have reached the study sites this way. The results indicate that on the one hand, dispersal works better than previously thought, but on the other hand, that succession is hindered by extreme disturbance and a degraded environment and will lead to an anthropogenic disclimax.

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Session 07: Tropical Fungi & Mykorrhiza - TalkT07-01

Seasonal microbial community composition in soil aggregate fractions from three land uses of the tropical dry ecosystem in Chamela, Jalisco, Mexico.

M. E. Gavito, A. Jiménez-Martínez, A.L. Sandoval-Pérez, F. García-Oliva & J. Larsen.

We investigated microbial community composition in aggregate fractions in soils from 1) tropical dry forest primary vegetation, 2) secondary vegetation derived from slash-and-burn conversion, short pasture use and over 25 years natural regeneration and 3) pastures originated by slash-and-burn conversion that had been under continuous use for over 25 years, in the Chamela region of the Pacific Coast of Mexico. Fatty acid biomarkers were used to quantify the abundance of some microbial groups (Gram+ and Gram- bacteria, actinomycetes, mycorrhizal fungi, saprotrophic fungi) and some microbial ratios such as fungi/bacteria. Sampling date, land use and aggregate fraction effects were tested with ANOVA. There was higher total microbial abundance in the dry season than in the rainy season and in the macroaggregate fraction than in the microaggregate fraction. The only significant date x land use x aggregate fraction interactions were observed for saprotrophic fungi and fungi/bacteria ratio. Altogether the results suggest that bacterial and fungal abundance are influenced by different factors: land use affects bacteria and date and aggregate fraction affect fungi, especially saprotrophic fungi. We conclude that, contrary to what we expected, saprotrophic fungi seem to be more responsive than mycorrhizal fungi and bacteria to seasonality and land management in this tropical dry ecosystem.

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Session 07: Tropical Fungi & Mykorrhiza - TalkT07-02

Species-rich but distinct arbuscular mycorrhizal communities in reforestation plots on degraded pastures and in neighboring pristine tropical mountain rain forest

Ingeborg Haug, Tesfaye Wubet, Michael Weiß, Nikolay Aguirre, Michael Weber, Sven Günter, Ingrid Kottke

Native tropical trees in a mountain rain forest were found associated with large numbers of different arbuscular mycorrhizal fungi previously, while, according to published data, degraded pastures were expected to harbor only a restricted number of potentially wide spread species. It was questionable therefore if seedlings of native tropical tree species planted for reforestation on degraded pastures in tropical mountain rainforest area would trap and associate with appropriate mycobionts. To obtain first insights, the arbuscular mycorrhizal fungal community in such reforestation plots was investigated from planted seedlings of four native tree species. A segment of fungal 18S rDNA was sequenced from the mycorrhizas. Sequences were compared with those obtained from mycorrhizas of adult trees of 30 species in the neighboring, pristine tropical mountain rain forest. On total, 193 glomeromycotan sequences were analyzed, 130 previously unpublished. Members of Glomeraceae, Acaulosporaceae, Gigasporaceae and Archaeosporales were found in both habitats. Glomus Group A sequences were by far the most diverse and abundant in both habitats. Glomus Group A phylotype richness did not appear to differ between the habitats; a large number was observed in both. Glomus Group A phylotype composition, however, was found distinctly different as revealed by Ward cluster analysis on presence-absence data. Seedlings were rarely colonized by fungi of the pristine forest but trapped a number of fungi known from other areas, which were rarely found in the pristine forest.

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Session 07: Tropical Fungi & Mykorrhiza - TalkT07-03

Defining biologically meaningful molecular operational taxonomic units

M. Göker

A reliable taxonomy is crucial for the assessment of biodiversity and for the comparison of habitats based on their species composition. Determining taxon boundaries is challenging in the case of organisms for which often only molecular data are available, such as bacteria, fungi, and many unicellular eukaryotes. Even in the case of organisms with well-established microscopical characteristics, molecular taxonomy is necessary to determine misidentified and mislabelled GenBank sequences, to identify incompletely known specimens and cryptic species, and last but not least to analyse sequences directly sampled from the environment as in metagenomics studies.
We here introduce a simple yet effective and flexible clustering optimization method that addresses all these issues. Using biologically sensible reference partitions, our method automatically distinguishes between within-taxon and between-taxon sequence heterogeneity in the course of identifying optimal clustering settings. Usage examples for clustering optimization with alternative types of biological data are provided, including approaches for calculating the degree of uncertainty in estimating the optimal parameters. The novel algorithm is discussed as a tool for the automated self-correction of GenBank data and as general method for molecular taxonomy that results in taxonomic units which optimally account for both traditional species concepts and genetic divergence.

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Session 07: Tropical Fungi & Mykorrhiza - TalkT07-04

Inocybaceae ectomycorrhizal fungi associated with the endemic Pakaraimaea dipterocarpacea in Guayana, Venezuela: ecological importance and relationship with Africa.

B. Moyersoen, C. Rondon and T.Iturriaga

The neotropical endemic P. dipterocarpacea is phylogenetically related with the most important EcM tropical tree family in SE Asia: the Dipterocarpaceae. The recent discovery of P. dipterocarpacea EcM status suggests that EcM evolved in the ancestors of Dipterocarpaceae before the splitting of S America from Gondwana, 130 Ma. Whether P. dipterocarpacea vicariant distribution is also reflected below ground in EcM fungal associates is not known. To describe P. dipterocarpaceae EcM fungal diversity and to test whether there is a specific EcM fungal flora associated with this endemic, EcM fungi were surveyed in a 400 m2 plot, close to a gold mining area, where P. dipterocarpacea co-occurs with the EcM tree Aldina, Papilionoïdeae. Amongst the 38 species belonging to 13 fungal groups, 2 species of Inocybe s. str. were particularly frequent and one of them was shared with Aldina. A phylogeographic analysis further demonstrated the close relationship of P. dipterocarpacea Inocybaceae with another legume tribe (Caesalpiniaceae Amherstieae) in the same Guayana Region. This tropical Inocybaceae clade also included African strains therefore demonstrating a mycogeographic link between the two continents. The biogeographic implication of EcM fungi sharing between Neotropical Dipterocarpaceae and legumes together with the African link will be discussed.

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Session 07: Tropical Fungi & Mykorrhiza - TalkT07-05

How leaf cutting ants defend their fungus garden against the fungal pathogen Escovopsis

S. Haeder, R. Wirth, H. Herz, and D. Spiteller¶

Many leaf-cutting ants cultivate a symbiotic fungus (Leucoagaricus) in their nests which serves them as major food source. The ants supply this fungus with pre-processed leaf material and weed their fungus garden to avoid infections. Still, the specialised pathogenic fungus Escovopsis can overcome Leucoagaricus and thus threaten the survival of the ant colony.1 Besides waste removal the ants use chemical treatment against pathogens. Indeed symbiotic microorganisms contribute to the ants' defence against Escovopsis.2 Until recently, not a single antifungal compound from the microorganisms was known. From three Acromyrmex species, we isolated 19 microbial symbionts (Pseudo¬nocardia, Derma¬coccus, and Streptomyces). Because Streptomyces sp. Ao10 was highly active against the pathogen Escovopsis, we selected this strain for bioassay-guided isolation and identified the highly active candicidin macrolides.3 At least one symbiont from each of the three leaf-cutting ant species analysed produced candicidins suggesting that it plays an important role against pathogenic fungi. 1C. R. Currie, U. G. Mueller, D. Malloch. Proc. Natl. Acad. Sci. U. S. A. 1999, 96, 7998-8002. 2C. R. Currie, J. A. Scott, R. C. Summerbell, D. Malloch. Nature 1999, 398, 701-704. 3S. Haeder, R. Wirth, H. Herz, D. Spiteller. Proc. Natl. Acad. Sci. U. S. A. 2009, 106, 4742-4746.

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Session 07: Tropical Fungi & Mykorrhiza - PosterP07-01

Yeasts from Environments in Kupang, West Timor, Indonesia

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Kupang is located in the western part of Timor Island (Nusa Tenggara Timur) and has a unique habitat where it is dominated by savanna and very dry forest. Kupang is an excellent place for studying yeast diversity because no report has been documented before. Yeasts were isolated from soil (20), litter (20), insects (11) (termites), and epiphytic soil (2) samples. The samples were collected from several sites in Kupang in August 2005. We selected 131 representative yeasts isolates from a total of 225 for molecular identification. The internal transcribed spacers (ITS regions) and D1/D2 region of nuclear large subunit ribosomal DNA (LSU rDNA) was amplified and sequenced. Identification based on ITS-D1/D2 of LSU rDNA sequence showed that those 131 isolates consist of 11 genera, five genera belong to the phylum Ascomycota (e.g., Aureobasidium, Candida, Dothichiza, Kodamaea, and Pichia) and six genera belong to the phylum of Basidiomycota (e.g., Cryptococcus, Cystofilobasidium, Rhodosporidium, Rhodotorula, and Sporidiobolus, Sporobolomyces). We found new taxa which phylogenetically closely related to the genus Cystofilobasidium. This genus has never been reported in Indonesia. Kupang (West Timor) which has semi-arid climate covered by savanna and very dry forest harbors a unique diversity of yeasts and yeast-like fungi.

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Session 07: Tropical Fungi & Mykorrhiza - PosterP07-02

The Wild Honey Bee Apis cerana Fabr. and its associated yeasts from flower of Jatropha integerrima Jacq.

A. Basukriadi, W. Sjamsuridzal and B. B. Putra

The wild honey bee, Apis cerana Fabr., is one of the most important visitors of Jatropha integerrima Jacq. The yeast community associated with Apis cerana was studied. Yeasts were obtained from 15 individual adult bees collecting pollen and nectar of the flower of Jatropha integerrima in University of Indonesia, Depok, Indonesia . Yeasts were isolated from the gut of bees and characterized by their internal transcribed spacers (ITS) regions of ribosomal DNA sequences. Molecular identification result based on ITS regions sequence data showed that yeasts found in the gut of Apis cerana were Aureobasidium sp., Dothioraceae sp., Candida cf. apicola, Candida cf. azyma, Candida sp., Cryptococcus sp., Hanseniaspora sp., Metschnikowia sp., Kodamaea ohmeri, and Yarrowia lipolytica. Undescribed yeasts were discovered in this study, they are belonging to the genera of Candida, Cryptococcus, and Metschnikowia. Some of the yeasts species isolated from adult bees were typical of species known to occur in flowers and bees, suggesting that interaction exists between them. Interestingly, we found yeast Kodamaea ohmeri which is involved in a bee-beetle-yeast-pollen multitrophic interaction. The ITS regions of more yeast isolates will be sequenced to elucidate the yeasts community in Apis cerana, especially in the pollen collecting and nectar collecting bees.

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Session 07: Tropical Fungi & Mykorrhiza - PosterP07-03

Isolation of dominant microorganisms involved in Balinese Arrack Natural Fermentation and Optimization of Controlled Fermentation using Zygosaccharomyces rouxii

D.I Astuti and A. Pratama

Balinese Arrack is an alcoholic beverages from the fermentation of white glutinous rice that very well known in Bali, Indonesia. The process is carried out by 2 fermentation stage, the first stage is 5 days incubation that involved of gelatinization and liquefaction of white glutinous rice and the second stage is 15 days alcoholic fermentation prior to distillation. From the microbial isolation of natural fermentation of Balinese Arrack, it was known that on the first and second stage fermentation there were 5 and 8 microbial isolates respectively. Zygosaccharomyces rouxii was a dominant microorganism in the whole process. Optimization of controlled Balinese Arrack fermentation using Z. rouxii was then conducted by sequential optimization of the amount of water for making a glutinous rice, inoculums concentration, and the addition of sugar concentration at the initial of 2nd fermentation. The results shows that the best fermentation was carried out by the addition of 100 mL water with 80 g glutinous rice (5:4) and 3% inoculums Z. rouxii, and the addition of 5% sugar concentration at the initial of 2nd fermentation process. However, organoleptic test revealed that the most preferred Balinese Arrack was resulted from the fermentation with the additional of 15% sugar concentration.

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Session 07: Tropical Fungi & Mykorrhiza - PosterP07-04

Sexual states of Tulasnellales in the tropical mountain forest: correlation between morphology and ITS-5.8S variability

D. Cruz, J. P. Suárez, I. Kottke, M. Goeker, M. Piepenbring.

The genus Tulasnella has been morphologically most studied in Europe, but this genus is wide-spread around the world. Recently investigation showed Tulasnellales as frequently associated to epiphytic orchids in the Reserva Biologica San Francisco (RBSF), South Ecuador. The taxonomy of Tulasnellales species is not consistent. Morphological information on 77 records of fruiting bodies is available but taxonomic clarification is needed. Molecular phylogenetic studies on ITS-5.8S sequences of Tulasnellales was used to correlate with teleomorph data of fruiting bodies. Resupinate fruiting bodies near to epiphytic orchids were collected from peaces of decayed wood in the tropical mountain rain forest of RBSF. Fruiting bodies were morphologically characterized and illustrated, using light microscopy. PCR amplification and sequencing of ITS-5.8S were performed using primers ITS1/ITS4Tul and molecular cloning was used for this PCR products. The sequences were aligned separately within subclades to phylogenetic calculations and these were compared with morphological results. We propose two different morpho-species defined by hyphae diameter, basidia and spore size and shape. Molecular analyzes of ITS-5.8S showed sequences of Tulasnellales in three clades A-B-C. The clade A and B appear near T. calospora sequences, and the clade C is clustering between T. asymmetrica and T. violea sequences. All clades found are close to sequences previously reported from mycorrhizal fungi of pleurothallid orchids in this region.

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Session 07: Tropical Fungi & Mykorrhiza - PosterP07-05

Three functionally different mycobiont groups, Glomeromycota, Rhizoscyphus ericae aggr. and Tulasnellales are associated with Graffenrieda emarginata (Melastomataceae) in the tropical mountain rain forest of Southern Ecuador

I. Kottke, J. Lempe, I. Haug

Graffenrieda emarginata (Melastomataceae) is the only frequent tree, partly site dominating on the mountain ridges at 2000 to 2200 m in the tropical mountain rain forest of Southern Ecuador. While all other tree species form mycorrhizas with Glomeromycota only, G. emarginata is simultaneously associated with members of Glomeromycota, Rhizoscyphus ericae aggr. (Ascomycota) and Tulasnellales (Basidiomycota). The latter two fungal groups are shared with ericads (Rhizoscyphus) or orchids (Tulasnella) in the same habitat but form superficial ectomycorrhizas with G. emarginata. Saprophytic capabilities may be presumed for these two fungal groups improving nutrient acquisition from humus soil fraction and thus promoting this slow growing tree species.

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Session 07: Tropical Fungi & Mykorrhiza - PosterP07-06

Tropical fungal endophytes and land use: finding the patterns and important differences between the dry tropics and the humid tropics in Mexico.

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It has been suggested that native forest conversion to monoculture cultivation opens the gate for endophyte unbalance and the spread of pathogens. Here we revise the results from two studies conducted in the Chamela, Jalisco region of the Pacific Coast (dry tropics) and the Los Tuxtlas, Veracruz region of the Gulf (humid tropics) of Mexico. We compared the richness of culturable endophytic fungi isolates from roots and leaf tissue (complemented whenever possible with molecular detection) collected from three plots established within each of the primary vegetation, secondary vegetation and pasture sites established in both regions. We considered endophytes all the fungi isolated from plant tissue, since we ignore if these organisms function as mutualists, neutrals or pathogens in part of or in their entire life cycles. Our results suggest that, as we expected, land use had a stronger effect on fungal richness in the humid than in the dry region. Fungal endophytes were highly diverse in all land uses in the dry Chamela region whereas in the humid Los Tuxtlas region there was higher endophyte diversity in primary vegetation than in pastures. We discuss the factors driving endophyte diversity in the highly changing land use scenarios common to most tropical regions.

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Session 07: Tropical Fungi & Mykorrhiza - PosterP07-07

Water repelling structures in tropical Marasmius species

Gerhard Kost, Christoph Ehlebracht & Karl-Heinz Rexer

Fruit body formation and sexual propagation is essential for the survival of agaric populations. In tropical rain forests, the basidiocarps of Marasmius spp. have evolved special morphological structures to protect the delicate hymenia. The morphology of the cortical layers of 17 tropical Marasmius species was investigated by lightmicroscopy and SEM. Seven types of hymenidermal pileipellis could be distinguished. The shape of the terminal cell in the pileipellis could be clavate, globose, irregularly swollen. Some of these are thickwalled. Their surface could be smooth, warty, diverticulate or covered with broom like spiny outgrowths.Some of these cap surfaces have the same characteristics as the water repelling leaves of Lotus plants. The cortical hyphae of the basidiocarps protect on one hand fruiting bodies against collapsing during dryness and on the other hand the hymenia against water coverage during rain and flood. Such morphological characters of cortical hyphae can be also found in several other basidiomycete genera in tropical regions. Therefore, it can be deduced that similar structures evolved convergently.

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Session 07: Tropical Fungi & Mykorrhiza - PosterP07-08

The diversity and distribution of species of Mycena section Calodontes (Agaricales)

Stefan Merkl, Gerhard Kost, Karl-Heinz Rexer

The members of the saprotrophic genus Mycena (Agaricales, Basidiomycota) are distributed world wide. The species of the section Calodontes are easy to be recognized to belong to this taxon. Mycena pura is the most common and widespread species in this section documented from the temperate zones to the tropics. Collections from sub tropical China (Yunnan), the Balkan region (Macedonia) and Central Europe were compared according to their morphology, anatomy, and the ITS sequences of the nrDNA. It could be shown, that the Chinese collections form a separate group within the section, according to the morphological as well as the molecular data. Three new species will be described. All specimen, which could be proofed to belong to M. pura originated from Europe. Within these the collections from Macedonia clustered together. The studies show that almost undiscovered biodiversity of the species of the section Calodontes can be expected in tropical and subtropical regions. The understanding of distributional patterns and phylogeographical relations will depend on the discovery of this unrevealed biodiversity.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - TalkT08-01

Silviculture in seasonally dry tropical forests

T.S. Fredericksen, B. Mostacedo, Marielos Peña-Claros

Because they have been disturbed by humans more than wetter tropical forests, there is an urgent need for conservation of remaining tropical dry forests and a great deal of research has also been directed towards their restoration. The development of cost-efficient silvicultural treatments will be critical to achieve sustained use of forest products from remaining natural dry forests, as well as for restoration efforts. Tropical dry forests present special problems for silviculturists because prolonged dry seasons reduce growth rates and can cause significant tree mortality, especially for seedlings. Coppice systems are particularly important in the regeneration of these forests. While reduced-impact logging is increasingly applied in tropical forests, post-harvest silvicultural treatments have not been integrated in the management of tropical forests, particularly in dry forests. Management in any form is often complex in areas where dry forests have been fragmented and used harvested for subsistence products, such as firewood, and are affected by the damaging effects of livestock grazing and wildfire.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - TalkT08-02

Effect of silvicultural treatments on the structure and dynamics of tropical moist forests - Examples from French Guiana and Central Africa

S. Gourlet-Fleury, L. Blanc, S. Guitet, Y. Yalibanda, S. Namkosserena, F. Baya, G. Vieilledent

Long-term experimental plots, specifically designed to quantify the effect of silvicultural treatments on the structure – tree size characteristics and floristic composition - and dynamics of tropical moist forests were settled in the early 80's in French Guiana and in the Central African Republic. More than 20 years after the implementation of logging and thinning operations, ie two-third of a current felling cycle in the tropics, we assessed and compared their impacts on various characteristics of the stands. We particularly focused on the floristic shift linked to the light increase produced by canopy openings, and on the relationships between the fate of species and their functional type. We used the results: (i) to discuss how "sustainable" were the logging rules used, from a double point of view: recovery of the commercial stock of trees, and preservation of the biodiversity; (ii) to discuss how far can additional-to-logging thinning operations help shorten felling cycles; (iii) to evidence the part played by the functional characteristics of the stands in their reaction to disturbance.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - TalkT08-03

Ecological basics for reforestation with native species in the Ecuadorian Andes

M.W. Weber, B. Stimm, S. Günter

For selected species in the montane rain forest region of the South Ecuadorian Andes we investigated basic silvicultural knowledge for different steps of reforestation activities starting from seed collection up to the establishment of plantations. First the phenology of selected tree species was investigated. The observations revealed seasonal and spatial variations that can be explained by precipitation, radiation and photoperiod. Second we analysed seed characteristics as a basis for adequate seed germination and seedling production. Optimisation of procedures in the nursery resulted in significant improvement of seedling production. In a last step the establishment of seedlings planted on experimental sites with different conditions, ranging from recently abandoned pastures to advanced succession after abandonment and underplanting of exotic pine, was tested. Dominant factors influencing the early performance of seedlings were soil characteristics and successional stage of the site in combination with successional status of the species. The results show that successful reforestation of abandoned land with native species requires consideration of environmental factors at the planting sites, information about the aut- and synecological characteristics of the tree species as well as a combination of both.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - TalkT08-04

Silvicultural treatments in neotropical montane forests- growth reactions and economical evaluation

S. Guenter, T. Knoke, R. Mosandl

Deforestation and conversion into pastures for cattle raising is one of the major threats for neotropical montane forests. Additionally to reforestation, an alternative strategy for avoiding deforestation, could be ecologically and economically sustainable management of natural forests. Previous studies showed that in the study area in Southern Ecuador cutting intensities of 32 individuals per hectare corresponding to 10 % basal area did neither result in changes of nutrients fluxes nor in changes of biodiversity indicators. In this paper we trace the following questions: How much net revenue could farmers obtain by applying sustainable forest management under these thresholds? Can silvicultural treatments improve growth of selected trees species, and thus, provide higher net revenues? What is the influence of topography on growth reactions and net revenues? In permanent plots of 13 ha a total of 440 potential crop trees from nine species were monitored monthly for five years. Half of them had received a liberation thinning at the beginning and the other half was used as reference. Our results indicate that the effect of silvicultural treatments is species-specific and in many cases only effective for certain life-stages. Topography in contrast had no general influence on treatment effects, but growth rates on ridges are lower than in ravines. Based on the economical valuation of these ecological data we discuss how natural forest management could contribute to conservation of neotropical montane ecosystems and to improving livelihood.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - TalkT08-05

Functional characteristics determine growth responses of timber species to logging and silvicultural treatments

M. Peña Claros & L. Poorter

Species vary largely in their light depending growth rates, and therefore also in their growth response to logging and application of silvicultural treatments. Traditionally species have been grouped into different functional groups in respect to their response to logging. There are, however, a lot of variation within those functional groups. Species functional traits may provide a better predictive framework to predict species response to release. In this study we linked the growth responses to release of 20 timber species to a number of leaf traits (leaf toughness, specific leaf area), wood (wood density), and life history traits (adult stature, seed size). The study was carried out in a moist forest site in Bolivia, using data collected in the experimental plots of the Long-term Silvicultural Research Program.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - TalkT08-06

Growth-Oriented Logging (GOL): The use of species-specific growth information for forest management in central Amazonian forests

J. Schöngart

The sustainable management of tropical forests is a promising way to protect the multiple functions and services of ecosystems and to guarantee the use of timber resources for the future. A fundamental indicator for a sustainable forest management is the wood increment of tree species. Timber resources in central Amazonian non-flooded upland forests (terra firme), nutrient-rich (várzea) and nutrient-poor (igapó) floodplain forests are managed by selective logging (polycylic systems) with felling cycles of 25-30 years and a minimum logging diameter (MLD) of 50 cm. Wood growth in diameter and volume were modeled from 19 tree species of terra firme, igapó and várzea forests using tree-ring analyses. Volume growth models indicate that the majority of commercial tree species reaches their highest increment rates at diameters above 50 cm. Species-specific MLDs were derived at diameters when tree species reached their highest current volume increments. Felling cycles, estimated as the mean passage time through 10-cm diameter classes until reaching the MLD, indicate large variations between tree species and also between different forest ecosystems. Tropical forest management concepts must therefore be species-specific and site-specific to become sustainable.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - TalkT08-07

Silviculture contributions towards sustainable management of plantation forests in the highlands of Ethiopia.

A. Nenninger, H. El Kateb, M. Fetene & R. Mosandl

Besides heavily degraded natural forests dense plantations of exotic tree species form the forest landscape of the study area in Munessa, in the highlands of Ethiopia. Within management plans of plantation forests defined thinning concepts are neglected and scientific knowledge about thinning effects on plantation stands is missing. The silviculture experiment in the plantation forest has a dual objective. Firstly, it aims for increasing the harvesting potential by mass and value. Secondly, it aims for identifying appropriate management practices to reconvert forest plantations into natural forest. Therefore three silviculture measures (control, intense promotion and conversion) were implemented at different age classes in plantation forests of Pinus patula, Cupressus lusitanica and Eucalyptus saligna. Promoting potential crop trees (PCTs) by removing competitor trees at different intensity levels form the basic idea of the silvicultural treatments. The impact of livestock on the forests is considered by including two different variants of protection (fenced and unfenced plots). The effects of silvicultural measures on mature stand, regeneration, ground vegetation and light climate are analyzed in detail.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - TalkT08-08

Can we use of pre-felling inventories for assessing tree diversity at local and regional scales?

J.P. Arroyo-Mora & R.L. Chazdon

We used pre-felling inventory (PFI) information from eight natural forest management plans in a biological corridor in northern Costa Rica to test whether this information can be used to assess local and regional patterns of tree diversity (alpha, beta and gamma). In addition, we carried out an independent tree diversity inventory (TDI) in the same management units to compare tree diversity patterns to the PFI. Our results indicate that the management units varied widely in species richness and diversity. Rankings of the management units based on Simpson's diversity index for stems ≥ 30 cm DBH were highly significantly correlated between the PFI and TDI. However, rankings were not significantly correlated between PFI and TDI for stems ≥60 cm DBH. Beta diversity based on hierarchical cluster analysis and non-parametric multidimensional scaling indicated very different spatial structures between the TDI and PFI, likely due to the use of morphospecies for the PFI. For trees species ≥ 60 cm DBH, the PFI provided a more complete assessment of regional tree diversity (gamma) than the TDI. Our study is a first step in exploring ways to integrate forest management information with biodiversity assessments and conservation at the regional scale, a virtually unexplored realm in tropical regions.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - TalkT08-09

Role of immigration in population dynamics of harvested understorey tropical palm populations.

J.C. Hernandez-Barrios & M. Martinez-Ramos.

The leaves of palms of the Chamaedorea genus are harvested from natural populations in Mesoamerican tropical forests for commercial purposes. As previous studies indicate, intensive leaf harvesting levels (>75%) lead to the depletion of the resource and the decline of the palms reproductive output, and over time to high mortality rates. Demographic analysis shows that population maintainance and growth in long-lived species are mainly dependent on the survival of adults, while fecundity values are less important. We established four defoliation experiments (0%, 50%, 75% and 75% excluding local reproduction for estimating foreign immigration) in natural populations of Chamaedorea ernesti-augustii, and generated matrix demographic models for all experimental populations during 2 years. With high levels of sustained harvesting, both defoliation levels (50% and 75%) exhibit finite growth rates values (lambda) below 1. By reducing local reproduction we estimated the contribution of immigration to seedling recruitment and produced deterministic immigration models. These models shows that it is needed a minimum number of seedlings arriving from foreign populations to sustain the replacement of adult individuals, and therefore, population stability and growth. It might be useful for resource management models to consider the establishment of reserve areas in order to guarantee propagule sources.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - TalkT08-10

A remote sensing approach to assessing forest recovery 15 years after logging: comparing conventional and reduced impact logging

F.J. Tomlinson, D.F.R.P. Burslem & M.A Pinard

Combining remotely sensed and field data, we describe and analyse forest recovery 15 years after reduced impact (RIL) and conventional logging (CL) in Ulu Segama forest reserve, Sabah, Malaysia. Vegetation was classified as forest or non-forest vegetation (NFV) based on successional status, and the distributions compared between treatments and relationship to disturbances examined. Results show a greater area of NFV in CL (CL 44%, RIL 23%); and NFV patch size distribution differed between the treatments (CL mean 1.60 ha, range 0.06-23.11 ha; RIL mean 0.17 ha, range 0.01-1.38 ha). In RIL the relationship between the area NFV and the felling intensity was tested and preliminary results indicate that felling intensity alone did not have an effect on presence of NFV, but presence of roads is having a significant but weak effect ($p = <0.01$, $r2 = 0.07$). We are currently examining the relationship between disturbance area (skid trails and roads) and the presence of NFV in the two logging treatments.Our results support those of earlier studies on these sites, that forest harvested under RIL guidelines can recover rapidly and effectively from logging, whilst CL areas can remain stalled or continue to degrade in the medium to long term.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - TalkT08-11

Demography of rattan species in Vietnam

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - TalkT08-12

Not all fragmented neotropical moist forests melt down at forest-pasture edges: spatial patterns and temporal dynamics of forest structure and functional composition in northern Costa Rica

B. Finegan, A. Forero, F. Casanoves, B. E. Salgado Negret

Over 6 yr, we determined forest structure and functional composition >= 10 cm dbh in relation to distance to forest-pasture edges formed 20-30 yr previously, in 36 permanent sample plots at edges and 150 m and 300 m from edges. There were no distance-to-edge effects on recruitment or mortality, total and by PFT delimited by dbh growth rate and adult height, or on liana abundance (repeated-measures ANOVA assuming compound symmetry, alpha=0.05). Stand density N, N 20-50 cm dbh, basal area G and basal area increment were highest at edges, G being higher than in undisturbed forest. Edge effects on N reflected increases 20 cm – 40 cm dbh for fast-growing midcanopy and canopy species, and for G, for all PFTs except understorey species. Higher G at edges for fast-growing PFTs reflected increased recruitment and growth, and for slow-growing species, increased growth. Independently of distance-to-edge, N and G, total, >=60 cm dbh and across PFTs, increased significantly over time.These fragmented forests are resilient reflecting the dynamic regional natural disturbance regime. Our results belie models of forest decline developed for functionally different Amazonian forests. More inclusive models of fragmentation impacts, reflecting understanding of regional functional patterns among old-growth forests, are needed.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - TalkT08-13

Demography of the Brazil nut tree (Bertholletia excelsa) in central Amazonia: implications for the management of an important NTFP

T. Haugaasen, J.M. Tuck Haugaasen, R. Gribel, C.A. Peres, P. Wegge, M. Lemes, J. Schongart

Brazil nuts are an important NTFP in Amazonian forests, but a management plan for this resource is lacking. This paper summarises the results from a 3.5-year investigation of a Brazil nut tree population in central Amazonia. In total, 1164 trees from six different Brazil nut stands were mapped and measured. Five stands were heavily exploited and one had not been exploited for the past 25yrs. Results show that DBH is correlated with tree age and crown size. The size distribution of Brazil nut trees among stands was very similar, with the majority of trees falling in the categories 100-150cm DBH. However, 16% of all individuals were juveniles (<50cm DBH) yet to produce fruits. In addition, seedlings were more abundant in heavily exploited stands and secondary forest than in the unexploited stand. A large number of seedlings were located along existing paths and at nut breaking sites, suggesting that human collectors may enhance regeneration of Brazil nuts in exploited areas. The results therefore suggest that intense long-term Brazil nut exploitation might not hinder Brazil nut regeneration. A management plan based on seed collection restrictions may thus not be ethically or economically viable and other options should be explored.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - TalkT08-14

Influence of climate and soil on the dynamics of tropical lowland forests

M.Toledo, M. Peña-Claros, L. Poorter, C. Leaño & F. Bongers

Rainfall and soil conditions are expected to affect forest dynamics. We used a network of 150 one-ha permanent plots distributed in the Bolivian lowland forests to analyze these effects. In each plot, all trees bigger than 10 cm in diameter were measured for different periods of time (2-10 years). Climatic data (rainfall, temperature, precipitation of the three driest months and the dry period length) were obtained by interpolation of local weather stations. Soils of all plots were analyzed for 16 parameters related to texture and fertility. Environmental data were summarized using Principal Component Analysis. The main four environmental axes were related to the average of tree growth rate at stand level. Sub-humid forest, located in the Pre-cambrian Shield, had higher annual growth rate than the Amazonian rain forest and the Chiquitano dry forest. Contrary to other studies, tree growth rate had no relationship with soil fertility. Forests respond differently to the environmental factors and these differences need to be considered in forest management.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - TalkT08-15

Do canopy disturbances drive forest plantations into more natural conditions? – A case study from the UNESCO biosphere reserve Can Gio, Vietnam

J. Vogt, M. Kautz & U. Berger

Large mangrove forests were destroyed in South Vietnam during the war. After its end in the 1970s, reforestation with Rhizophora apiculata in monospecific plantations has taken place. One of these biggest areas (about 75,000 ha), Can Gio, was announced as a biosphere reserve by UNESCO. , However, there are still ecological problems resulting from the unnatural state of the plantations. Homogeneous size and age structure results in a synchronized collapsing of large forest stands. Therefore, a conversion into a more stable near-natural forest is essential. This study tests whether natural canopy disturbances such as lightning strikes are capable of contributing to this transformation. The gaps were detected, quantified and characterized in spatial distribution, size, shape and formation frequency by remote sensing techniques. Simulation experiments conducted with the mangrove model KiWi were carried out in order to test the influence of disturbances on the vertical and horizontal forest structure of the current plantation. The results reveal that the capacity of disturbances to transform the even-aged plantation into a diverse structured forest adequately strongly depends on the ratio between disturbance frequency and the growth rates of individual trees.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - PosterP08-01

Impact of human pressure on the viability of tamarind (Tamarindus indica L.) populations in W Trans-boundary Bioreserve in Benin

A.B. Fandohan, A. E. Assogbadjo & Brice Sinsin

The conservation status of many wild fruit tree species that support rural people in Africa remains poorly documented despite their importance. T. indica is a dryland species that has nutritional, medicinal and cultural importance for rural communities. We compare the viability of the species' populations under different human-pressure levels, i.e. gallery forests, savannah woodlands and farmlands, using dendrometric characterization and diameter size distributions. Tamarind trees density and regeneration (expressed as stems/hectare) are found to be relatively low compared to other species of the same ecosystem, suggesting tamarind populations may not be self-rejuvenating. Nonetheless, tamarind density in gallery forests is 3-8 times higher than that in savannah woodlands and farmlands ($P < 0.001$). Although diametric structures' coefficients of skewness indicate declining populations irrespective of human-pressure levels, higher median diameter values suggest the species' populations in farmlands and savannah woodlands to be more vulnerable than those occurring in gallery forests. These findings suggest that gallery forests are the best habitats for tamarind species in situ conservation. The observed reduction of trees and juveniles in farmlands and woodlands suggest a drawback on the long-term viability of tamarind populations in these areas.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - PosterP08-02

Seed production of the andean oak “”Quercus humboldtti” in two forests of the colombian eastern cordillera

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Knowledge of mechanisms of tree species reproduction under natural situations including fruit and seed production patterns is very important for management strategies. Considering the influence of abiotic factors such as soil characteristics, humidity and rainfall on plant phenology, we studied the seed production patterns of the Andean oak (Quercus humboldtii: Fagaceae) in two nearby forest sites of the Colombian Eastern Cordillera, under contrasting environmental conditions (Cachalú and Patios).At both sites we monitored monthly seed production of 15 trees in Cachalú and 11 in Patios using seed traps placed under the tree crowns. In general, trees in Cachalú produced more seeds than in Patios Altos, as well as mean fruit mass (wet and dry weight) was significantly higher in Cachalú. At both sites, oak fruiting peaked from April to May, when the highest rainfall occurs. However, fruiting peak at Cachalú was slightly earlier than in Patios. Differences in seed production seem to be positively correlated with differences in soil fertility between sites, while the slight variations in the timing of fruiting peaks seem to be a consequence of environmental factors such as rainfall and humidity. This information may have potential application in management and restoration strategies of disturbed oak forests.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - PosterP08-03

Significance of tree diameter thresholds in forest structure and species composition for sustainable forest management in Costa Rica.

J.P. Arroyo-Mora, M. Kalacska & R.L. Chazdon

We evaluate the impact of using the standard logging inventory threshold (30cm DBH) rather than the more ecologically standard 10 cm DBH threshold for assessing forest structure and composition in eight forest management units (selective logging) in lowland forest of northern Costa Rica. In Costa Rica, a standard threshold of 30 cm DBH is used by logging inventories to determine stand structure (tree density and basal area) and species composition. Based on an independent tree inventory we examined differences in basal area, and stem and species density based on the two diameter thresholds (10 cm and 30 cm) for eight logging units. We also evaluate changes in species composition for each diametric threshold using Self-Organizing Maps (SOM), a neural network based technique. Our results show a decrease in basal area ranging from 17% to 41%, a decrease in tree density ranging from 68% to 84% and a decrease in species density ranging from 63% to 81% if the 30cm diameter threshold is employed. The SOM results illustrate a difference in the overall pattern of species composition within the management units between the two diameter thresholds. They also show a different clustering pattern based on overall species composition for the two diameter thresholds.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - PosterP08-04

Tree water use in relation to tree diversity in a Panamanian forest plantation

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Tree plantations may play a significant role in carbon sequestration and wood supply but there is concern about high water use rates. Objectives of our study were to compare tree water use rates among five native tree species, and to analyze effects of species mixture on water use. Xylem sap flux rates were continuously monitored for one year in 60 trees. Sample trees were planted in monoculture, 3-species mixtures and 5-species mixtures. Annual tree water use differed significantly among species, and maximal tree water use was strongly related to tree diameter ($r^2 = 0.85$, $p < 0.001$). Trees in 3- and 5-species mixtures had attained bigger diameters than those growing in monocultures, which was associated with increased tree water use rates. Accordingly, the estimated annual transpiration from trees in 3-species mixtures and 5-species mixtures exceeded those from monocultures by 15% and 8%, respectively. Our results suggest that both, tree species selection and tree species mixture influence tree water use rates and can thus be used for an optimization of water resource management.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - PosterP08-05

Developing capacity to teach biodiversity conservation in Rwanda

B.A. Kaplin, A, Gasogo, A. William, K. Uwantege, and Y.P. Gaukunde

Rwanda is in the Albertine Rift, a biodiversity hotspot known for endemism, threatened species, and high human population densities. The Rwandan Government identified nature tourism as its economic focus and adopted new laws and policies for biodiversity and environment. However, little capacity existed in the region for the study and management of biodiversity and natural resources. In 2006, the Conservation Biology Education Project was launched in the Biology Department at National University of Rwanda with funding from MacArthur Foundation. The Project had three goals over three years: 1) revise the undergraduate curriculum and introduce conservation biology; 2) build capacity to teach using active teaching methods; and 3) develop a Masters program in Biodiversity Conservation. We developed activities to generate change and increase capacity to teach and maintain a conservation biology program, conduct research, and link to policy. How did we introduce active teaching methods and help instructors embrace new methods in their teaching? We invited instructors for training sessions and created incentive programs. We found networking and involvement of stakeholders to be integral to the success of this project. Today the Biology Department has moved from isolation and obscurity to a front seat in conservation research and policy in Rwanda.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - PosterP08-06

Ecological services of pigs and cattle for forest fallow restoration on biologically degraded pastures in the north-eastern Amazon

S. Hohnwald, O.R. Kato & G. Gerold

In north-eastern Pará, extensive smallholder cattle husbandry often leads to biologically degraded pastures after ten years, where both the forage grasses as well as the fallow vegetation are eliminated. Instead, pastures are invaded by shrubby weeds. To bring these areas back into the slash-and-burn cycle, the natural forest succession has to be accelerated by breaking up the weed layers. As manual weeding is expensive, domestic animals like pigs and cattle can provide this ecological service.This hypothesis was tested in a researcher-leaded on-farm experiment in the Bragantina region (1°03'S/47°30'W). The soil-opening effects of ten domesticated pigs (40 days+nights) and ten steers (40 nights), respectively, were tested against manual clearing and control. Soil cover of bare soil, shrubs, spontaneous grasses, and capoeira were estimated in forty 6.25 m² subplots/plot, before and after effect, on three farms (n=3844).It was found that pigs provide a comparable ecological service like manual clearing: pigs (+26.2%; -0.9%, +0.9%; -8.3%), manual (+25.9%; -22.1%, +5.9%; -3.9%), cattle (+3.4%, +4.6%, -9.2%, -2.2%), control (-6.8%, +21.0%, +8.1%; -5.9%). However, both animal species worked rather patchy.Animal keeping means extra-work for farmers but while manual clearing is too expensive, animal maintenance costs can be kept low by modest weight gains.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - PosterP08-07

Spatial structure of the endangered Afzelia africana Smith ex Pers in Pendjari Biosphere Reserve (Benin): changes along vegetation type and implication on the viability of the species

T. Houehanou, B. Djossa & B. Sinsin

Afzelia africana is a multipurpose and endangered tree species in Benin. This study assesses its current status in Pendjari Biosphere Reserve. The spatial structure of its population was surveyed with univariate point pattern methods and by using O-ring statistic to determine whether individuals are aggregated, evenly or randomly distributed, to detect spatial scales at which these patterns occurs and to quantify spatial associations between adults and juveniles. Results show that individuals (adults and juveniles) are randomly distributed in woodland with a low tendency to aggregated distribution (< 2 m and at 5 m). In contrast, individuals are aggregated distributed (up to 9 m) in savanna–woodland mosaic. These differences are explained by the higher occurrence of juveniles (dbh < 10 cm) in savanna-woodland mosaic compared to woodland. However, adults and juveniles are only weak associated in savanna-woodland mosaic (< 2 m and 3 – 4 m). We conclude that the population of A. africana is endangered in the Reserve and that other factors than human activities must have a negative effect on its viability.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - PosterP08-08

Virtual Library of Biology (vifabio): a biological information portal for research, teaching, and study

Gerwin Kasperek, Jashar Rexhepi, Judith Dähne & Berndt Dugall

The Virtual Library of Biology is a central library portal on the internet (www.vifabio.de) providing access on printed and electronic materials relevant to biologists, including many resources in tropical ecology. The portal is undergoing continuous development, led by the University Library Frankfurt/Main with several partner institutions. The core elements are:(1) A meta-catalogue is integrating four libraries with important holdings of biological literature for parallel search. In the near future, more libraries will join. In addition, bibliographical databases, the tables of contents of more than 1,500 current biological journals with data on 1.8 mio. articles, and title data from Biodiversity Heritage Library are available for parallel search.(2) In cooperation with Kurt Stübers BioLib, digitised versions of historic books are available as PDF files, among them many titles relevant to tropical ecology.(3) The Internet Guide is a collection of quality controlled links to biological internet resources. Access is provided via search tools and via browsing. Particular emphasis is put on an inventory of important online databases.Access on electronic journals is enabled through the Electronic Journals Library (EZB). Further enhancements of vifabio will include a repository for electronic documents, providing a platform for open access publication.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - PosterP08-09

Rehabilitation of degraded ecosystems in Northern Sudanian and Sub-Sahelian zones of Burkina Faso

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Soil degradation is a major problem in Sahelian countries. Combined effects of low fertility of soils, bad management of ecosystems and very severe climatic conditions lead to sealed and encrusted bare soils locally called "zippélé". In this study, soil and water conservation methods (deep ploughing, half-moon holes and Zaï system) were combined with the plantation of five highly valued socio-economically important species: Combretum micranthum and Jatropha curcas for the Northern Sudanian zone, Pterocarpus lucens and Acacia senegal for the Sub-Sahelian zone and Faidherbia albida for both zones. The main objectives are on the one hand to test the chosen species for growing under hard conditions and on the other hand to restore the degraded sites by improving conditions for spontaneous vegetation.The experimental design was set up near Ouagadougou (Gampéla) and Ouahigouya (Baporé), Burkina Faso. It consisted of randomized blocks with two replications and four treatments. The results show a significant positive effect of all treatments on the development of seedlings, in particular, for Jatropha curcas in Zaï system, for Faidherbia albida and Pterocarpus lucens in half-moons and for Acacia senegal and Combretum micranthum by deep ploughing.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - PosterP08-10

Germination, seedling establishment and growth of Qualea grandilflora (Vochysiaceae) in the savannas of Central Brazil

A.C. Franco, A.C. Toniol, W.S. do Carmo, A.S.C. Pereira, A. M. de Carvalho & C.S. Ferreira

The cerrados (savannas) of Central Brazil are characterized by a high diversity of trees. However, changes in land use are leading to rapid disappearance of the native vegetation. Although recognized as a highly threatened ecosystem, studies on natural regeneration by seeds in this ecosystem are scarce. The objective of this study was to understand the dynamics of the germination process in Qualea grandiflora, one of the most common trees of the cerrado. We measured starch and total soluble sugars (TSS) concentrations in whole seeds and variations in their concentrations during the pre-germination state, percentage of seed germination (up to the 17th day) and the speed germination index (SGI). Additionally we followed seedling establishment and growth in natural conditions during a ten-year period. Seeds of Q. grandiflora have soluble sugars as the main carbohydrate reserve (454 mg.g-1); only traces of starch were detected. The elongation of the radicle is due to seed imbibition, since there was no significant ($p > 0.05$) reduction in TSS concentrations of the seed. Germination rate (83%) and SGI (6.6) were high. However, seedlings grow slow under natural savanna conditions. Ten-year old plants reached a stem length of only 11 to 58 cm. FAP-DF, CNPq, FINATEC.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - PosterP08-11

Analysis of the diametric structure and natural regeneration of principal galactogenic plants in villages surrounding the Pendjari Biosphere Reserve (Northern Benin)

K.I.E. DeleKe Koko, K. Hahn-Hadjali & B. SINSIN

A survey of four medicinal plant species used in traditional medicine for the treatment of breast-feeding disorders (Adansonia digitata, Khaya senegalensis, Parkia biglobosa and Vitellaria paradoxa) was conducted in the Pendjari Biosphere Reserve, North Benin. Diametric structure and natural regeneration was recorded in plots estabished in the Hunting Zone of Pendjari Biosphere Reserve along two transects between the villages of Porga, Batia and Tanguièta. Vitellaria paradoxa, the most abundant species (186 stems/ha on the Tanguiéta-Batia axis and 88 stems/ha on the Tanguiéta-Porga axis), shows rejuvenation within population. Parkia biglobosa presents densities of 42 stems/ha on Tanguiéta-Batia axis and, respectively, 35 stems/ha on the Tanguiéta-Porga axis and shows a typical structure of an overaged population. Adansonia digitata (9 stems/ha) and Khaya senegalensis (19 stems /ha) present smallest densities and the biggest difficulties to regenerate. The studied species do not show a uniform distribution pattern within the study area. The extreme values for the relative frequency are 70 % for Vitellaria paradoxa and 21% for Khaya senegalensis. In general, the four species studied show a demographic decline, characterized by ageing populations and by regeneration difficulties, noticed in establishment and development of young plants.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - PosterP08-12

Abundance and population structure of Sclerocarya birrea (A.Rich) Hochst (Anacardiaceae) subsp. birrea in agroforestry systems compared with a protected area in Northern Benin

G.N. Gouwakinnou & B. Sinsin

Non-Timber Forest Products are important resources under pressure of increasing human populations. Sclerocarya birrea is a wild fruit tree with strong multiple-use characteristics. We compare populations in W National Park and surrounding agroforestry systems in Northern Benin. Adult tree density is about nine time higher in the Park (27.6 ± 3.8 versus 3.4 ± 0.6 trees/ha). Seedling occurrence is fairly the same in both land use types, even though seed germination is favored in agroforestry systems. Conversely, saplings (D130 < 5cm) and adults (D130 5-20cm) are almost absent in agroforestry systems. Mean diameter in agroforestry systems is about twice the one in the protected area (46.61 ± 1.40 cm vs. 26.74± 1.23 cm), suggesting an ageing population. There was a significant difference in the size class distribution between land use types, although all distributions are right skewed. Green's index shows aggregated distribution patterns in the protected area (0.48) whereas it is quasi random in agroforestry systems (0.05).Variations in population structure can be mainly explained by human impact linked to agriculture. Preservation actions in favor of saplings are required in agroforestry systems to ensure sustainable use.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - PosterP08-13

Comparison of understory diversity under Teak (Tectona grandis) and mixed species plantations in Western Panama

C. Paul, M.W. Weber

Tropical timber plantations can help to recover biodiversity in degraded areas by facilitating natural regeneration of native species in their understory. However, fast-growing timber species as for example Teak (Tectona grandis) are hypothesized to repress the growth of native species and thus lead to low species richness in the understory. The present study compares woody regeneration under pure Teak stands and mixed stands of native tree species in Western Panama. The results do not prove the hypothesized negative effect of T. grandis on species richness. There was also no relation between the prevalent dispersal mechanism of the understory and overstory species. Species diversity was rather affected by plantation site than by the species composition of the overstory. The study shows that the negative effect of T. grandis on plant species diversity can be reduced by small-scale mixing of Teak stands and stands of native species.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - PosterP08-14

Indonesia's richest forests: a preliminary result from permanent sample plots in Malinau, Indonesia Borneo

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In Malinau, East Kalimantan, 24 Permanent sample plots (PSP) of 1 ha each were established and all trees with dbh ≥ 20 cm were identified and their diameters were measured in 1998. Two logging systems were implemented during that period: reduced-impact logging and conventional logging. PSP is an important tool in monitoring forest dynamics and change. A total of 705 trees species with diameter at breast height (dbh) ≥ 20 cm were recorded from the PSP. The forests of Malinau appear richer in trees than any yet examined in Kalimantan (Indonesian Borneo). Here we summarize stems over 30 cm girth in one hectare of primary lowland hill forest. The 759 stems consist of 211 species in 48 families making this the richest hectare yet published from Indonesia. The most abundant species by stems are Gluta wallichii, Cleistanthus bakonensis and Lithocarpus cantleyanus, while those contributing most to basal area are Shorea venulosa, Dipterocarpus lowii and Calophyllum lowii. A third of the 37.7 m2 ha-1 basal area (11.52 m2ha-1) is contributed by Dipterocarpaceae, the dominant family amongst the largest stems. Noting the general paucity of regional observations we briefly consider why these forests are so rich.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - PosterP08-15

Functional Ecology and Sustainable Management of Mountain Forests in Ethiopia: Some scientific basis for effective tropical forest management

A. Abate, A. Bräuning, A. Gebrekirstos, B. Felbermeier, B. Glaser, W. Zech, E. Beck, M. Fetene, G. Guggenberger, O. Shibistova and R. Mosandl

Tropical mountain forests are increasingly endangered by lack of management plans that is based on scientific knowledge. The project package “Functional ecology and sustainable management of the Munessa forest, Ethiopia” aims at a better understanding of environmental variables that govern the functioning of native forest remnants and forest plantations. The project package consists of five inter-related sub-projects. So far over 70 permanent plots have been established both in the natural and plantation forests for undertaking integrated investigations. The investigations mainly focus on above and below-ground carbon dynamics, efficacy of photosynthesis and water use as well as quantifying seasonal growth parameters. The outcomes of the project package are expected to lay strong scientific bases for the sustainable management of Ethiopian forests and recommends measures for the rehabilitation of natural forests. The poster will present highlights of the project objectives, methods used and results achieved.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - PosterP08-16

Diurnal and Seasonal pattern of soil CO2 efflux in Afromontane forest, Ethiopia

Y.Yonas, O. Shibistova, A. Asferachew and G. Guggenberger

A study was conducted to compare trends in soil CO2 efflux at diurnal and seasonal scale under the canopy of three different species using Li-8100. Efflux at Podocarpus plot showed the highest average (4.24 ± 1.2 µmol m-2 s-1), followed by Croton plot (4.05 ± 1.05 µmol m-2 s-1) and Prunus plot (3.60 ± 0.91 µmol m-2 s-1). Regression models indicated that soil moisture and soil temperature accounted for 80.4%, 81% and 87.3% of the seasonal variability in soil respiration rates at Croton, Prunus and Podocarpus plot respectively. However, soil moisture emerged as significant predictors, explaining 78% ($p<0.001$), 80.8% ($p<0.001$) and 85.6% ($p<0.001$) of the total explained variance of Croton, Prunus and Podocarpus plot respectively. In diurnal observation while most CO2 fluxes were under 6 µmol m−2 s−1, in July relatively high flux, 7.93 µmol m−2 s−1, was observed under Podocarpus plot. Compared to July record (wet season), mean diel respiration rate was reduced by 60 and 13% at Croton plot, 66 and 41% at Podocarpus plot, 61 and 23% at Prunus plot on March and December measurement period respectively. Thus, this study bears important implications for the study of soil CO2 efflux, particularly in response to climatic variations and plant life strategy.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - PosterP08-17

Age-related changes in nutrient fluxes under natural populations of Acacia senegal: applications for savanna agroforestry management

M.E. Isaac, J.M. Harmand, D. Lesueur & J. Lelon

Acacia senegal, an important leguminous species in semi-arid environments, has shown promise as an agroforestry tree. Of particular importance are the undetermined chronological effects in A. senegal populations on site level dynamics and production. Consequently, our research objective was to investigate age-related changes in A. senegal interactions using natural populations in the Rift Valley, Kenya. Our results showed that in early growth A. senegal foliar N concentration was significantly greater (P = 0.0236) when associated with an herbaceous layer, with increases of ~20%. However, total soil N pools were comparable under all acacia saplings, regardless of interspecific interactions. Conversely, soils under mature A. senegal exhibited significantly greater total N (38% higher). Tree age did not affect soil carbon pools, CO2 soil fluxes or soil N mineralization estimates, but as expected, nutrient pools and fluxes declined with increasing distance from mature Acacia trees. Currently, we are testing these findings with in-situ soil transplant experiments and natural 15N abundance methods to confirm rates of fixed N transfer to soil resources and associated vegetation. Our findings suggest that the presence of associated intercrops stimulates N availability in early growth, thus improving soil resources and potential productivity with time, but only in direct association with the A. senegal trees.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - PosterP08-18

A question of protection: selective logging diminishes ant diversity in a Guineo-Congolian rainforest

F. Hita Garcia, G. Fischer & M. Peters

Concerns of conservationists about the anthropogenic destruction of tropical rain forests in the past have lead to the protection and conservation of forest remnants, usually as natural parks or reserves. In order to effectively conserve the biodiversity of these last pristine habitats it is crucial to understand how biodiversity responds to habitat fragmentation and small-scale human disturbance. Ants are keystone organisms in tropical habitats and fulfil a wide range of ecosystem functions. We analysed the impact of habitat fragmentation and selective logging on the diversity of the ground ant fauna of the Kakamega Forest in Western Kenya. For this purpose 200-m-pitfall-trap-transects were established in primary forest habitats in all remaining forest fragments. The sampling locations covered two management regimes present in the area (Kenya Forest Service, Kenya Wildlife Service) which strongly differ in their protection policy resulting in different logging rates. We found no direct evidence for an effect of habitat fragmentation on ant diversity, whereas ant species richness and abundance significantly decreased with less protection and consequently higher rates of selective logging. Our results indicate that conservation status alone is not enough to preserve biodiversity - strict protection is necessary.

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Session 08: Applying ecological knowledge for sustainable management of tropical forest - PosterP22-05

Osmotic potential of six bamboo species planted in the mountainous regions of Northern Vietnam

Tran Viet Ha

The osmotic potential within the plant reflects the water and salt situation of soils. Therefore, measuring osmotic potential is a way to specify not only site conditions but also plant characteristics to match plant species to sites or to diagnose the adaptation of plant species in relation to the site conditions. In theory, the plant osmotic potential is relative minimum at noon due to water lose inside the cells during the daytime to against high temperature while it reaches relative maximum at night when temperature decreases and water in the cells is saturated. In this research, the midday and saturated osmotic potential (measured at noon and in a position of saturated water) of six bamboo species included three monopodial species (Phyllostachys edulis; Oligostachyum sp and Indosasa angustata) and three sympodial species (Dendrocalamus latiflorus; Dendrocalamus barbatus and Dendrocalamopsis sp2) planted in the mountainous regions of Northern Vietnam were measured to assess their site condition and the adaptation towards these sites

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Session 09: Nutrient manipulation experiments in tropical forests - TalkT09-01

Chronic N addition to a tropical lowland forest: leaching losses, soil chemical changes, and tree nutrient status

M.D. Corre, E. Veldkamp, H. Schulte-Bisping, & S.J. Wright

Nitrogen deposition is projected to increase rapidly in tropical ecosystems. How this elevated N input will affect soil characteristics and solution chemistry has rarely been studied in tropical forests. We used an on-going nutrient manipulation experiment in a diverse lowland forest in Panama on a deeply weathered Dystrudept soil to 1) investigate changes in soil chemical characteristics after 8-yr N addition, 2) determine leaching losses at 1.5 m depth during the 9-10-yr N addition and which processes neutralize soil acidity, and 3) assess changes in foliar nutrient levels. Chronic N addition led to decreased soil pH and base saturation, increased soil exchangeable Al, and increased NO3- leaching amounting to 8.5% of applied N. In the control plots, high dissolved bases concentrations together with high HCO3- concentrations indicated active silicate weathering, which is an acid-neutralizing process. Chronic N addition led to a decrease in dissolved bases concentrations which we explain with a reduction in weathering rate of silicates, many of which have a lower dissolvability if the soil water pH drops from 7.2 to 6.7. The foliar nutrient elements of the three tree species common in both control and N addition plots showed decreased in Ca:Al ratios after 10-yr N addition.

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Session 09: Nutrient manipulation experiments in tropical forests - TalkT09-02

Nutrient dynamics along an elevation transect in the Peruvian Andes

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The eastern flank of the tropical Andes Mountains and adjacent Amazonia is the most biologically diverse region of the planet, and accounts for the largest component of global terrestrial productivity, but this diversity and productivity is generally sustained on nutrient-poor soils. With predicted changes in the nutrient dynamics of the region, it is unknown how the ecosystems will respond to these changes. We conducted a comprehensive assessment of nutrient dynamics and the impacts of nitrogen and phosphorus addition at four sites along an elevation transect in the Peruvian Andes (200 m, 1,000 m, 1,700 m, and 3,000 m). We monitored changes in aboveground growth (DBH, LAI) as well as belowground shifts in mycorrhizal dynamics.

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Session 09: Nutrient manipulation experiments in tropical forests - TalkT09-03

Response of plant communities to nutrient and water addition at the forest-savanna boundary in central Brazil

E.L. Geiger, S.G. Gotsch, W.A. Hoffmann, M. Haridasan, A.C. Franco,

Predictions of large-scale vegetation change in the tropics largely rely on the assumption that water is the resource most strongly limiting to the distribution of tropical forest. This overlooks strong evidence that nutrients are a primary determinant of some savanna-forest transitions. We conducted a factorial experiment to test for the relative importance of water and nutrient availability at a savanna-forest boundary in the Cerrado biome approximately 35 km south of Brasília, Brazil (15º 55' S and 47º 53' W). In 12 10m x 70m plots, centered on, and aligned perpendicularly to a savanna-forest boundary we placed metal dendrometers on 945 trees with stem diameter >5cm to monitor growth increment. We applied 60 mm of water per week during the dry season and applied fertilizer during the wet season. Both irrigation and fertilization increased the rate of tree growth, however nutrient addition resulted in a 64% increase in mean diameter growth, while irrigation resulted in a 23% increase. Forest tree species exhibited a greater response to both nutrient and water than did savanna species. These results indicate that predictions of vegetation change based on water availability may overestimate the climate sensitivity of the distribution of tropical forest.

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Session 09: Nutrient manipulation experiments in tropical forests
- TalkT09-04

Rapid effects of nutrient addition on aboveground producitvity of Ecuadorian montane forests

J. Homeier, N. Cumbicus, N. Poma, D. Hertel, V. Horna & C. Leuschner

The nutrient manipulation experiment (NUMEX) combines experimental and descriptive studies along an altitudinal transect of Andean mountain forests in southern Ecuador to investigate the type of nutrient limitation and the responses of the forest ecosystems at different elevations to nitrogen (N: 50 kg ha-1 yr-1) and/or phosphorus (P: 10 kg ha-1 yr-1) addition. The study sites at 1000, 2000 and 3000 m a.s.l. are located in Podocarpus National Park and in the Reserva San Francisco (RSF), respectively, and represent mature forest stands without visible human or natural disturbance. After the first year of nutrient manipulation there are already noticeable changes in the aboveground productivity of the studied ecosystems: Addition of N and N+P led to an increase of total fine litter production at all elevations, whereas the total amount of fine litter generally decreased after P addition. Plot basal area growth was increased notably by N+P at all three studied elevations, N addition was followed by a higher basal area growth only at 1000m, and a slight decrease at the higher elevations. After addition of P there was a minor increase in basal area growth at 2000m, and little decreases at 1000 and 3000m, respectively.

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Session 09: Nutrient manipulation experiments in tropical forests - TalkT09-05

Leaf litter decomposition in a tropical mountain rain forest as affected by nutrient addition and elevation

D. Sandmann, F. Marian, M. Maraun,S. Scheu

We investigated the impact of nutrient (phosphorus and nitrogen) addition and elevation on leaf litter decomposition in a long-term litterbag field experiment set up in the framework of the Nutrient Manipulation Experiment (NUMEX) in the tropical mountains of southern Ecuador. Two different litter types were investigated. Freshly fallen leaves of Graffenrieda emarginata and Cecropia sp. were collected, dried and bags containing 10 g dry weight of the leaves were exposed in three forest sites along an elevational gradient from 1000 to 3000 m. The bags were collected after six months, and results of this first sampling date are reported. Decomposition rates of both litter types decreased with increasing altitude. Nitrogen addition increased the decomposition of both litter types but only at 1000 m. Addition of phosphorus alone had no significant effect. Only in combination with nitrogen decomposition rate of Graffenrieda was increased at 1000 m. At 2000 m and 3000 m altitude nutrient addition had no significant effect on litter decomposition. Parallel to litter decomposition microbial biomass decreased with increasing altitude and in leaf litter of Cecropia sp. it was increased by addition of phosphorus but only at 1000 m. In addition, we analyzed colonization of litter bags by soil fauna and these results will also be presented.

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Session 09: Nutrient manipulation experiments in tropical forests - TalkT09-06

Chronic nitrogen addition causes a quick reduction in soil carbon dioxide efflux from a tropical montane forest but no response from a tropical lowland forest in decadal scale

B. Koehler, M.D. Corre, E. Veldkamp, M. Adamek

Atmospheric nitrogen (N) deposition is rapidly increasing in tropical regions. We studied the response of soil carbon dioxide (CO2) efflux to long-term experimental N-addition (125 kg N ha-1 yr-1) in mature lowland and montane forests in Panamá, and estimated the total belowground carbon allocation (TBCA). Annual soil CO2-C efflux was larger from the lowland than the montane forest. TBCA in the lowland forest was on average two times annual litterfall-C, which agrees with the relationship established from mature forests worldwide. The montane forest had smaller annual TBCA and a regression analysis of data from the few studied montane forests suggests that TBCA averaged only one fourth of litterfall-C. Despite changes in soil chemical characteristics (i.e. decrease in pH and base saturation) soil CO2 efflux did not differ between the control and 9-10 yr N-addition lowland plots. This suggests that chronic N input to nutrient-rich lowland forests may not change C balance in decadal scale. In the N-limited montane forest, where decomposition is restricted, first year N addition did not affect soil CO2 efflux but annual CO2 efflux was reduced by 16% in the second year N addition compared to the control. This smaller soil CO2 efflux in spite of higher litterfall suggests an increase in soil C storage following N enrichment.

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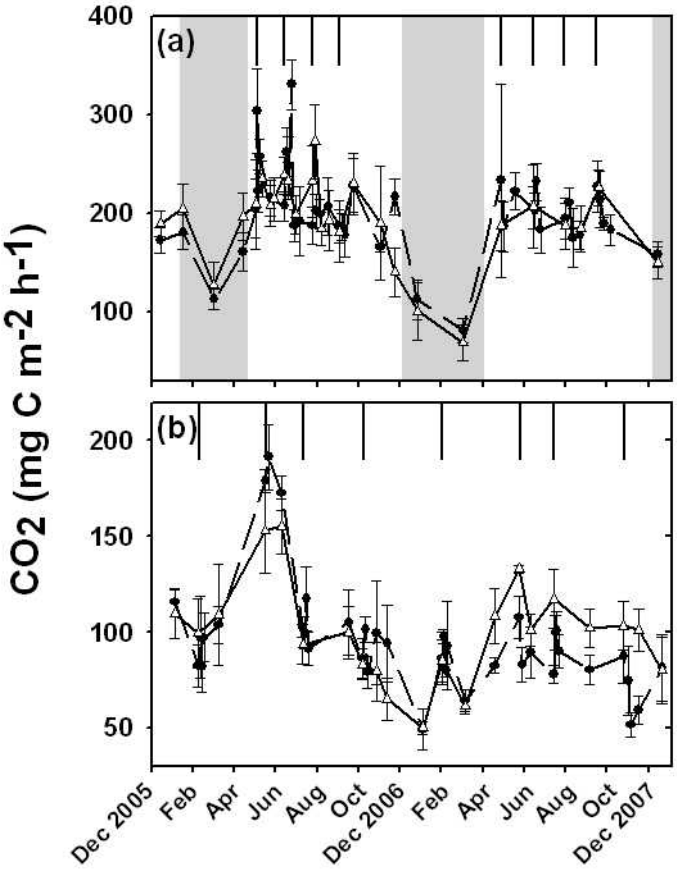
- TalkT09-06

Figure 1: Mean (± SE, n = 4) soil CO_{2} efflux from the control (?) and N-addition (?) a) lowland and b) montane forest. Black vertical lines indicate dates of N addition. Grey shadings mark the dry seasons in the lowland forest.



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Session 09: Nutrient manipulation experiments in tropical forests
- TalkT09-07

Trace gas fluxes react on elevated nitrogen input in tropical mountain forests of southern Ecuador

G.O. Martinson,E.Veldkamp,H.Flessa,J.Homeier

The projected increase in nitrogen (N) deposition is one of the most influential factors that will act on tropical forests in the next decades. How elevated N deposition will impact soil-atmosphere fluxes of methane (CH4), nitrous oxide (N2O) and nitric oxide (NO) is not well known. Nutrient addition experiments in Hawaii provided evidence that N-limited mountain forests will react differently to N additions than P-limited lowland forests. However an N addition experiment in Panama could not confirm these results. Here, we present first results of monthly measured soil N2O, NO and CH4 fluxes from a nutrient manipulation experiment (NUMEX) at three sites along an altitudinal gradient in the Ecuadorian Andes (1050 m, 2100 m, and 3000 m) over a one-year period. Nutrient application rates are modest (50 kg N ha-1 yr-1 and 10 kg P ha-1 yr-1) compared to published experiments. Fertilizer (urea and sodium phosphate) was applied twice a year. The lower elevation sites responded to N-additions with larger changes in N2O, NO and CH4 fluxes probably due to a faster soil N cycling. Nitrogen oxide emissions increased shortly after N-addition by a factor of ten, while CH4 uptake decreased by a factor four. One month after N addition, nitrogen oxide emissions returned to their original values before N addition, while this lasted 2 to 3 months for CH4. This trend was observable at most sites but its magnitude decreased with elevation. An increase in nitrogen cycling rate and a partial inhibition of atmospheric CH4 oxidation by N addition probably led to higher nitrogen oxide emissions and a decrease in CH4 uptake. P additions showed no significant short-term or long-term effects on trace gas emissions at all sites. These short-term impacts on N2O, NO and CH4 fluxes in tropical mountain forest soils by moderate nitrogen additions suggest that this ecosystem is strongly susceptible to increased nitrogen deposition in the future and do not confirm current ideas on the impact of N addition on trace gas fluxes.

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Session 09: Nutrient manipulation experiments in tropical forests
- TalkT09-08

Is potassium in throughfall an indicator for forest growth?

Wullaert H., Valarezo C., Homeier, J. and Wilcke W.

Several studies indicate that tropical montane forests are N-limited while tropical lowland forests are rather P-limited. In previous work, we detected extra Ca deposition from the atmosphere in the northern Andes originating from Sahara dust during a pronounced la Niña event. Calcium losses from the ecosystem during such an extra Ca deposition were determined to be smaller than in periods without extra deposition. Our aim in this study was to determine if N, P and Ca are limiting nutrients for a tropical montane rainforest in southern Ecuador at 2000 m a.s.l. To determine nutrient limitations, we added N, P and Ca to experimental plots. Throughfall and litter percolate were collected on a biweekly basis in five treatments: N, combined N and P, P, Ca addition and control plots without fertilizer application. Application rates were 50 kg N, 10 kg P or 10 kg Ca ha-1 yr-1 with resp. urea (46%), NaH2PO4.2H2O, and CaCl2.2H2O. Nutrient additions were distributed on two dates per year and the effects were compared with non-fertilized control plots. Throughfall and litter percolate samples were analyzed for concentrations of H+, NO3-, NH4+, TN, PO43-, TP, Ca2+, K+, Na+, Mg2+, TOC, Cl-. Two months after the first and second nutrient applications, a peak in K+ concentrations of throughfall is visible in the Ca applied plots and only after the second nutrient application in the N applied plots. In the literature, enhanced K release from tree structures like fruits and seeds is sometimes attributed to increased tree growth. This is in line with the observation of an accompanying project demonstrating that N and Ca (but not N+P and P) application resulted in faster tree growth. Increased K+ concentrations in throughfall were surprisingly not detected in the combined N and P applied plots. As there was nevertheless no difference in N leaching through the organic layer between the N and combined N and P treatment, this suggests that the applied N in the combined N and P applied plots was not taken up by trees but rather by soil microorganisms. This nutrient immobilization by soil organisms prevented increased tree growth in the N+P treatment and hence did also not result in increased K+ concentrations in throughfall. From these preliminary results we hypothesize that (i) tree growth at our study site is limited by N and Ca and (ii) bacterial growth is limited by P.

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Session 09: Nutrient manipulation experiments in tropical forests - TalkT09-09

Diversity patterns and aboveground biomass partitioning among tree families in mountain forests of Sulawesi (Indonesia)

H. Culmsee

For testing ecological and evolutionary responses of biota to gradual changes in temperature, altitudinal transect studies are among the most powerful natural experiments. The study presented was conducted in old-growth montane forests along a transect ranging from 1050 to 2400 m a.s.l. in Lore Lindu National Park, Sulawesi (Indonesia), in order to detect altitudinal changes in tree diversity, above-ground biomass (AGB) and the significance of biogeographical elements in the explanation of AGB stocks. Tree species and tree family richness were decreasing with altitude. The highest diversity turn-over took place at 1400-1800 m (borderline to mid montane forests). There was a steep altitudinal increase in stem density, but no decrease in AGB. The Fagaceae contributed up to 50 % to the total AGB in the montane forests; thus, the family's importance did not decrease East of Wallace's line. The constant AGB along the altitudinal montane forest transect was caused by the contribution of the Fagaceae together with southern-hemispheric conifers. A cross-continental comparison of old-growth rainforests showed the general pattern, that AGB decreased with altitude if the Fagaceae were absent, but remained high if the tree family was well represented in the montane belt.

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Session 09: Nutrient manipulation experiments in tropical forests - TalkT09-10

Atlantic Forest: the most ancient Brazilian forest, and a biodiversity hotspot, is highly threatened by climate change

A.F. COLOMBO & C. A. JOLY

After 500 years of destruction, the Brazilian Atlantic Forest has been reduced to less the 8% of its original cover, and climate change may pose a new threat to the remnants of this biodiversity hotspot. In this study we used Genetic Algorithm for Ruse-set Predictions/GARP and Maximum entropy modeling of species geographic distributions/MAXENT to predict possible consequences of Global warming upon future geographic distribution of 38 species of Mata Atlantica trees. The results obtained show an alarming reduction in the area of possible occurrence of the species studied, as well as a shift towards the most southern part of Brazil. Using GARP, in average, in the optimistic scenario this reduction is of 25% while in the pessimistic scenario it reaches 50%, and the species suffering the worst reduction in their possible area of occurrence are: Euterpe edulis, Mollinedia schottiana, Virola bicuhyba, Inga sessilis and Vochysia magnifica. Using MAXENT, in average, in the optimistic scenario the reduction will be of 20% while in the pessimistic scenario it reaches 30%, and the species suffering the worst reduction in their possible area of occurrence are: Hyeronima alchorneoides, Schefflera angustissima, Andira fraxinifolia and the species of Myrtaceae studied.BIOTA/FAPESP 03/12595-7

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Session 09: Nutrient manipulation experiments in tropical forests - PosterP09-01

Different growth reactions of montane forest trees after experimental nutrient manipulation

N. Cumbicus, J. Homeier & C. Leuschner

The Ecuadorian nutrient manipulation experiment (NUMEX) combines experimental and descriptive studies along an altitudinal transect of Andean mountain forests in southern Ecuador to investigate the type of nutrient limitation and the responses of the forest ecosystems at different elevations to nitrogen (N: 50 kg ha-1 yr-1) and/or phosphorus (P: 10 kg ha-1 yr-1) addition. The study sites at 2000m a.s.l. are located in the Reserva San Francisco (RSF)and represent mature forest stands without visible human or natural disturbance. Tree diameter growth of 907 stems (dbh ≥ 10 cm) within 20 permanent plots is monitored 6-weekly. After the first year of nutrient manipulation there are already noticeable changes in diameter growth of the most common tree species.

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Session 09: Nutrient manipulation experiments in tropical forests - PosterP09-02

Decomposition rates and microarthropod colonization of litter and roots along an altitudinal gradient in a tropical mountain rain forest in Southern Ecuador

F. Marian, D. Sandmann, M. Maraun, S. Scheu

The effect of altitude and litter type on decomposition rate and microarthropod colonisation in a tropical mountain rain forest in southern Ecuador was investigated. Leaf litter from the three most abundant tree species and roots of different sizes 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 month the remaining dry mass, ergosterol content, microbial biomass and colonisation by microarthropods were determined. In leaf litter the amount of ergosterol was significantly higher than in roots, and the microbial biomass decreased with increasing altitude. Decomposition of roots and leaf litter depended on root size, litter type and also on the origin of the material. Surprisingly, fine root biomass increased during the six month period at the lowest altitude. This may be due to intensive colonisation by saprophytic fungi and microorganisms which have their highest abundance at the lower sites. Some Orbatida species were more abundant in roots whereas others preferred leaf litter. We suggest that oribatid mite species which preferentially occurred in roots feed on VA-mycorrhiza wherease the species which preferentially occurred in leaf litter feed on saprophytic fungi.

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Session 09: Nutrient manipulation experiments in tropical forests - PosterP09-03

Vegetation structure and composition along the toposequences in Aguimo sub-catchment (Benin)

I. Toko, B. Orthmann, S. Porembski & B. Sinsin

Structure and composition of the vegetation of the Aguimo catchment in the Upper Oueme Catchment in Central Benin were studied. In total, 50 phytosociological relevés were carried out to determine plant communities along a slope transect. Cluster analyses permit to obtain seven plant communities whose distribution follows a topographic and edaphic gradient. A total number of 345 species belonging to 232 genera and 75 families were recorded. Poaceae (16.47 %) and Leguminosae-Papilionideae (10.88 %) are the most represented families. Phanerophytes (42 %) followed by therophytes (28 %) are the abundant life forms. Tree cover, tree density and basal area decrease from upper to lower slope and vegetation type change from woodland to woodland savanna and tree savanna. The amount of herbaceous biomass decreases from open sites with low canopy to woodlands with high cover. In temporarily inundated depressions, grass savanna occurs with scattered trees. Trees with small stem diameter are more frequent in natural savanna compared to trees with large diameter. We find an opposite distribution on cropland.

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Session 10: Who saves the rainforest? - TalkT10-01

Who saves the rainforest?

K. Riede

"Save the rainforest" has become a guiding principle for modern citizens from industrialised nations, but also for indigenous people, NGOs and increasing numbers of citizens from tropical countries. Most national and international governmental organisations basically agree on the importance of tropical forests for ecosystem services, and the high value of hitherto unstudied biodiversity. Inspite of this general consensus, tropical forest loss continues at unprecedented rates, revealing international conservation goals as mere lip services. Numerous projects and campaigns of NGOs made a huge contribution to raise public awareness, gained some spectacular victories, but certainly could not stop the main drivers of rainforest loss. Likewise, scientists continue to stress the importance and even economic value of tropical biodiversity, but hitherto did not succeed to establish mechanisms for efficient protection or sustainable use of rainforests. I will present a review and evaluation of historic and recent initiatives to save the rainforest, analyse lessons learnt, and identify obstacles in effective cooperation among scientists, NGOs, IGOs and local stakeholders.

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Session 10: Who saves the rainforest? - TalkT10-02

Progress and Potentials of Community-based Conservation and Development in South Asia

R. Seidler & K.S. Bawa

There is considerable debate about the success of community based integrated conservation and development projects in meeting the twin goals of conservation and poverty reduction. The resolution of this debate concerns a central issue in conservation, namely the effectiveness of community-based management or co-management of biodiversity versus centralized, state-controlled management. An implicit assumption of co-management is that economic incentives for local communities (deriving from limited commercial exploitation of biodiversity) will increase their stake in conservation. Although there have been several evaluations of community based management projects, evidence to support or refute their effectiveness remains mixed. Apart from difficulties in measuring poverty reduction and biodiversity conservation, there is a lack of site-specific data on economic and conservation gains as a result of social and economic interventions. We review a number of case studies from South Asia, asking how they compare with the types of programs that may realistically be needed to stem the ongoing biodiversity crisis in populous industrializing economies. We distinguish and explore five fundamental requirements of such programs: 1) appropriate scaling; 2) priority setting for short, medium and long-term goals; 3) choices and options to realistically accommodate the inherent diversity of individuals and communities; 4) dispersed governance structures for flexibility; and 5) overall movement toward landscape-level planning. We contrast “threat-based” with “capability-based” approaches to biodiversity protection under rapidly changing conditions and uncertainty. Finally, we suggest possible ways to stimulate the growth of a “conservation & restoration economy” that could eventually satisfy the above requirements, by contributing to genuine economic development and resilience via the protection and rehabilitation of critical natural capital.

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Session 10: Who saves the rainforest? - TalkT10-03

Rainforest conservation on tribal land: lessons from Papua New Guinea

G. Weiblen

Papua New Guinea (PNG) is unique among nations possessing large tropical rainforest areas insofar as 98% of PNG is privately owned by clan societies. The island of New Guinea also harbors the world's third largest lowland rainforest wilderness so it is of great interest to conservationists. In recent years, rural landowners have tended to reject conservation in favor of logging contracts that sacrifice forest resources for roads, royalties, and other developments. What can be learned from the repeated failure of conservation initiatives in PNG? Conservationists focus their efforts on the most isolated forests because they are usually larger and of superior quality. However, tribal landowners in such areas generally have the highest hopes for development and are most vulnerable to foreign manipulation. Hostility toward conservation can arise in PNG when programs fail to meet naïve expectations. Scientists and non-governmental organizations can better affect conservation on tribal land by focusing efforts in active logging concessions where landowners are more familiar with the economic realities of development and the need to implement conservation guidelines. For example, PNG logging operations are required by law to reserve 10% of the forest per concession but until now forest reserves were never defined. Recently, a 10,770-hectare reserve was established in the Middle Ramu Block 1 logging concession of Madang Province, PNG. The tribal stewards of Wanang Conservation receive annual royalties in exchange for preservation of forest and collaboration with research scientists. This represents a rather different model for rainforest conservation on tribal land.

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Session 10: Who saves the rainforest? - TalkT10-04

Saving the Rainforest- strategies and approaches of WWF

J. Kirchgatter

In many areas of the worlds rainforest belt the forest cover is quickly depleted or degraded. WWF has fought a fierce fight for over 30 years in many countries to stop or at least significantly slow down the deforestation rate. Over the years strategies have changed greatly due to scientific findings, risen awareness and political opportunities.Today WWFs approach is an integrated one: fully protecting precisely defined “high conservation value forests” in core zones is certainly still a corner stone, especially within the focal point of the “Global 200”, the most important ecoregions defined by scientific criteria. But, as studies show, the limited dimensions of cero use zones are often not sufficient to stop the loss of biodiversity, preserve minimum viable populations, natural dynamics and ecosystem services. Therefore WWF combines the implementation of strict PAs with an overall landuse planning process. Together with many stakeholders and partners regional zoning systems are developed and implemented, focussing on the local population. Based on research and steady monitoring land and resource use practices in the defined use zones are altered to approximate sustainability. This starts from enhancing agriculture to minimize land use pressure and reaches over communal and professional hunting, use of non timber forest products, alternative livelihoods and eco-tourism to selective timber use under FSC-certification. In cooperation with state administrations regulations for this land uses are developed and the resulting laws enforced. In the back ground political action is taken to stop illegal and unsustainable logging and resource trade. The most current progress is the valorisation of forests as carbon sinks and storage, therefore WWF is developing standards to capitalize the standing forest.

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Session 10: Who saves the rainforest? - TalkT10-05

"Those who act upon our territories" - Socio-cultural approach to the diversity of human intervention in ecological processes

V. von Bremen

In the Gran Chaco of Southamerica, there is a variety of socio-cultural groups that witness an accelerated process of environmental changes. Their actions as well as interactions have a great impact on the region and its future. Knowing more about their socio-cultural backgrounds might offer a better understanding of their motivation, their goals and dynamics of action in their relationship with the natural environment. A more conscious approach to this diversity of actors is needed to identify possible ways of improving the life in this particular geographical en ecological region.

V. Von Bremen, -, -

Session 10: Who saves the rainforest? - PosterP10-02

Eco-tourism and nature excursions to save rainforests and wildlife in Costa Rica

G.Hoebart

Eco-tourism is important for the economy of Costa Rica since 25 years. Developments are not always sustainable and have an impact on natural resources, but in the form of small-scale tourism this can contribute to save rainforests. An example is a small tourism operator focusing on nature excursions for cruise ship passengers in the Caribbean of Costa Rica. Starting from Puerto Limon guests go on boat rides in river channels. They learn about mangrove habitats with water birds, sloth, iguanas, monkeys and other wildlife. Visiting a banana plantation clients hear about the plants, its processing and environmental damages due to sediment run-off and toxic pesticides. During a short hike in a coastal national park guests hear about tropical ecology, impacts of climate change and some interesting plants. Before returning to the ship guests enjoy a swim in the Caribbean sea, lately in many places in risk of losing the blue flag for clean water quality. People also have a chance to get to know marine sea turtles in a rescue centre and learn about their high risk of extinction. The aim is to educate and at the same time create awareness amongst tourists about the destruction of sensitive nature reserves.

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Session 10: Who saves the rainforest? - PosterP10-03

Biodiversity and Conservation in Central Africa: The Gabon Biodiversity Program

T.E.J. LEUTERITZ, G. DIVINA, F. DALLMEIER, AND A. ALONSO

The development and conservation issues in Central Africa are on the increase and despite new protection measures; biodiversity in Gabon remains threatened by resource extraction to meet human demands for food, energy and shelter. In Gabon's Gamba Complex of Protected Areas oil has been extracted for more than 40 years. The Gamba Complex covers over 11,000 km2 of tropical rainforest bordering the Atlantic Ocean and extending up to 100 kilometers inland. To protect this wild land, two national parks have been established in the complex, Loango and Moukalaba-Doudou, the remainder of the complex remains under a lesser degree of environmental protection.In 2000, the Smithsonian Institution and Shell Gabon initiated the Gabon Biodiversity Program. The main goals are to conduct biodiversity research and education programs that contribute to minimize the impact of oil development in the Gamba Complex while providing conservation strategies for species and habitats. The objectives of this partnership are: 1) to create approaches to minimize oil and gas impacts, 2) to provide capacity building for conservation practitioners through community outreach and professional training, 3) to increase knowledge, and 4) to contribute to long-term conservation. Fieldwork has determined that Shell Gabon is operating in an area that is exceptionally rich in biodiversity where wise environmental policies have reduced possible impacts.Through this partnership, Smithsonian has been carrying out long-term independent biodiversity studies in the area. SI has developed a framework, incorporating principles of adaptive management, conservation biology, biodiversity assessments and monitoring, and ecological studies to better understand biological processes. The framework is designed to understand biodiversity within the context of sustainable development and conservation.

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Session 11: Modified forest ecosystems: linkages between dispersal, recruitment, and carbon storage can improve conservation
- TalkT11-01

Bird dispersal and persistence affects plant recruitment in a fragmented east-African biodiversity hotspot

L. Lens, V. Lehouck, T. Spanhove & T. Callens

Habitat fragmentation is known to reduce the viability of animals and plants independently, yet effects on mutualistic relationships are less well understood. Tropical forest birds are important seed dispersers of fleshy-fruiting plants, and habitat- or landscape-level effects on avian survival and mobility may indirectly affect seed dispersal and seedling recruitment of dependent plants, in interaction with direct environmental effects. To test this hypothesis, we combined a demographic and genetic study of avian dispersal and persistence in a highly-fragmented African cloud forest with (radio-telemetric) observations of dispersal vectors, seed retention times and seed(ling) experiments to model dispersal and recruitment of avian-dispersed Xymalos monospora seeds. Landscape-wide persistence of avian frugivores was positively related to their ability to disperse among fragments, with less mobile species showing stronger genetic population differentiation. Impoverishment of frugivore communities in small or degraded fragments reduced seed removal rates and seed dispersal distances. We conclude that reduced bird persistence and low resilience can cause strong disruptions of disperser-seed interactions that may have long-lasting effects on tropical plant communities. Whether, and to what extent, loss of seed dispersal due to local extinction of key frugivores can be compensated by 'functional substitute' species depends on frugivore diversity, landscape heterogeneity and connectivity.

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Session 11: Modified forest ecosystems: linkages between dispersal, recruitment, and carbon storage can improve conservation
- TalkT11-02

The presence of howler monkeys influences the richness of the seed rain and seedling bank in tropical rain forest fragments

A. M. GONZALEZ-DIPIERRO & J. BENITEZ-MALVIDO

Tropical rain forest fragmentation affects regeneration throughout modifications in physical and biological factors (e.g., reduced seed dispersal and germination). In the Selva Lacandona, southeastern Mexico, we evaluated the effect of fragmentation on the composition and species richness of the seed rain and seedling bank focusing on those species dispersed by howler monkeys (Allouata pigra). We selected three continuous forest sites (control); and 6 fragments of similar size, 3 occupied by primates and 3 without primates, respectively. The richness of the seed rain for those species dispersed by howlers was significantly higher in continuous forest and occupied fragments than in fragments without howlers; whereas the richness of seedlings was greater in fragments occupied by primates than in the other habitats. Overall, the results indicate that the loss of howler monkeys from forest fragments reduces forest regeneration. Therefore, the conservation of howlers as well as other seed dispersers is relevant for the maintenance of tropical rain forest biodiversity and functionality.

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Session 11: Modified forest ecosystems: linkages between dispersal, recruitment, and carbon storage can improve conservation
- TalkT11-03

Effects of experimental tree plantations on seed rain and recruitment in Mexican humid and dry tropical forests

C. Martinez-Garza, M. de-la-Pena-Domene, Y. Urincho-Pantaleon, R. Gadea-Nogueron, A. Nicolas-Medina, L. Alba-Garcia, V. Miranda-Hernandez

Fragmentation in the tropics precludes the movement of animals and plants across the agricultural landscape. Natural succession back to forest in perturbed areas is a stake due to seed-dispersal and recruitment limitation of forest species. To test effects of experimental plantations on seed rain and recruitment, native tree species were planted in exclosures of cattle located in dry and humid tropical fragmented landscapes in Mexico. In the humid tropical forest of Los Tuxtlas, Veracruz, 24 exclosures, 30 X 30 m plots were located in active pasture separated 35 m from each other in June 2006. In the dry forest of Sierra de Huautla, Morelos, eight exclosures of 50 X 50 m were located in January 2006 in secondary forest frequently perturbed by cattle. In Los Tuxtlas, an analysis of non-metric multidimensional scaling including seed traps with more than four species showed that there is a high connectivity from the forest to the secondary forest while species falling in pastures comprise a different group of species. Those species recruiting in pastures are mainly pioneers dispersed by wind and animals; however, experimental plantations have not affected recruitment after two years. In Sierra de Huautla, seed rain increased after two years of exclusion while recruitment was similar. Plantations have not affected seed rain and recruitment after two years but animals (ants, reptiles and rodents) showed higher abundance and richness in those exclosures with plantations. Even when no effect of plantations was apparent in vegetation dynamics after two years, animal presence was affected by the increase in biodiversity due to plantations. Attraction of animals to exclosures will increase vegetation dynamics in the near future when species in plantations start set fruits.

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Session 11: Modified forest ecosystems: linkages between dispersal, recruitment, and carbon storage can improve conservation
- TalkT11-04

Seed dispersal syndromes and plant regeneration in highly diversified shaded coffee plantations

E. Andresen & A.M. Clavijo-Gutierrez

Shaded coffee plantations are recognized worldwide as important agroecosystems for the conservation of biodiversity. We worked in organic plantations of shaded coffee in Cuetzalan, Mexico. We wanted to evaluate how many of the plant species present in coffee plantations are dispersed by animals vs. by abiotic vectors, and whether or not these plant species are regenerating naturally. We worked in 7 coffee plantations, establishing in each one 0.25 ha-quadrat for registering trees with DBH ≥10 cm, four 25 m2-quadrats for registering trees and shrubs with DBH < 10 cm and height ≥ 1 m, and twenty 1 m2-quadrats for registering woody seedlings < 1 m in height. Coffee plantations held an average of 94 trees belonging to 23 species in 0.25 ha. Of more than 70 tree species recorded in total, over 80% are adapted for seed dispersal by vertebrates. For about 60% of the tree species, farmers reported relying on natural regeneration. We will present data on saplings and seedlings to assess to what degree plant species with abiotic vs. biotic dispersal syndromes are regenerating successfully in this agroecosystem.

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Session 11: Modified forest ecosystems: linkages between dispersal, recruitment, and carbon storage can improve conservation
- TalkT11-05

The potential of plantations for bird conservation and natural forest regeneration

N. Farwig, N. Sajita & K. Böhning-Gaese

Tree plantations of native and exotic species are frequently used to compensate for forest loss in the tropics. Yet, these plantations may support lower species diversity and different communities than natural forest. To evaluate the potential of differently managed forest types for conservation of forest birds and indigenous seedling recruitment we studied structural characteristics as well as tree, bird and seedling communities in stands of natural forest, different types of tree plantations and secondary forest in Kakamega Forest, western Kenya. Forest types differed considerably in structural characteristics and tree species richness and composition. Accordingly, species richness and composition of the bird communities clearly changed between natural forest and plantations of single tree species. By contrast, seedling species richness did not differ among forest types and seedling communities were placed in closer proximity to each other and tended to be closer to natural forest communities than the respective adult tree communities. These findings demonstrate that natural forest areas are needed for the conservation of forest bird diversity, but that plantations with a mixture of indigenous tree species can have similarly high conservation value. Further, a convergence of monocultures to natural forests may take place but changes in the seedling species composition in the course of succession are also possible.

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Session 11: Modified forest ecosystems: linkages between dispersal, recruitment, and carbon storage can improve conservation
- TalkT11-06

Forest recovery in abandoned tropical pastures: generalists frugivores as ecological rock stars in plant-animal mutualistic networks

T.A. Carlo

Plant-frugivore relationships at community levels are now modeled as bipartite networks of interactions. These models predict that generalist frugivores are the backbone of mutualistic networks, making ecological communities more resilient to disturbances. However, this and other general predictions based solely on bipartite architectural network patterns are fundamentally untested, particularly in the face of forest destruction & regeneration dynamics. Here I examine a frugivory network in action during the early phases of forest recovery in abandoned tropical pastures in Puerto Rico. I use this system to test some of the main predictions o network models by confronting predictions with field data on frugivore behavior and seed dispersal across forest patches and abandoned tropical pastures. I conclude that bipartite network approaches often fail to identify the key frugivores that shape shrub and tree diversity in regenerating tropical forests.

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Session 11: Modified forest ecosystems: linkages between dispersal, recruitment, and carbon storage can improve conservation
- TalkT11-07

What makes Melia azedarach a successful invader? The role of seed dispersal in the invasion process

F.A. Voigt, N.Farwig, S.D. Johnson

Frugivorous animals facilitate the spread of invasive plants through seed dispersal. We evaluated the effectiveness of various frugivores as dispersers of the seeds of Melia azedarach, a highly invasive alien tree species in South Africa. During 264 hrs of observation, we recorded seven bird species and one bat species foraging on fruiting trees of M. azedarach. The most common visitors were black-eyed bulbuls (Pycnonotos barbatus) and fruit-eating bats, but both these species dropped nearly as many seeds as they dispersed. Knysna Louries (Tauraco corythaix) dispersed the highest number of fruits per minute, but occurred in low abundance. Individual trees appeared to vary in the palatability of their fruits to frugivores, with some trees being visited intensively, while others nearby were apparently never visited. Seed germination differed significantly between de-pulped fruits and untreated fruits after 2 months, but was similar after 4 months, thus spreading the seed shadow in time. Germination success did not differ between animal-handled and hand-depulped fruits. In contrast to the high germination success in the green house, seedlings showed very low recruitment in the field. Thus, M. azedarach seems to be dependent on frugivores (particularly black-eyed bulbuls and bats) for dispersal to suitable micro sites.

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Session 11: Modified forest ecosystems: linkages between dispersal, recruitment, and carbon storage can improve conservation
- TalkT11-08

How is Southeast Asian biodiversity coping in human-dominated landscapes?

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As governments in Southeast Asia (SEA) prepare their national reports on their progress towards achieving the 2010 Convention on Biological Diversity (CBD) target, how will they depict the conservation status of biodiversity in the region? Given the paucity of literature indicating stable or increasing populations, these national reports could project a bleak outlook for biodiversity in the region. Since 2001, large-scale species extinctions in SEA have been predicted to be in the offing. Has anything changed? In this review, we provide an update on the conservation status of SEA forest biodiversity by synthesizing recent reports documenting the effects of agricultural expansion, urbanization, logging and fragmentation on plants, invertebrates, vertebrates and ecosystem functions. Apart from identifying major emerging threats and future research needs in the region, we also provide conservation recommendations that can potentially mitigate the biodiversity crisis in SEA.

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Session 11: Modified forest ecosystems: linkages between dispersal, recruitment, and carbon storage can improve conservation
- TalkT11-09

Biodiversity conservation and carbon sequestration in secondary montane forests, Tanzania

T.H.Mwampamba, M.W.Schwartz & J.W.Six

Secondary forests present both an opportunity and a challenge in terms of how well they maintain the numerous attributes of primary forests that are valued by society, including ecosystem services. Naturally regenerating forests, in the form of fallows, are a prominent feature of the Eastern Arc Mountain (EAM) landscape, Tanzania, but are little studied and not well understood. They present low-cost opportunities for meeting multiple-objectives, including biodiversity conservation and sequestration of tradable carbon, C. We conducted a large-scale study in the EAM to investigate the potential of fallow vegetation to conserve tree diversity and sequester C. Soil and vegetation surveys were carried out in 127 (20 x 50 m) plots spanning 300 - 1600 m elevation gradient, representing a chronosequence of fallows (0 – 56 y) and 13 primary forest plots. Our results reveal that after 30 y of regeneration, overall tree diversity can recover (30 – 95%), particularly in lowland areas; that endemic tree diversity rarely recovers; that fallow vegetation is important for maintaining beta diversity at landscape level. Secondary forests accumulated high levels of C in aboveground biomass (3 to 25 Mg C yr-1) compared to models for the pan- and neotropics. No detectable patterns were discernible for soil C sequestration. Our findings suggest that C offset projects are a viable conservation-development strategy for the EAM if the opportunity costs of putting more land into long-term fallow can be kept low.

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Session 11: Modified forest ecosystems: linkages between dispersal, recruitment, and carbon storage can improve conservation - TalkT11-10

Rainforest restoration and carbon sequestration in eastern madagascar: Linking biodiversity conservation, Ecological functioning and sustainable livelhoods

R. Dolch

Since a long-time branded as synonymous with large-scale deforestation, Madagascar has recently embarked on a pilot project of large-scale forest restoration. The TAMS Project is located in the eastern rainforest biome of the country and focuses on restoration of the natural forest and the ecological functions associated with it. Supported by Conservation International and the World Bank, TAMS integrates habitat connectivity, carbon sequestration and sustainable livelihoods. It includes the human dimension and is based on indigenous knowledge. Rainforest restoration is achieved by selective planting of tree species that are attractive to seed dispersers such as birds, flying foxes and lemurs. Areas adjacent to restoration sites are being upgraded to species-rich agroforestry plots that focus on sustainable land use and maintaining of ecological functions. Increasing diversity of land use at both the local and landscape levels is hypothesized to positively affect biodiversity and ecosystem functions, as well as livelihoods. Consequences of rainforest restoration with respect to these three aspects are discussed.

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Session 11: Modified forest ecosystems: linkages between dispersal, recruitment, and carbon storage can improve conservation
- PosterP11-01

Effects of forest fragmentation on the reproductive success of Acanthus eminens (Acanthaceae) in Kakamega Forest, Kenya

N. Hasenbein & M. Kraemer

Disturbance and fragmentation are known to disrupt ecosystem processes. Genetic effects, changes in microclimate and shifting pollinator abundance and diversity may limit the reproductive success of plant species, which in turn might lead to the extinction of populations.We observed several populations of the shrub Acanthus eminens (Acanthaceae) in main forest and forest fragment populations in Kakamega Forest, Kenya. Flower phenology, flower density, population size, fruit set and seed set were recorded in all study sites.Moreover, we hand-pollinated 30 flowers in each population with pollen from a) the same population and b) another population of the same species. 30 additional flowers were left untreated.Results indicate that although Acanthus eminens seems not to be limited by pollinator visitation, genetic effects may decrease fruit and seed set in forest fragments, indicating an inbreeding depression and possibly threatening the continued existence of these populations.

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Session 11: Modified forest ecosystems: linkages between dispersal, recruitment, and carbon storage can improve conservation
- PosterP11-02

Impact of forest disturbance on seed predator diversity and seed predation pressure in coastal scarp forest in South Africa

A. Botzat, L. Fischer, E.L., Neuschulz, and N. Farwig

Forest fragmentation and disturbance can affect the regeneration potential of subtropical forests, e.g., by limiting seed dispersal and increasing seed predation. We studied the influence of forest disturbance on small mammal diversity and seed predation pressure along a forest disturbance gradient in coastal scarp forests in KwaZulu-Natal, South Africa. The gradient ranged from continuous natural forest over small natural forest islands, forest islands in agricultural matrix, secondary forest in game reserves, forest in eucalyptus plantations to farm gardens. We recorded species richness and abundance of seed predators as well as seed predation pressure. Additionally, we conducted seed predation experiments to assess whether seed predators also contributed to secondary dispersal of seeds. Species richness, abundance, and seed predator activity varied significantly along the forest disturbance gradient: they were highest in game reserves and forest islands in agricultural land and lowest in continuous natural forests. Small mammals acted as seed predators, as we did not record any caching of seeds. Predation rates will be compared to seed predator diversity and activity and consequences for forest regeneration will be discussed. It is critical for conservation management to understand how human-induced alterations in ecosystem processes, such as seed predation, affect biodiversity and ecosystem functions.

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Session 11: Modified forest ecosystems: linkages between dispersal, recruitment, and carbon storage can improve conservation
- PosterP11-03

Foundress composition of Ficus thonningii in a rain forest remnant and adjacent farmland in Western Kenya

Y. Hiller & M. Kraemer

The ongoing decline of rain forests leads to biodiversity loss and to modification of species assemblages and important ecosystem services. The species-specific interactions between Ficus and their pollinator wasps deserve extraordinary attention, regarding the key role of Ficus in the ecosystem. Each fig tree is dependent on tiny wasps, which pollinate the flowers inside the fig syconia. Here we present differences in foundress and, thus, pollinator composition along a gradient from forest interior to adjacent farmland. In Ficus thonningii Bl., three pollinator species were found to oviposit, either together or separately. Elisabethiella stuckenbergii deliberately acts as pollinator, whereas Philocaenus barbarus and Alfonsiella longiscapa pollinate only occasionally. E. stuckenbergii appeared mainly solitary inside the figs, whereas in cases where more than one foundress occurred, E. stuckenbergii was usually joint by P. barbarus. The main pollinator E. stuckenbergii was dominant in all habitat types. However, inside the forest, A. longiscapa was only rarely found, whereas its abundance highly increased with growing distance from the forest. The number of foundresses occurring in a fig was highest at the forest edge.

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Session 11: Modified forest ecosystems: linkages between dispersal, recruitment, and carbon storage can improve conservation
- PosterP11-04

Variation on phenology and fruit production between edge and interior of a cerrado sensu stricto savanna vegetation in Southeastern Brazil

M.G.G. Camargo & L.P.C. Morellato

Brazilian savanna is suffering an intense fragmentation process, exposing the remaining biota to edge effects that change abiotic conditions and plant community phenology. We evaluated changes in fruiting patterns and fruit production by dispersal syndrome across edge and interior of a cerrado savanna woody community in Southeastern Brazil. The individuals were sampled on edges and interiors of south and east sides of the study area, on 36 transects. We performed phenological monitoring, fruit counting and estimated fruit biomass, fortnightly during 17 months. There was no difference in fruiting pattern between edge and interior, both with seasonal fruit production, predominantly on the wet season for animal-dispersed fruits and on the dry or end of the wet season for wind and self-dispersed fruits. In the south side, the production of animal-dispersed fruits was greater in the edge, but this difference was more related to changes on species composition. Significant differences occurred between the east and the south habitats, because of the greater light availability on east side throughout the year. Studies aiming to evaluate edge influence in fragmented areas of cerrado should consider the variation of vegetation structure and luminosity, which is natural on this biome, but may be enhanced by fragmentation.

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Session 11: Modified forest ecosystems: linkages between dispersal, recruitment, and carbon storage can improve conservation
- PosterP11-05

A new method to track seed dispersal and recruitment using 15N stable isotope enrichment

T.A. Carlo, J.J. Tewksbury, & C. Martínez del Río

Seed dispersal has a powerful influence on population dynamics and community ecology. Yet, patterns of seed dispersal are difficult to measure due to methodological shortcomings in tracking dispersed seeds from sources of interest. Here we introduce a new method to track seed dispersal – stable isotope enrichment. It consists of leaf-feeding plants with sprays of 15N urea during the flowering stage such that seeds developed after applications are isotopically enriched. We conducted three experiments to field-validate the method. We show that plants sprayed with 15N urea reliably produce isotopically enriched progeny, and that δ15N of seeds/seedlings is a linear function of the dosages sprayed on mothers and that can be used to unambiguously differentiate offspring of labeled plants even after seeds are dispersed by birds. The high enrichment of seeds allows tracking not only where seeds arrive, but locations where seeds germinate and recruit. We also show that a mixing model can be used to analyze seed samples in bulk. We confirm that isotope enrichment combined with bulk-sampling is a cheap, reliable, and user-friendly method to estimate dispersal kernels empirically and to easily detect rare events such as long-distance seed dispersal.

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Session 11: Modified forest ecosystems: linkages between dispersal, recruitment, and carbon storage can improve conservation
- PosterP11-06

Spatial determinants of reproductive success in tropical forest trees

S.A. Queenborough, D.F.R.P. Burslem, N.C. Garwood, R. Valencia

There is an increasing awareness of the importance of spatial processes in tropical forest ecology. Amongst these processes is the effect of recruitment limitation on tree demography and forest dynamics. Temporal and spatial variation in seed production in individual frugivore-dispersed tropical trees is particularly poorly understood. Here we examine annual variation in seed production in co-existing populations of six closely-related tree species, and examine factors influencing their reproductive success.We studied how (i) resource availability (female size and local abiotic environment) and (ii) pollen availability (local male density and flower production) affected the reproductive behaviour and fruit production of 336 female Myristicaceae trees in six species over three reproductive episodes in an Amazonian lowland tropical rain forest. Additionally, we experimentally increased pollen availability to some individuals.Resources were significant determinants of the transition from flowering to fruiting. Female size (dbh) was a significant covariate of fruit production in most species. The relative importance of resource and pollen availability varied from year to year and between species. Species that differed in abundance and/or occupied different canopy strata had different reproductive strategies. The spatial and vertical pattern of individuals and their numerical abundance therefore have important implications for coexistence and conservation.

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Session 12: Tropical Research Station La Gamba (Costa Rica) – studying effects of global change on a regional scale
- TalkT12-01

Impact of climate change on the performance of tropical lowland forests in SW Costa Rica

Wolfgang Wanek, Sigrid Drage, Florian Hofhansl, Nina Hinko, Eva M. Pölz, Andreas Richter

Recent studies on the impact of rainfall seasonality and annual climate fluctuations will be presented and interpreted in terms of future responses of rainforests to climate change. El Nino Southern Oscillation (ENSO) strongly affects precipitation patterns in SW Costa Rica, with mean annual precipitation (MAP) ranging between 4700 mm (1997 El Nino) to 6500 mm (2007 La Nina) at the Tropical Station La Gamba. Seasonality was not affected by ENSO. Effects of MAP on net primary production i.e. wood increment and litterfall in the Esquinas rainforest were assessed. The effect was most pronounced in leaf litterfall in primary rainforests in valley bottom positions (primary ravine forest) being positively related to annual precipitation and in residual litterfall being inversely correlated. In contrast total fine litterfall was unaffected in primary ravine forests. Since leaf litter is more nutrient rich than residual litter (mostly woody debris) one can assume that aboveground nutrient cycling may be strongly positively affected in wet years promoting net primary production as a whole. This is though not evident in stem increments indicating lower woody biomass production in wet years. Moreover, major effects of land-use and topography on biomass pools, primary production and nutrient use efficiency will be demonstrated.

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Session 12: Tropical Research Station La Gamba (Costa Rica) – studying effects of global change on a regional scale - TalkT12-02

The Tropical Station La Gamba/Costa Rica ("Tropenstation La Gamba") – a place for scientific studies in the Neotropics

A. Weber

In this lecture, the Tropical Station La Gamba ("Tropenstation La Gamba") and its surroundings are presented in more detail. The Station, run by a private association but being closely connected to the University of Vienna, serves three main purposes: (1) Research in tropical biology and other scientific disciplines, (2) Teaching of university students (excursions, courses, and lectures), (3) Teaching of biologically interested laymen. The surroundings of La Gamba host a broad spectrum of natural habitats in terrestrial and aquatic settings, which are embedded in a matrix of different land use. Therefore, the station could develop as base for studying the impact of global change and the effects of complex interactions between rainforests and the adjacent cultural landscape on tropical ecosystems.

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Session 12: Tropical Research Station La Gamba (Costa Rica) – studying effects of global change on a regional scale - TalkT12-03

The importance of small gallery forest strips for maintaining biodiversity – case studies from a human-dominated landscape in southern Costa Rica

B.S. Seaman, H. Binz, F. Hofhansl, I. Riedl, S. Schneeweihs & C.H. Schulze

Small riparian forest strips against soil erosion are a common landscape structure in many largely deforested tropical landscapes. Using birds, butterflies and dragonflies, we studied the importance of such forest strips, embedded in a human-dominated countryside, for maintaining biodiversity and to act as corridors for forest species in the Pacific lowlands of southern Costa Rica. All taxonomic groups were surveyed at forest sites as well as in gallery forests connected to remaining forest and isolated gallery forests. Point counts and mist-netting were used to inventory bird assemblages; butterflies and dragonflies were recorded by transect walks. The capability of gallery forests to act as corridors for forest species differed prominently between taxonomic groups. While species richness of forest birds and dragonflies decreased dramatically from forest habitats towards connected and even more pronouncedly towards isolated gallery forests, forest butterflies proved to reach similar species richness in gallery forest strips compared to forest interior and forest margin sites. In general, although acting as a filter for a major proportion of forest birds, dragonflies and butterflies, our studies emphasize the potential of such landscape structures for connecting remaining forest fragments and increasing the permeability of human-dominated landscapes for forest species.

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Session 12: Tropical Research Station La Gamba (Costa Rica) – studying effects of global change on a regional scale - TalkT12-04

Neotropical Rainforests: Nutrient Export by Rainforest Streams

F.Schiemer & M.Fordinal

The paper provides a survey of the overall hydro-geochemical conditions of the Esquinas river catchment in context of its complex geology and land use pattern. The geochemical signatures of the different tributaries show a close spatial relationship with the geology. A similar pattern is evident with regard to plant nutrients, nitrate, phosphate and silicate. A more detailed analysis of nutrient dynamics shows clear differences in the retention of P and N by the rainforest system. The relationship between nutrient concentrations and flow was analysed for two streams of different stream order. These analyses allow the calculation of the total nutrient loss from the catchment and a discussion of the potential consequences of the change in runoff patterns due to climate changes.

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Session 12: Tropical Research Station La Gamba (Costa Rica) – studying effects of global change on a regional scale - TalkT12-05

Mycelial carton galleries of Azteca brevis (Formicidae) in Southern Costa Rica and the impact of global change

V.E. Mayer, H. Voglmayr & G. Windischbauer

Azteca brevis (Formicidae, Dolichoderinae), an arboricolous ant living on branches of Tetrathylacium macrophyllum (Flacourtiaceae) cultivate fungi for reinforcement of the walls of nest constructions or of tunnel-shaped runway galleries. These fungi are grown on organic material like bark, epiphylls or trichomes forming stable "carton structures". The molecular investigation of the fungi found on the Azteca brevis carton revealed, that a complex association of several fungi is involved. All fungi isolated were unequivocally placed within the Chaetothyriales. Whereas the New World Attini with their highly specialised one-to-one (one ant species – one fungal cultivar) pattern, and temperate Lasius with a one-to-two (one ant species - two mutualists) or many-to-one (different ant species share the same mutualist) system, the Azteca brevis-fungi association is a one-to-many multi-species network. Experiments with Atta workers placed on T. macrophyllum branches covered with a carton tunnel inhabited by A. brevis revealed that the numerous small holes which perforate the carton tunnels allow a highly advanced group ambush strategy to chase prey and to defend the colony. In field observations it was observed that the construction of the galleries is dependent on regular precipitation and dramatically declining during dry periods. Increasing drough may, therefore, disrupt this interesting system.

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Session 12: Tropical Research Station La Gamba (Costa Rica) – studying effects of global change on a regional scale - PosterP12-01

The importance of gallery forests in the tropical lowlands of Costa Rica for understorey forest birds

B.S. Seaman & C.H. Schulze

Rivers and streams lined by narrow forest strips are common in the lowland countryside of Southwestern Costa Rica. We studied the importance of these gallery forests for birds, especially forest species. Using mist-nets, we captured 1110 birds belonging to 90 species between June and September 2007 at sixteen sites spread equally over four habitat types: forest interior, forest margin, gallery forest connected to closed forest, and isolated gallery forest. Though isolated gallery forests had the greatest number of expected species in total, they supported the lowest number of forest specialist species, lower even than connected gallery forests. The studied habitats differed from each other in their faunal composition. There was no significant difference in the proportion of birds with brood patches or of recaptures across the studied habitat types, leading to the assumption that birds not only use gallery forests for movement and foraging but also for reproduction. Though of limited conservation value for most forest understorey birds, at least for a small fraction of forest species gallery forests constitute an important secondary habitat. Furthermore, they can form corridors or stepping stones that allow movements within the matrix of human-dominated habitats, and benefit total bird species richness in the Costa Rican countryside.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - TalkT13-01

How much of the Atlantic Forest is effectively conserved?

A. Diederichsen; J. Guimarães, J. Touval, L. Sotomayor, A. Freitas, A. Machado, M. A. Gonçalves

It is essential that decision makers understand the current status of conservation in the Atlantic Forest (AF), based on the biome's land protection initiatives (public and private protected areas (PA)). The Nature Conservancy (TNC) has built a framework (Ecoregional Status Framework) to measure the state of conservation for South America. Under this framework, conservation is defined by places where we find viable biodiversity (V), an acceptable level of threat (T), and adequate level of conservation management status (CMS) to abate threats. Viability includes landscape context (20km buffer) and size of individual ecosystem occurrences. Threats include land conversion, grazing and five others. Conservation Management Status includes intent for which an area is protected, the duration of the protection agreement, and potential for providing effective management for each PA. These factors were combined according to the equation that Conservation = V*(T+CMS). AF´s results show that, out of 2.056.682 hectares of public PA CMS analyzed, 43% have acceptable governance, only 17% have acceptable planning frameworks, and 24% have acceptable resources. AF has 5.383.476 hectares in viable conditions (4,4% of the AF). The next step will be to calibrate viability parameters according to the AF scientific literature review to increase the analysis accuracy.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - TalkT13-02

Uncontrollable hunting, extinctions and the disappearance of unknown mammal species: scenario and perspectives of a hotspot's hotspot (Pernambuco Endemism Centre)

A.R. Mendes Pontes, R. Gadelha, E.R.A. Melo, A.C.C. Loss, Y.L.R. Leite

Although considered as a hotspot's hotspot, 98% of the Pernambuco Endemism Centre has been destroyed. Most of the fragments have not more than 10 ha, are all isolated in a hostile sugar-cane matrix, and no longer have a font forest fragment or pristine forest. During a decade I carried out systematic line transect surveys in 27 forest fragments of all sized classes available in the CEPE. In this scenario, uncontrolled hunting has caused the regional extinction of all large and most medium-sized mammals (n=18, 47,4%), the fauna is simplified and homogenised, abundance is below minimum viable populations, and only three smaller generalist species will comprise the 21th century fauna of this hotspot. Contrastingly, at least two new species have recently been discovered in these highly-threatened small forest fragments, and at least another three are being thought after. In situ protection of these small fragments is inexistent and will only be possible if, as an urgent task, active guard patrol of each forest fragment are demanded by decision makers, who in turn have to provide incentives for such investment.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - TalkT13-03

Use of wood products for domestic purposes in an Atlantic Forest area, Northeastern Brazil

P.M. Medeiros, T.C. Silva, A.L.S. Almeida & U.P. Albuquerque

This study highlights the most intensively used wood species and their most important use-categories in the community of Três Ladeiras, located in an area of Atlantic Forest fragments in northeastern Brazil. Wood products were inventoried and their volumes were estimated for sixty-two households. One respondent per household indicated the average turn-over time for each use (e.g.: house poles, firewood, chairs). Data about use-categories (construction, fuelwood, and technology) were analyzed statically (wood volume in the households) and dynamically (wood volume divided by turn-over time). Static analysis found a higher wood volume for construction (91.5 m³) compared to fuelwood (20 m³) and technology (6.2 m³). But, as average turn-over time was much shorter for fuelwood than it was for technology and construction (56 days, 4.5 years and 17 years respectively), about 90% of consumed wood is applied as fuelwood (190 m³/year). Species with higher stored volumes were Eschweilera ovata (Cambess.) Miers (22.3 m³) and Pogonophora schomburgkiana Miers ex Benth. (4.9 m³). P. schomburgkiana and Byrsonima sericea DC. were the most demanded for fuelwood. These species may be included in local reforestation programs. Also, conservation efforts shall be directed to fuelwood use-category, by firewood optimization or replacement with cooking gas.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - TalkT13-04

Domestic dog (Canis lupus familiaris) invasion in the Atlantic Forest: which factors determine the presence and frequency of occurrence in the remnants?

K.D. Espartosa & R. Pardini

Although domestic dogs are frequently found inside Atlantic Forest remnants and represent a risk to the local fauna through infectious disease transmission, predation and competition, few studies focused on the understanding of the factors that influence and facilitate their entrance into forest remnants in an anthropogenic disturbed landscape. In this study, using standardized surveys with camera-trapping in 24 Atlantic forest remnants, we compared the fit of a null model with that of models that combine variables such as forest amount and quality, density of domestic dog in the remnant's surroundings, and extension of roads, to explain domestic dog distribution inside remnants. Domestic dogs were more frequent than seven of the 11 native species; their occurrence was better explained by the amount of dogs in the surroundings and its frequency of occurrence by the reduction in the amount of forest in the surroundings. Our results warn for the high proportion of domestic dogs in relation to native species inside forest remnants, for the need of population control of this invasive species, especially in rural landscapes to minimize its occurrence inside native forests, and for the importance of fragmentation, which facilitates visitation by domestic dogs.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - TalkT13-05

Species and functional diversity of ants in tropical secondary forests

J.H. Bihn

Secondary forests increasingly dominate tropical wooded landscapes in place of primary forests. The potential effect of biodiversity loss in secondary forests on ecosystem functioning depends largely on the associated loss in the functional diversity of animal and plant assemblages. I investigated how changes in the species diversity of ground foraging ant assemblages translate into changes of functional diversity along a successional gradient of secondary forests in the Atlantic Forest of Brazil. Ants were sampled in four successional stages of forests and the functional diversity of ants was analyzed based on four functional traits related to resource use of ants: body size, relative eye size, relative leg length and trophic position. There was a strong and linear relationship between species and functional diversity with no evidence for saturation in this relationship. Recovery of species richness and diversity of ant assemblages in tropical secondary forests were accompanied by a proportional increase of functional richness and diversity of assemblages. The observed loss of both species and functional diversity in secondary forests offers no reason to believe that the ecological functions provided by secondary forests are buffered against species loss through functional redundancy.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - TalkT13-06

Variety matters: Immune gene diversity and parasite burden in two marsupial species from the Brazilian Atlantic forest

Y. Meyer-Lucht, C. Otten, T. Püttker, R. Pardini & S. Sommer

In a rapidly changing world genetic variation is essential to cope with omnipresent environmental challenges and diseases. Thereby variation in immune genes, such as genes of the major histocompatibility complex (MHC), might be of particular importance. In marsupials, there is very little knowledge about natural levels and functional importance of MHC variation, despite their key role in mammalian evolution. We compared two species of mouse opossums (Gracilinanus microtarsus, Marmosops incanus) inhabiting fragments of the Brazilian Atlantic Forest in terms of MHC class II diversity and parasite burden. The species differ in their tolerance to habitat fragmentation, and we discovered remarkable differences in the MHC diversity: G. microtarsus showed high and M. incanus low levels of MHC diversity. We tested two contrasting scenarios including parasite burden that might explain these differences in MHC diversity. We predicted that a species with low MHC diversity would either be under relaxed selection pressure by low parasite diversity ('Evolutionary equilibrium' scenario), or there was a recent loss in MHC diversity due to a bottleneck leading to a lack of resistance alleles and increased parasite burden ('Unbalanced situation' scenario). Parasite diversity did not markedly differ between the two host species. But we did observe considerable differences in the parasite load (parasite prevalence and infection intensity): while the species with low MHC diversity, M. incanus, revealed very high parasite load, G. microtarsus showed a tenfold higher MHC diversity and lower parasite burden. These results support the second scenario of an unbalanced situation in M. incanus.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - TalkT13-07

Litterfall, litterstock and litter decomposition in the Atlantic Rainforest of Parana State, Brazil

Dickow, K.M.C.& Marques, R.

The work presented here is part of the SOLOBIOMA Project, Mata Atlântica Program (BMBF/DLR – CNP/ASCIN). The aim of this research was to evaluate litter production, litterstock and litter decomposition in different stages of forest regeneration in the Southern Atlantic Rainforest of Brazil. Three plots were installed in the forest, representing different regeneration stages, called Initial, Medium and Advanced stages. At each plot litterfall was retrieved every 21 days. Average litter production was above 5 Mg.ha-1.year-1. The production of litter leaves reached 73,2% of the total litterfall, followed by miscellaneous materials (12,6%), twigs (11,1%), and reproductive organs (3,1%). In parallel, we studied litter decomposition through the evaluation of the litterstock, collected every 6 weeks during a 1-year period. For the assessment of litter decomposition of specific tree leaves, we carried out a “litterbag” experiment during one year. Specifically, decomposition rates of Tibouchina pulchra and Sloanea guianensis leaves were evaluated. The highest litter production was observed during spring. Annual decomposition rates (k) of T. pulchra and S. guianensis leaves were of 2.74 and 1.18, respectively. Therefore, leaf decomposition of T. puchra was more than two times faster than leaf decomposition of S. guianensis.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - TalkT13-08

Fragment size effects on Cecropia species in the seed rain of northeastern Brazilian Atlantic Forest fragments

U.C. Knörr, D. Piechowski, G. Gottsberger

Fragmentation can lead to alterations of biological processes. We aimed to evaluate the impact of habitat fragmentation on the seed rain in different-sized forest patches. Some functional groups of seeds/fruits might be advantaged in small fragments because of their dispersal mode and size. Especially, the pioneer tree species of the genus Cecropia were hypothesized to profit from the high edge/interior ratio of small forest fragments due to their ability to establish rapidly at disturbed sites. We installed 105 seed traps in 7 different-sized fragments and compared the number of Cecropia fruits (kernels) collected in a one-year period. In fact, we found continuously more Cecropia fruits in small patches. The mean number of fruits per trap was 17 times higher in small (< 30 ha) than in large fragments (>300 ha) during the fruiting peak of 2008. The preference of common marmosets (Callithrix jacchus) in small forest fragments might be a reason for this inequality since these primates are an important disperser of Cecropia in this region. These results demonstrate cascading anthropogenic caused effects of forest fragment size.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - TalkT13-09

Comparing the use of species and landscape structural measures as indicators of ecological integrity

C. Banks, R.M. Ewers, V. Kapos, A.C. Martensen & J.P. Metzger

The use of indicators for assessing and monitoring the status, condition or conservation value of a given landscape has been attacked on several grounds, but nonetheless retains appeal as no more parsimonious approaches exist. Among the many variants, two indicator strategies stand out: the use of indicator species or of measures of landscape structure. Here, our goals were to contrast the advantages and disadvantages of these two approaches by: (1) comparing the effectiveness of species-based and structural-based indicators at regional vs. landscape spatial scales; (2) assessing how changes in data resolution (abundance vs. presence-absence data for indicator species, and coarse vs. fine pixel size for structural indicators) would affect these results; and (3) quantifying the degree to which indicators that are generated in one landscape can be transferred to additional landscapes. We used data from more than 7000 birds captured using mist nets in 65 sites from six landscapes in the Atlantic Forest of Brazil. Our results showed structural indicators performed better, were less variable and more transferable across landscapes and across scales than indicator species. We propose that landscape structural indicators might be the best, simplest to implement, and cheapest strategy for monitoring community composition changes.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - TalkT13-10

The BIOTA/FAPESP Program: a well succeeded Brazilian experience to use scientific data to improve biodiversity conservation and restoration within the Atlantic Forest domain in SE Brazil

C.A. JOLY; R.R.RODRIGUES; J.P. METZGER & L.CASATTI

Since 1999 the BIOTA/FAPESP Program (www.biota.org.br) has been working to inventory and characterize the biodiversity of the State of São Paulo. In ten years, with an annual budget of approximately US$ 2.000.000,00 the Program supported 90 major research projects - which trained successfully 150 MSc and 90 PhD students, produced and stored information about approximately 12.000 species and managed to link and make available data from 35 major biological collections.

During 2007/08 the BIOTA/FAPESP researchers, in collaboration with the State of São Paulo Secretary for Environment/SMA and Conservation International, made an extraordinary effort to synthesize its databank in a book and set of 8 maps of biodiversity conservation and restoration priority areas in Sao Paulo state.

This effort allowed the use of 55,539 registers of 5,463 species of plants, 1,815 & 433 spp Cryptogams, 8,062 & 149 spp Mammals, 19,742 & 523 spp Birds, 431 & 81 spp Reptile, 15,351 & 162 spp Amphibians, 11,620 & 350 spp Fishes, in combination with landscape structural parameters and biological indexes, to establish priority areas not only for conservation but also for restoration. These maps were officially adopted by the State's government as the legal framework for biodiversity conservation.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-01

Is the palm community a good indicator for altitudinal zonation in the Atlantic Rain Forest?

S.T.V. Fisch

The official classification system for the Brazilian vegetation identifies four altitudinal divisions to Atlantic Rain Forest (lowland forest up to 50m, submontane forest 50-500m, montane 500-1200m and upper-montane >1200m). The objective was to investigate if the palms, recognized by its occurrence limited by the highest elevations, can be used to confirm these vegetation zones. The surveys were made in 3 phytophysiognomy (lowland, submontane and montane), in Serra do Mar-Brazil. In these areas 11 species occurred, some of them (Euterpe edulis and Geonoma gamiova) were found in all zones. For submontane and montane forest it has been observed restricted occurrence of two species, Bactris hatschbachii and Geonoma schottiana, respectively. The palms Syagrus pseudococos and Geonoma elegans had been affected by the elevation and they didn't occur in the montane forest. It was observed the reduction of the richness with the elevation, but the density of palms increases in the montane forest, mainly E. edulis and G. gamiova. Probably they occupied the niche opened by the disappearance of the sensible species. It is considered that due the sensitivity to the strict ranges of temperature some palms are good indicating of the zonations and can be useful for studies of climatic changes.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-02

Chromosomal evolution in mountainous rock outcrops from Brazil

E. R. Forni-Martins, I. R. Costa, C. F. Verola & J. D. Urdampilleta

The main rock outcrops in SE Brazil occur at 900-2500 m.a.s.l. in the ranges of Espinhaço and Mantiqueira as relicts of grassland/shrubland scattered in the threatened Brazilian Cerrado and Atlantic Tropical rainforest biomes. Experiencing poor soils and daily extreme temperatures, they have a peculiar flora with high level of endemism, among which Myrtaceae, Orchidaceae and Sapindaceae are important components. These families are widespread in Neotropical forests and all Brazilian biomes, besides having high taxonomic complexity with hybrid species. We carried out chromosome counts for 80 species of Myrtaceae, 17 Sapindaceae and 12 Orchidaceae. We found 16 pairs of cytotypes and five different ploidy levels (2x, 3x, 4x, 6x and 8x) distributed in six genera: Eugenia (6), Myrcia (1) and Psidium (1) – Myrtaceae; Hoffmannseggella (5) – Orchidaceae and Paullinia (2) and Urvillea (1) – Sapindaceae. The greatest ploidy levels in Myrtaceae and Orchidaceae were found in high altitudes of Espinhaço and Mantiqueira ranges, whereas Sapindaceae species have the highest ploidy levels in lower altitudes in the Tropical Atlantic rainforest. Bromeliaceae, Velloziaceae and Xyridaceae also have highly poliploid species in these two contrasting environments, and investigations aiming to explain the origin of polyploid cytotypes in these contrasting environments are necessary.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-03

Litter decomposition in the Atlantic Forest

U.C. Gießelmann, P. Schmidt, K. Geronazzo Martins, M. Brändle, H. Höfer, R. Marques

As part of the SOLOBIOMA project two litterbag experiments were conducted in the highly species-diverse Atlantic Forest/Brazil. First, effects of litter mixing and invertebrate activity on decomposition rates were investigated in an advanced secondary forest stage (35-55 years after pasturing). Mixtures with two, four and six species were created by random draws from a species pool of eight native tree species. Interactions between mixture effects and fauna activity were investigated by invertebrate exclusion using two different mesh sizes. Second, the decomposition rates of a litter mixture of four native plant species were compared between four regeneration stages (8, 15-20, 35-55 and > 100 years after pasturing; three replicates each) in two different forest reserves 30 km distant from each other (24 sites in total). The first experiment showed an effect of litter mixing on decomposition, but only due to the composition of mixtures. The number of litter species had no influence. Furthermore, there was no consistent effect of invertebrate activity on the decomposition of the different mixtures. In the second experiment there were differences in decomposition rates between both forest reserves, whereas no differences occurred between successional stages.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-04

Spatial and seasonal variation in niche partitioning between blue manakin (Chiroxiphia caudata) and greenish schiffornis (Schiffornis virescens) in southeastern Brazil

E Hasui, V. S.M. Gomes, M.C. Kiefer, J. Tamashiro and W.R.Silva

The diet of Chiroxiphia caudata and Schiffornis virescens were studied over three years in four forest sites in the southeastern Atlantic Forest of Brazil. Theory suggests that coexistence of similar species is possible by resource-use differences. To test this, patterns of niche overlap and niche breadth in diet were measured at different seasons and forest sites, based on fruit morphological traits and plant life forms. The results suggest seasonal and spatial variation in resource partitioning. During periods of high fruit availability, there was no evidence of fruit trait selection. In contrast, during periods of fruit scarcity in primary forests, there were evidences of niche partitioning, where C. caudata foraged for larger fruits in canopy and S. virescens searched for understory plants. The niche overlap was higher in secondary forest during periods of scarcity, when both species used small understory fruits.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-05

Habitat Fragmentation: Impacts on Mutualistic Interaction Networks

R. C. Rodrigues and E. Hasui

Fragmentation has resulted in great changes in species composition, habitat structure and ecosystem processes. There is increasing concern that this process may strongly affect species interaction, including those among plants and pollinators and seed dispersers. Here we examine the effect of landscape configuration (percentage of landscape) and structure (patch size, isolation, core area and shape) in the patterns of mutualistic interactions networks (parameters: Nestedness and Connectance). We studied plant-pollinator and dispersal interactions between birds and plants in six Atlantic Forest remnants and used these data to construct plant-animal interaction networks. The results from simple linear regression models suggest that the patch isolation was positive related with the Nestedness of interaction network, by increasing the interaction among some generalist species. The anti-nested pattern was found in lower percentage of landscape. The patch shape marginally interfered in the Connectance, mainly because non-forest or edge species were included in the network, which increased the matrix size and consequently the community complexity. In this case, the irregularity of patch shape should increase the edge effect and favored the movement into the forest of bird species typically associated with disturbed habitat. Thus, specific landscape strategies should be applied if we are planning the conservation of interaction biodiversity.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-06

Differences on allochthonous matter input in adjoining pools of an Atlantic Rain Forest stream (Paranagua, Brazil)

C.R. Jonck & J.M.R. Aranha

Due to the importance of allochthonous organic matter to headwater stream dynamics we quantify the riparian vegetation input, identifying differences caused by its destruction and potential effects on the biological community. The allochthonous organic matter was sampled in a degraded area and another minimally disturbed area in Ribeirão stream. Four data collections (two in spring and two in summer) were performed in each area. The material was sampled with 12 plastic trays of 97.5cm², fixed with 70% alcohol, sorted out under the stereomicroscope, dried in oven at 60°C for 48h and weighed on a precision scale with resolution of 0.001g. Comparisons between areas were made with t test (student) using statistical significance α=0.10. The allochthonous matter intake was 2219.23mg/m² on the reference study site and 517.84mg/m² on the degraded site (P=0.0914), both showing more than 97% of vegetable material. According to our results, weather variations affect the daily dynamic of allochthonous material input in streams, which seasonally, follows the forest's leaf drop dynamic. Disregarding changes on the organic matter retention dynamic, we can infer a reduction in the substrate availability as food and shelter for the biota, resulting in simplification of stream biodiversity in the degraded site.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-07

Small scale structure and dynamics in the Atlantic rainforest – Implications on understorey light fluctuation

A. Lindner & D. Sattler

Fluctuation of light availability in the understorey is an important component for understanding the complexity in vegetation regeneration and succession of tropical forest ecosystems. The effect of small scale structure dynamics of forest stands and their canopies on spatiotemporal heterogeneity of understorey light availability was assessed by this study.Forest structure and woody species composition in combination with canopy structure parameters and understorey light availability were measured in three investigation plots in the Atlantic rainforest of southeastern Brazil. Sampling took place during two periods to check on interannual differences of canopy conditions and light availability.All plots differed considerably in species composition. Forest structure and canopy openness varied between different plots. Whereas no differences in leaf area index and light availability was found during the same sampling period.Interannual differences were identified for leaf area index and canopy openness, but never in conjunction. This emphasises the non-linear relation between both factors. Interannual differences in light availability on the other hand were only identified in combination with significant canopy openness changes. In this context interannual light fluctuations in the understorey of the Atlantic rainforest are substantiated and canopy openness seems to be the determining factor of such dynamics.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-08

Long-term effects of landscape modification on birds and small mammals in an Atlantic Forest region (SE Brazil)

P.K. Lira, R. Pardini & J.P. Metzger

Time-lags between landscape modification and species response are widely recognized, but the ecological mechanisms involved in these responses are still poorly understood for animal species. In order to relate time-lag response with life-history characteristics, 26 birds and eight small mammals' species were analyzed in 17 and 20 Atlantic Forest fragments, respectively. We evaluated past and present-day landscape structure around each sampling site using forest cover maps of three different dates. For each date, landscape metrics representing forest cover and aggregation were estimated, and the influence of past and present-day structure on species abundance were analyzed using a model selection framework. There is a large variation regarding the influence of landscape structure on species abundance, including species not sensitive to landscape structure, species sensitive to present-day landscape structure, species sensitive to past landscape structure and species sensitive to past and present-day landscape structure. Life-history characteristics investigated, such as: endemism, forest-dependency, vulnerability to fragmentation and others, had a limited capacity to discriminate species according to their response to past or present-day landscape structure. Only forest-dependency explained partially the different responses of small mammals' species. These results suggest that time-lag responses are controlled by more complex processes, which are still to be revealed.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-09

Biogeographic processes are different in the herb layer and trees above: Evidences from the southern and southeastern Bazilian Atlantic Forest

L.T.Vieira & F.R.Martins

The Brazilian Atlantic Forest sensu lato is constituted by three main vegetation types grading into one another in gradients associated mainly with rainfall and temperature. Since herbs in the forest floor are finely tuned to their special environment, we asked whether changes of the forest type above them would be enough to change their flora equally. We tested the hypothesis that the herb layer flora varies in gradients similar to those of the tree flora.Using metadata of Southern and Southeastern Brazilian Atlantic Forest fragments, we computed 947 herb species in 41 sites classified as Lowland, Submontane and Montane Rainforest, Mixed Rainforest and Seasonal Forest. We considered a binary matrix of 304 species from 39 sites and performed DCA, NMS, CCA, UPGMA, and TWINSPAN.All analyses distinguished three floristic centers for the herb layer species: Seasonal Forest, Lowland Rainforest, and Upland Rainforest (Submontane and Montane forests together). The herb layer flora and the trees above have different patterns: whereas the tree flora varies in gradients, the herb layer flora has distinct floristic centers. This might indicate that the herb layer species are very specialized and that they were subjected to different biogeographic processes from those acting upon the tree flora.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-10

Carbon stocks and forest dynamics based on monitoring data in Atlantic Rainforest areas

T. I. F. Metzker, T. Spósito & Q.S. Garcia

Tropical Forests are considered to be the great biodiversity epicenter and they work as important climatic change rate modulators. Recent studies suggest a speed up process in the last decades due to forest insemination caused by CO2 increase. This study aims to evaluate four years of changes in forest dynamic patterns through Permanent Monitoring Plots of Brazil's Atlantic Rainforest Hotspot. The average stem density increased from 525 (±99) to 529 (±99) individuals per hectare. In primary forest plots the aboveground dry biomass shows an increase of approximately 2%. The average growth rates of individuals from RDSP have increased throughout time reaching 0,21 cm per year. At the present time these environments seem to show an increase of the forest dynamic processes evidenced by the increase of recruitment, mortality and turnover rates. After the results released by IPCC in 2007, the concern for conservation and management of tropical forests was intensified. Monitoring data provide subsidies for understanding the dynamics of forest communities, where changes in forest patterns can be early identified and management strategies can be developed. This data can still be used to elect forest conservation for CDM or REED projects, where allocated financial resources can be applied exclusively on the preservation of these environments.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-11

Demographic Effects of Habitat Fragmentation on a Tropical Palm

R.C.Q. Portela, E.M. Bruna & F.A.M. Santos

In a highly impacted tropical forest, we compared the population dynamic of Euterpe edulis in a bigger fragment that is protected for harvesting to that in three smaller fragments where harvesting has occurred. Palms were censused in nine 30 x 30 m plots in each forest fragments from 2005 to yr 2007. Each individual was assigned to one of the five class stages. We compared the asymptotic growth rate (λ) between the fragments, and to quantify the contribution of each lower level vital rate to the observed differences in λ, we used a fixed-design LTRE. Euterpe edulis populations in the protected area are projected to shrink at rates of 4.54 to 12.6 percent per yr and the populations of the three smaller fragments are projected to growth at rates of 3.44 to 9.43 percent per yr. Our LTRE analysis revealed that the generally upper λ in the smaller fragments was due primarily to great survival of immatures and reproductives in both transitions yr. We found that the capuchin monkey pressure on the later classes killing a great number of immatures and the density dependence effects in the growth and survival of E. edulis may are causing the differences between the areas.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-12

Edge of forest fragments: abiotic and biotic factors and seedlings mechanical damage are always different from the interior?

Marques, T. E. D.; Ramos, F. N. & Beijo, L.A.

The scope of this work was to answer the following question: Are there differences between the edges and fragment interior on (1) environmental descriptors (open canopy, temperature, soil moisture, bamboo and liana covers and litterfall), (2) the total number of seedlings damaged and (3) damage type to the seedlings. This study was carried out on 4 Atlantic Forest fragments in Brazil. The environmental descriptors were measured in ten 10 x 10m plots in each forest fragment: 5 plots at the edges and 5 inside. Ten artificial plants were installed in the same plots, having their damage monitored. Litterfall was the main cause of seedling damage in the present study. Bamboo and liana coverage, litterfall, soil moisture, canopy openness, minimal and maximal temperature, as well as damage types and quantity did not differ between the edges and fragment interior. Temperature amplitude, however, was higher in the interior than in the edge fragments. The inexistence of differences between the edge and interior fragments was probably due to the reduced size of the remnants of the Atlantic forest studied; the intense internal activity of anthropogenic actions on them and the older fragmented time of landscape in which they are inserted.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-13

Balancing natural and agricultural systems in the Atlantic Rainforest of Brazil

Juan Carlos Torrico Albino

The aim of this work was to find ways of balancing natural and agricultural systems in the Atlantic rainforest of Brazil. Trade-offs and synergies were analyzed. We propose six hypotheses related to; (i) the contribution of agricultural systems to biodiversity conservation, (ii) the agricultural and natural mosaic in the landscape, (iii) the agriculture as consumer and producer of energy, (iv) the eco-volume as parameter to measure ecological functions, (v) the environmental impacts, quality of inputs, and sustainability, and (vi) the measurement of resilience in natural and agricultural systems. Energy and emergy analysis, agro-biodiversity assessment, eco-volume, biomass partitioning, cost benefit analysis, surveys, and case studies were used as methodologies during 24 months of field work. The identified agricultural and natural systems were: (i) vegetables systems (leaf, fruit and mixed vegetables); (ii) citrus; (iii) ecological; (iv) cattle, (v) sylvopastoral, (vi) forest fragment and, (vii) forest in regeneration stage (1, 2 and 3 years old)

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-14

Aboveground biomass change in Brazilian Atlantic Forest plots

L.F. Alves, S.A. Vieira, M.A. Scaranello, P.B. Camargo, L.A. Martinelli & C.A. Joly

Long-term monitoring of permanent forest plots has been recognized as a key factor to quantify changes in carbon stocks of tropical forests, as a response to global change. Using inventory data from a network of 10 1-ha forest plots across the Brazilian Atlantic Forest, we assessed changes in aboveground biomass for trees and palms ≥ 4.8 cm dbh across a two-year study period. Annual increments in aboveground biomass (AGBi) were determined as the sum of the individual dbh increments of stems measured after two years. Net changes in AGB included: AGBi plus recruitment and losses to mortality. All forest types accumulated biomass over two years, and we found a shifting balance in carbon allocation to larger trees. AGB losses through mortality were high for small trees (< 10 cm dbh), but larger trees ≥ 50 cm dbh accumulated ca. 80% of AGB. Our observation of increasing biomass (consistent with an overall increase in aboveground biomass in tropical forests) may be a response to undetected past disturbance, but alternative explanations cannot yet be discarded. Changes in increment growth might be associated with regional climate, or directly correlated with rates of N and P uptake by the vegetation.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-15

Small populations in fragmented landscapes: A long-term study of the opossum Micoureus paraguayanus populations in Atlantic Forest fragments

C.S. Barros & F.A.S. Fernandez

A long-term demographic study on a metapopulation of the marsupial Micoureus demerarae was carried out in a fragmented Atlantic Forest landscape, Brazil. Data were obtained from a capture-mark-recapture study in a set of eight small (1.2-13.3ha) forest fragments at Poço das Antas Biological Reserve, Rio de Janeiro state. The demography of three populations had been studied in detail. The populations showed small sizes, seldom exceeding 20 individuals. Population densities did not differ significantly among fragments, but they were higher than usual densities in non-fragmented areas. Breeding was seasonal, with reproductive activity in the months of the wet season. Significantly biased sex ratios were found in all populations, in both directions and in different periods. In two populations, there was a significant bias towards females when wet seasons were exceptionally dry. One population increased after a fire severely hit the fragment. Another shrinked coincident with the increase in captures of Didelphis aurita, which may be due to a competitive or predatory interaction between the two species. M. demerarae benefit from fragmentation as it is well adapted to habitats disturbed by edge effects.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-16

Does forest fragmentation have an effect on flower, fruit, and seed production of Paypayrola blanchetiana (Violaceae)?

M. Braun, D. Piechowski, G. Gottsberger

Fragmentation of rainforest ecosystems may have severe negative consequences for pollination success and resulting reproductive output of rainforest trees. We studied flower, fruit, and seed production of the xenogamous Paypayrola blanchetiana (Violaceae), a widespread tree species in the understory of Northeast Brazilian Atlantic Forest remnants. Pollination apparently depends on specialized pollinators with at least some long distance pollen dispersal, while seed dispersal is autochorous, typically leading to clumped distribution patterns. Fruit set was generally very low (ca. 1 %), indicating the possibility of severe pollination limitation. A total of 86 individuals were studied in six forest fragments. Flowers, fruits, and seeds per fruit were monitored monthly for eleven months. Differences in fruit set and seed set between the fragments were analyzed using general linear models to test for effects of different factors related to fragmentation (e.g., fragment size and time since isolation). There were large differences in both fruit set and seed set between the studied populations. Higher flower production did not lead to higher fruit production in most cases. Pollinator abundance and inbreeding due to reproductive isolation are discussed as possible causes.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-17

What seasonality really means to tropical birds specialized in eating fruits? Insights from comparisons between the hooded berryeater and the bare throated bellbird in eastern Parana, Brazil.

B. Clausi & C. Baartsch

The present study searched for phenological patterns of ripe fruits across 4 altitudinal gradients in eastern Parana, atlantic forest range, Brazil, and it´s impacts in two Cotingidae: the hooded berryeater Carpornis cucullatus and the bare throated bellbird Procnias nudicollis. The areas are in the following heights: a)800-900m; b)500-700; c)75-250m; d)1-50m. All tracks were already open before the study. Random walks in these trails were realized between January 2005 and april 2009. When a fruit was found it was marked the date and if there's any bird eating it. The phenological pattern detected with base in the results was the following: 3) austral solstice(Dec-Jan); 4)after austral solstice(Fev-Mar); 5)April transition month; 6)boreal solstice(May-Jun-Jul); 1)August transition month; 2)before austral solstice (Set-Oct-Nov). The data suggest that Procnias eats different fruits in different places in different times than Carpornis, with a few exceptions. The three main plant families in importance are Myrtaceae, Lauraceae, Moraceae followed by Sapindaceae and several other less specious families. As a general conclusion Carpornis cucullatus does not move between fragmented landscape and Procnias nudicollis does at least in the study sites.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-18

Direct and indirect causal relations between frugivorous birds and plant communities in fragments of the Brazilian Atlantic Forests.

C. Guimarães, C. Banks, E. Hasui, J. P. Metzger & C. Knogge

Causal relations among productivity and composition of forest remnants and bird communities are typically known because the abundance of dispersers is spatially correlated with abundance of fruits. However, this causal relationship may also be affected in fragmented landscapes due to spatial and functional parameters. Changes in the landscape may directly lead to a decrease of species through changes in the availability of resources and in the intensity of interspecific interactions. To analyze this causal relationship we used path analysis which may identify the causal correlations. We tested the importance of direct and indirect effects of landscape (patch size and forest cover) on rates of plant species richness and productivity and the abundance and richness of frugivorous birds in seven fragments and three continuous forest during one year. The models are still inconsistent, however with significant trends of routes. Patch size has direct effect on the richness of birds and productivity of fruits. However the richness of fruits affects indirectly the bird species. The primacy of effects suggests that birds are most affected by the direct effects of the structure and configuration of the landscape and just indirectly through the availability of fruits, which highlights the habitat conditions in fragmented forests.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-19

What science may tell how to maintain biodiversity patterns and processes in fragmented landscapes in the Brazilian Mata Atlântica

C. Knogge, J.P. Metzger& K. Henle

The Brazilian Atlantic forests represent a hotspot in terms of biodiversity but also among the top ranking threatened forest ecosystems. Urbanisation and the expansion of agricultural lands producing food and biofuel resulted in a highly fragmented forest biome with nearly 11% of its original area left. Around 80% of the remnant forest fragments represent habitat islands of less than 50 ha. Increasing land consuming interests and the need for the restoration and maintenance of forest ecosystem services makes scientifically based land use and management plans necessary. Studies on different taxonomic groups and ecological processes reveal the differential sensitivity of species and functional groups with typical life history traits to fragmentation. The functional connectivity of a landscape depends on dispersal capacities and the susceptibility to matrix effects. Forest fragments history, structural features, location in relation to other habitat patches and the overall forest cover are affecting habitat quality, the maintenance of populations and ecological processes in a long term run. The evaluation of different landscape configuration and habitat quality thresholds on different scales provides an essential base for planning and priority setting tools in order to meet ecologically and economically requirements of a long term sustainable development in anthropogenic landscapes.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-20

Rainfall triggering in an insect-pollinated tree species in the Atlantic forest of Northeast Brazil and its implications for floral display and pollinator guidance

L. Krause, G. Gottsberger

Tropical plant species with short flowering peaks require a high degree of flowering synchronisation among the individuals to ensure efficient pollinator attraction and pollen transfer. Rainfall events are often neglected as a possible cue for synchronous flowering due to lack of local daily precipitation data or too long phenological observation intervals. In the dioecious tree species Tapirira guianensis, 19 flowering events in which at least two tree individuals began to flower at the same day were registered between 2003 and 2007 at a mean time of 10.8 days after rainfall events (9 – 13 days, sd: 1.03 days). During one flowering period, flowering occurred several times both in single individuals and in the observed population. In contrast to other local, highly comparable dioecious tree species with more continuous flowering activity (Ocotea glomerata and Trichilia lepidota), the male excess (sexual dimorphism) in terms of flower number at the level of the inflorescence clusters was significantly higher in the rainfall-triggered species (24.1:1 vs. 3.7:1 and 3.8:1). The high excess in Tapirira guianensis is interpreted as essential to guide floral visitors first to male and then to female individuals during the extremely short flowering peaks.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-21

Conservation value of fragments of the Brazilian Atlantic forest in the State of Espírito Santo

R.Pellens, I.Garay & P.Grandcolas

The fragments of the Brazilian Atlantic forest remain in the most populated and developed region of the country and their conservation is in constant conflict with the local patterns of development. Our research was developed in Linhares and Sooretama, Espírito Santo. Our purpose were: 1) evaluate the conservation value of the forest fragments based on a study of the community of Blattaria; 2) propose guidelines to the biodiversity conservation. The analysis of the community of Blattaria showed that the number of species shared among sites is very low (between 22.9% and 39.6%), with a high number of species found only in single fragments; the richness per area in small fragments is not smaller than in large reserves; habitat diversity is stronger than the effect of area per se. Therefore, small and very disturbed fragments still shelter important biodiversity of insects, and can be of extreme interest for composing a set of remnants that maximizes the number of species to be protected. Thus every fragment should be considered, and biodiversity conservation should be conceived at the landscape scale.Pellens, R., Grandcolas, P. 2007 Zool. Sci., 24, 11-19.Pellens, R. et al. 2009 In: Conservation of natural resources. Nova Publishers, in press.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-22

Effects of Atlantic forest regeneration on forest structure and availability of food resources: implications for wildlife recovery in second-growth forests

B.T. Pinotti, C.P. Pagotto & R. Pardini

Forest regeneration in abandoned land is occurring simultaneously to conversion of old-growth forests, leading to a secondarization of tropical forests. The biodiversity value of secondary forests, however, has been poorly investigated and is in the center of an intense debate. We investigated how regeneration, quantified as both a categorical and a continuous factor, affects forest structure and availability of food resources for wildlife by sampling 27 Atlantic forest sites at different regeneration stages. Although arthropod biomass, total number of plants with fruits and degree of connectivity among branches decreased with regeneration, specific features associated with the forest ground (leaf-litter height and wood debris volume) or particular food resources (fruit availability of an understory palm) increased during the regeneration process. Results suggest that generalist animals could benefit from the increased food availability, a result of increased productivity in secondary forests, while species specialized in particular food resources, or dependent on forest ground structure, could be unable to successfully occupy younger forests - a general pattern of turnover from generalists to specialists already observed in the few faunistic studies available in the literature. Thus, the value of secondary tropical forests should be higher for generalist species, which are of less conservation concern.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-23

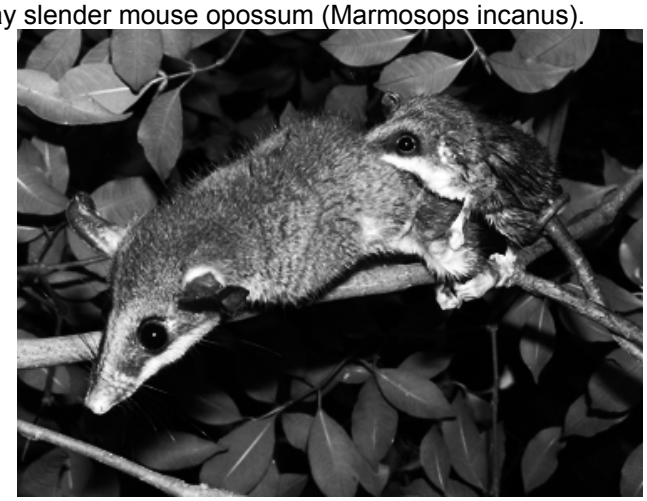
Influence of amount of remaining forest on demographic parameters of the endemic marsupial Marmosops incanus in the Mata Atlântica, Brazil

T.Püttker, C. de Barros, A. A. Bueno, S. Sommer, R.Pardini

Although the amount of remaining habitat in fragmented landscapes is likely to have an impact on biodiversity patterns, few fragmentation studies include this parameter. In the highly fragmented coastal Atlantic forest, investigations on the amount of remaining forest showed a significant effect on the abundance of the endemic marsupial Marmosops incanus: While its abundance was independent of fragment size in a landscape with 50 % of remaining forest, abundance was positively correlated with fragment size in a landscape with only 30 % of remaining forest. To understand demographic processes leading to this pattern, we studied the demography of M. incanus in small fragments of these landscapes using population parameter modeling in the program MARK. We investigated demographic parameters on different scales (fragment, landscape) using model selection methods by Akaike´s information criterion (AIC). Further, we tested the hypothesis that isolation of small fragments diminishes immigration from neighboring habitat patches. Models selection procedures favored a model comprising higher survival and population growth rates in small fragments of the 50 % landscape compared to small fragments of the 30 % landscape. Moreover, a lower number of immigrants was calculated in the 30 % landscape. These results underline the necessity to consider the amount of remaining habitat in management plans of fragmented landscapes in order to successfully maintain biodiversity.

Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-23

Figure 1: Gray slender mouse opossum (Marmosops incanus).



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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-24

Understanding fragmentation effects on Tropical Forests

S. Pütz, J. Groeneveld, L.F. Alves, J.P. Metzger & A. Huth

Land use leads to massive habitat destruction and habitat fragmentation in tropical forests. Despite its global dimensions the effects of fragmentation on ecosystem dynamics are still not well understood due to the complexity of the problem.To improve the understanding of fragmentation on tree species communities in tropical forests we disentangle the single effects of several fragmentation processes (edge mortality, increased big tree mortality, local seed loss and external seed rain) on the dynamics on tree species communities in tropical forest fragments. We present simulation results from the individual-based forest growth simulation model FORMIND. This study investigates long-term effects of fragmentation processes on structure and dynamics of different sized remnant tropical forest fragments at community and Plant Functional Type (PFT) level. Additionally, we analyze the impact of different degrees of isolation within the landscape of a fragment via different external seed rain scenarios. FORMIND was adapted to the Mata Atlántica at the Plateau of São Paulo.We demonstrate that tropical forest fragments will suffer strong structural changes in the long-term. The potential of natural regeneration of a landscape scattered with forest fragments seems to be limited. Our findings have important consequences for the management of heavily fragmented tropical forest landscapes.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-25

The flowering plants of the Brazilian Mata Atlântica: Centers of diversity and narrow endemism and potential threats

C. Raedig, & S. Lautenbach

The tropics in general are under-collected and the taxonomical identification of the specimen collected is often difficult, hampering the detection of broad-scale distribution patterns. Reliable species and species distribution information is available from monographs. However, this distribution information is prone to heterogeneous sampling effort. In this study, we use an interpolation approach which is adjusting for heterogeneous sampling effort, to analyze monographic data of 667 angiosperm species occurring in the Mata Atlântica. We identify two diversity centers, one large center covering the Brazilian Mata Atlântica between the western tip of Paraná and the center of Espírito Santo, and a second center south of Bahia. We further locate centers of narrow endemism, which are characterized as areas holding many species with a narrow distribution (less than 50,000 km2). These centers of narrow endemism are located in the coastal region stretching from São Paulo to Rio de Janeiro, in the center of Espírito Santo, in Minas Gerais and south of Bahia. The combination of maps of narrow endemism and maps of protected areas (World Database on Protected Areas WDPA 2008) as well as maps of forest and population development scenarios pinpoints areas most threatened by Global Change.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-26

Influence of habitat fragmentation on amphibians at community and population level in the Brazilian Atlantic Forest

Dixo, M., H. Steinicke, T.H. Condez, R.T. Bruscagin, J.P. Metzger & K. Henle

Habitat loss and fragmentation are considered as the major causes of species extinction and the decrease of biodiversity.We investigated the impact of habitat fragmentation on amphibians at community and population level. Population dynamics and morphological parameters were studied on selected species in a landscape with 70% habitat loss. Leaf-litter frog communities were studied in a comparative approach among three landscapes with different degrees of habitat loss (50%, 70%, and 90%). We further analysed the impact of edge effects on the amphibian community in a landscape with 90% habitat loss.We observed that the intensity of fragmentation effects depends on remaining forest cover, being superior in landscapes with higher habitat loss. Species with different ecological characteristics were affected differently, and especially those species that require an aquatic habitat for their reproduction were affected negatively by habitat loss and fragmentation. Similar pattern were found in population dynamics and morphological parameters. Preliminary results of the study on edge effects showed an inconsistent response of leaf-litter frogs and tree frogs.Our results highlight the importance of the amount of habitat for the understanding of frog sensitivity to fragmentation and underline the influence of habitat preferences on the response on fragmentation effects.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-27

Landscape and local scale effects of the expansion of open anthropogenic areas on the distribution of endemic and invasive small mammals in areas of agriculture in the Atlantic forest

F. Umetsu & R. Pardini

Although agricultural areas are still expanding, most biodiversity assessments in altered tropical landscapes focused on forest remnants. Using standardized sampling in 36 agricultural areas in two 10000-ha landscapes in the Atlantic forest (41 and 79% of open deforested areas), we investigated if the influence of open anthropogenic areas at the local scale (800-m around sampling sites) on small mammal distribution varies between landscapes with different contexts.Effects of landscape context were strong. Not only richness of non-endemic species was higher and richness and abundance of endemic species were lower in the landscape with higher proportion of open areas, but also effects of the expansion of open areas at the local scale were context-dependent. Richness of non-endemic species and richness and abundance of invasive species increased with the quantity of open areas at the local scale only in the landscape with lower proportion of open areas.Results indicate that: (1) the control of invasive species, one of the main threats to biodiversity, depends on strategies at large spatial scales, (2) the value of agricultural areas for conservation is context-dependent, and should be higher in heterogeneous landscapes, and (3) local scale strategies are more important for the management of well-forested landscapes.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-28

Population structure of Parkia pendula (Fabaceae) in Atlantic Forest fragments: the fragmentation effects and absence of the major animal disperser

B. Vlasáková, D. Piechowski,G. Gottsberger

Fragmentation of a continuous ecosystem may have vast impacts on the distribution and population structure of plant species. We studied the population structure of Parkia pendula (Fabaceae), a rainforest canopy tree that is pollinated by bats and dispersed by medium-sized primates. The study was conducted in 22 Atlantic Forest fragments surrounded by sugarcane plantations. The reproduction of the species is severely impaired by the absence of dispersers. Currently, large vertebrates capable of dispersing the seeds (Capuchin monkeys) occur in only one fragment. We determined the population structure based on DBH and height and related it to the fragment characteristics: fragment size, fragment shape and isolation, vegetation structure, and presence of major animal dispersers. Additionally, we studied the distribution of the size classes in relation to the physical environment (e.g., distance to the edge, light conditions, topography). The highest density was detected in high-quality fragments including those fragments where primary dispersers still occur or are in their vicinity. Remarkable differences in the distribution exist between the size classes in relation to the physical environment. Individuals of smaller size classes are frequently found in areas with higher light availability suggesting that regeneration of this species might be associated with gap dynamics.

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Session 13: Interactions in a changing world: the Brazilian Atlantic Forest – a case study direct and indirect human impacts on a threatened ecosystem - PosterP13-29

Habitat disturbance reduces post-dispersal seed removal in the Atlantic Rain forest of southern Brazil

V. P. Zwiener, J. Bihn, M. C. M. Marques

Anthropogenic habitat disturbance is reducing and changing tropical forests. Knowledge about the extent to which theses changes affect ecosystem processes is a key issue in order to preserve forest structure and the services they provide. Seed removal and predation are important processes in tropical forests as they can influence seedling recruitment, plant species diversity and community structure. We carried out an exclusion experiment to investigate the relative impact of ants and vertebrates on seed removal along a gradient of regenerating tropical forests in southern Brazil. Early successional stages were considered more disturbed forests. Seeds were placed on the forest floor and checked after 48h. The rate of seed removal by ants and vertebrates followed similar trends along the successional gradient: for both groups of granivores seed removal increased with increasing successional age of forests. Seed removal in old growth forests (43%) was higher than in 40-55 years, 15-20 years and 9-11 years old forests (35%; 26% and 26%, respectively). Our findings showed that habitat disturbance affects species interactions reducing post-dispersal seed removal and probably affecting seedling recruitment, forest structure and ecosystem processes.

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Session 14: Human ecological dimensions in sustainable utilization and conservation of tropical rainforests - TalkT14-01

The use of Traditional ecological knowledge in forest management: an example from India

L. Rist, R. Uma Shaanker, E.J. Milner-Gulland and J. Ghazoul

Many forest communities possess considerable knowledge of the natural resources they exploit. Such knowledge can inform scientific approaches to management, either as a source of baseline data, by filling information gaps, or by providing alternative management approaches from which scientists and managers might learn. In general, however, little attention has been given to quantitative knowledge of relevance to resource management or to identifying specific areas where it is most useful or where it may be problematic.We contrasted scientific data with Traditional ecological knowledge (TEK) in the context of a threat to the sustainable harvesting of a non-timber forest product (NTFP) of livelihood importance in southern India. The efficiency of deriving information from NTFP harvesters compared to scientific field studies, its potential to provide novel management solutions as well as quantitative information were assessed. TEK complemented previously gathered ecological data by providing concordant and additional information, but also contradicted some results obtained using a scientific approach. TEK also gave a longer-term perspective with regard to NTFP harvesting patterns. The use of diverse information sources, including TEK may provide an effective approach to assessing the status of harvested resources.

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Session 14: Human ecological dimensions in sustainable utilization and conservation of tropical rainforests - TalkT14-02

Ecosystem management and sustainable development in the southwest of Mexico City.

L. Almeida, A. Ramos, J. Álvarez, E. Cantoral, S. Castillo, J. Cifuentes, L. León, A. Nieto.

One of the areas with major deterioration are the megalopolis, an example is Mexico City and its metropolitan area, where 20 million people live. However, it still has ecosystems relatively in good conditions, this is the case of the Magdalena river basin (MRB), localized in the southeast limit of Mexico City, it presents a mountain relief, where there are native forests of Pinus harwegii, Abies religiosa, mix forest and Quercus. The lack of strategies regarding the environment and people needs makes the area more vulnerable to the deterioration. An analysis was completed using a sector diagnostic of the MRB where social-environmental and biophysics dynamics were included and multivariable dynamics were identified to determinate the integral functionality of MRB. The results made possible to affirm that MRB is a very important haven of biodiversity and it has the major diversity mild-forests of Mexico central area and provided important ecosystems services. Since the MRB has several threats that might cause the depletion of biodiversity, it has been proposed to make a strategy of ecosystem management and sustainable local development that includes the restoration by ecosystem type, biodiversity protection, sustainable management, environmental education and communication proposals.

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Session 14: Human ecological dimensions in sustainable utilization and conservation of tropical rainforests - TalkT14-03

The value of local biodiversity to communities in Madang Province, Papua New Guinea

D. Bastyte

The biodiversity of Papua New Guinea's tropical rainforests is utilized by local communities in diverse and often unrecognised ways. Aside from the high commercial value of some rainforest trees, forests provide a number of other goods and services to communities that are more difficult to quantify such as construction, food, household, medicinal, religious, spiritual and recreational values. In addition to being of importance to livelihoods, the forests of PNG are among the worlds most biodiverse, and their valuation, and recognition by local communities, may contribute to their preservation.The research is being carried on in two remote villages in Madang province. The importance of different components of biodiversity for local villagers is estimated according to Pebble Distribution Method (PDM) which is a weighted ranking exercise used in researched groups. This method helps to identify patterns of the importance of local biodiversity and stimulates dialogue between participants about their perceptions of local biodiversity and its importance to sustaining livelihoods.

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Session 14: Human ecological dimensions in sustainable utilization and conservation of tropical rainforests - TalkT14-04

Carapa crop and oil production: to be or not to be sustainable and equitable.

P.-M. Forget

Carapa spp. (Meliaceae) trees occur in contrasting habitats such as inundated, littoral swamp and gallery forests, lowland and highland, and high-altitude mountain forests in both tropical America and Africa. Overall, taxonomy is not well known, species being often misidentified. Nonetheless, recent botanical studies showed tree species differ in their morphology, and likely also differ in composition and properties of oil that is extracted from seeds. Knowledge of Carapa tree ecology mainly focused on neotropical species, whereas paleotropical ones remained poorly investigated so far. I will briefly review seed-seedling ecology of Carapa trees showing how long-term tree recruitment highly depends on crop size and seed dispersal by animals in both continents. In Africa, a greater pressure is exerted on trees that are used for oil production and fuel wood might endanger their recruitment. Thus, the development of organic cotton for international market and use of carapa oil as repellent might exert a strong pressure on tree survival on the long term. Preliminary data on seedling recruitment from gallery forests in Mali will be presented and discussed in light of an exploding market for organic cotton and cosmetic products that are not always equitable, fair and sustainable, especially on the web.

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Session 14: Human ecological dimensions in sustainable utilization and conservation of tropical rainforests - TalkT14-05

Dioscorea divaricata Burk. (Dioscoreaceae) as a cultural keystone species of the Magbukún Ayta community of Morong, Bataan, Philippines: implications for biocultural diversity conservation

M.D.C. Tongco

Biodiversity, along with cultural diversity to which it is intimately linked, is rapidly being lost due to socio-political and economic factors. Conservation efforts are thus needed from both the local and conservation fronts. One approach to the loss of biocultural diversity is to use cultural significance. Species that have become important to a group of people due to certain traditions and phenomena, called cultural keystone species (CKS), tend to be conserved and have great potential to be used as instruments in trying to preserve biocultural diversity. I am currently looking at the CKS concept in the context of the Magbukún Ayta community, a semi-hunter-and-gatherer group in the Philippines, and their relationship with buloy (Dioscorea divaricata Burk., Dioscoreaceae), a local species of wild yam. Buloy is a valuable root crop harvested for food. There are special techniques, tools, and taboos associated with the harvest of this yam that reach back hundreds of years. Using ethnographic techniques, I explored the Aytas' perceptions regarding this yam. I also discuss the role of buloy in the community as a CKS, and how this information might be used to address conservation concerns, and in this way contribute to the global efforts seeking to conserve biocultural diversity.

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Session 14: Human ecological dimensions in sustainable utilization and conservation of tropical rainforests - TalkT14-06

Students' Perception of Commons Dilemmas at the Forest Frontier of Central Sulawesi

S. Koch, J. Barkmann & S. Bögeholz

Central Sulawesi harbors core ecosystems of the global Wallacea biodiversity 'hotspot'. Largely consisting of common pool or open access forest resources, it is heavily threatened by intensive resource appropriation. To improve prospects for conservation and sustainable long-term development, a set of socio-ecological 'commons dilemmas' need to be solved. This requires local actors who command knowledge on the social, economic, institutional, and ecological aspects of forest resource utilization. In the spirit of the Agenda 21 or the Convention on Biological Diversity, fostering such knowledge should be a prime task of international environmental education. While Indonesia strives to include environmental education in its school curricula, we report on first results of a study that systematically investigates the pre-concepts that future teachers bring to local resource conservation issues in Central Sulawesi.

Results are abstracted from 19 in-depth interviews with agronomy and biology teacher students from UNTAD University, Palu, i.e. from potential key communicators on resource use dilemmas. Most interviewees readily recognized ecological aspects of the exploitation of forest resources, and frequently called for state regulations. However, the core of the commons dilemmas, i.e., the need to institutionally balance short-term individual exploitation profits with long-term and community interests was not recognized in any detail.

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Session 14: Human ecological dimensions in sustainable utilization and conservation of tropical rainforests - TalkT14-07

The social-ecological focus in the mexican conservation: case study

Santos Arelí, Estrada-Lugo Erin, Nazar-Beutelspacher Austreberta, Vester Henricus, Vázquez-García Verónica.

Poverty and marginalization are common factors in the eight suburbs established around the Huitepec Volcano in San Cristóbal de las Casas Chiapas, Mexico. The mainly indigenous population keeps a close relationship with the forest and their recourses, not only for their subsistence but also because it represents a sacred place and relates to their cultural identity. There is already a private reserve, another area which was formerly used as communal land, was decreed Federal Reserve in 2007 and soon taken as a Communitarian Reserve by the Zapatista movement. In both cases, the conservation strategies are tight, which means that people are not included in the objectives of the reserve. The limitations for including people in conservation activities were analyzed and emphasis was put on the social potential available. The social analysis records positive indicators: organization, social inter-communication, participation, confidence in the authorities as well as interest of the people for getting involved in conservation. But the lack of social spaces, communication and coordination between authorities and stockholders, contrasting interests, and the refusal of the environmental authorities to include people in management and preservation restrict the potential and new opportunities of conservation and puts in risk the permanence of the Huitepec reserves.

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Session 14: Human ecological dimensions in sustainable utilization and conservation of tropical rainforests - TalkT14-08

Impact of harvesting practices and traditional protection actions on the population dynamics of Adansonia digitata L. in West African savanna areas

K. Schumann, R. Wittig, U. Becker & K. Hahn-Hadjali

One of the most important useful trees in West Africa is the baobab (Adansonia digitata), providing various non timber forest products (NTFP). This study examines the impact of NTFP (bark, fruit and leaf-) harvesting and traditional protection actions on the population dynamics of the baobab in West African savanna areas. We studied size class distribution and abundance of the baobab with regard to the degree of harvesting in different land use types within and outside the protected area W National Park in Burkina Faso. Inhabitants living next to the W Park were interviewed to estimate harvesting practices and the value of the baobab for locals. Results show that the villagers use products of A. digitata in a regular and varied manner. Average diameter of A. digitata individuals differs significantly between the different land use types. Most of the largest individuals are found in fallows and in cropland, whereas smaller trees are mainly detected in villages and protected area. Harvesting practices are more intense in villages and cropland than in fallows and protected area. However, the number of seedlings does not differ between the populations in the protected area, the villages and the cropland, but was lowest in the fallows.

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Session 14: Human ecological dimensions in sustainable utilization and conservation of tropical rainforests - TalkT14-09

Fire as a common agricultural tool in the tropics favours the growth of tropical bracken, an extremely aggressive weed

K. Roos, J. Bendix & E. Beck

Fire is commonly used in the tropics for forest clearing and maintenance of agricultural areas. Bracken (Pteridium aquilinum agg.) is one of the world's most aggressive weeds whose growth and spreading is promoted by repeated burning. In contrast to the well investigated bracken of the northern hemisphere, the ecology of the neotropical P. arachnoideum and caudatum is less well known. On undisturbed bracken areas a 1 : 1-ratio of leaf emergence and leaf dying was found suggesting growth control by nutrient shortage. After burning very high frond development rates were found, resulting in canopy closure after 4 months. In the laboratory the effect of fire was simulated by artificial heat shocks on bracken rhizomes at different temperatures. The leaf producing rhizome laterals, growing close to the soil surface showed heat tolerance of up to 80°C, whereas the main rhizome axes (long shoots) which are commonly found at deeper soil layers were less heat tolerant. Stimulation of bud break and frond production was significant up to 60°C which is in good agreement with the field observations. Therefore the invasive power of bracken as a postfire colonizer appears to rest with the short shoots. Fast canopy closure outcompetes all kinds of crops.

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Session 14: Human ecological dimensions in sustainable utilization and conservation of tropical rainforests - TalkT14-10

How do tropical forest people respond to flood and how do they use the forests?

Liswanti, N., Sheil, D., Frost, P., Padmanaba, M., Basuki, I.

Tropical forest people often suffer from the floods disaster that common happened in many parts of the world. An improved knowledge of the important of forest in respond to flood could improved decision making. Here we work with seven indigenous communities living near and inside forests and mining concessions in East Kalimantan (Borneo Indonesia). This article examines the important of tropical forest landscape for indigenous communities in respond to floods using interviews. The result showed the local people respond to floods differently depending on their previous experience of flooding, the level of government support, and the extent of cultural and economic attachment to an area. Flooding increases local people's vulnerability to which they respond by moving to another area, temporarily relocating their agricultural lands, temporary out-migration in search of employment, purchasing and breeding livestock with government assistance, and increasing the harvesting of forest products. The last of these is the most important coping strategy specially in providing social safety net for local people in the aftermath of floods. Key word: Borneo, flood, local coping strategies, safety net, subsistence, forest dependent peoples, indigenous people

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Session 14: Human ecological dimensions in sustainable utilization and conservation of tropical rainforests - PosterP14-01

Role of Niouma' protected forest (North-western Burkina Faso) for the surrounding populations

G.E. Kaboré, K. Hahn-Hadjali, R. Wittig & A. Thiombiano

Increase of populations' daily needs of plant resources is a major threat to protected areas. This study shows the impact of local populations on the protected forest of Niouma, situated in the Passoré province of Burkina Faso, North Soudanian zone, with an area of about 1327 hectares. Semi-structured interviews were conducted in five surrounding villages located within 5 kilometers from the forest edge. Eighty persons were interviewed (equally women and men). Sixty-five of the woody plants species are used by the local population. This represents 76,47% of woody species of the forest. Medicinal usage is most commonly mentioned (61,5%), followed by harvesting for food purposes (47%), energy (33,8%), construction (30,8%), tools (18,5%), fodder (18%) and other services (15%). All plants organs are used, most of all leaves, followed by wood, fruits, bark, roots, and flowers. Harvesting and climate changes are kept as the main threats for many species. Forty five species are mentioned by local population as preferential and/or threatened species (69,29%) and six species as almost disappeared (i.e. Boscia senegalensis, Parkia biglobosa, Securidaca longepedunculata, Strychnos spinosa Pterocarpus erinaceus and Pseudocedrela kotschyi).

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Session 14: Human ecological dimensions in sustainable utilization and conservation of tropical rainforests - PosterP14-02

Social Stratification, Village Institutions, and Deforestation in Central Sulawesi (Indonesia)

S. Koch, J. Barkmann & H. Faust

Deforestation rates around Central Sulawesi's Lore-Lindu National Park differ more strongly between villages than can be explained by differences in the individual characteristics of the village households as assessed by quantitative village censuses. This setting provided the background for a study into inter-village differences in power structures regarding access to natural resources. Our results are abstracted from 30 semi-structured interviews with key informants from the leading groups of autochthonous and migrant households of three contrasting villages. In village A, nearly feudal power relationships are exerted by a group of local "first settler" families that dominate formal village leadership as well as the influential Council of Traditional Leaders, and that restricts deforestation and land transactions. No such institutional restrictions exist in village C. Traditional power relationships are replaced by economic power based on petty capitalist production of cacao. Deforestation is much higher in village C. In village B, traditional institutions and power structures still appear in place although land transactions are less restricted than in village A, resulting also in high deforestation rates. While socially problematic, our study highlights the potential efficacy of traditional institutions in the regulation of access to land and tropical forest resources.

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Session 14: Human ecological dimensions in sustainable utilization and conservation of tropical rainforests - PosterP14-03

Management of two highly valued species (Afzelia africana and Pterocarus erinaceus) in the surrounding area of W National Park, South-Eastern Burkina Faso

B.M.I. Nacoulma, K. Hahn-Hadjali, R. Wittig & A. Thiombiano

This study analyses current harvest practices, population structure and dynamics of two multipurpose species, Afzelia africana and Pterocarpus erinaceus, in the surrounding of W National Park in South-eastern Burkina Faso. Data were collected in 45 randomly selected plots (900 m²) in different land use units. Dendrometrical data (dbh>5 cm, total height) and percentage of pruning and of trunk debarked of the two species were recorded in the plots. In total, 312 individuals of A. africana respectively 274 individuals of P. erinaceus were sampled. Results reveal that the two studied species are under severe human pressure in the surrounding of W National Park. More than 90% of the individuals of the two species are harvested in this area. The highly valued species are harvested for forage, construction, tools (e.g. mortars) and medicinal purposes. Harvesting practices affect mainly saplings and adults. Highly valued species are declining in this area and present a threat for the phytodiversity of the park. We conclude that A. africana and P. erinaceus are not managed sustainably in the South-eastern Burkina Faso.

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Session 14: Human ecological dimensions in sustainable utilization and conservation of tropical rainforests - PosterP14-04

Sacred woodlands of Burkina Faso: impact of the social changes on the local modes of management and on biodiversity

S. Savadogo, K. Hahn-Hadjali, R. Wittig, A. Thiombiano

Sacred woodlands represent traditional protected areas in Burkina Faso, directly managed by local people for cultural purposes. Revealing high species richness, these sites are of particular interest for conservation biology. However, changing management strategies are threatening these woodlands. A floristic inventory was carried out, evaluating the conservation value of the woodlands. To assess social factors influencing changes of the traditional management, semi-structured interviews were conducted with traditional authorities.We found 250 species included in 130 genera and 70 families. Important families are Combretaceae, Mimosaceae, Poaceae and Fabaceae. Manilkara multinervis (Sapotaceae) was found to occur in a sacred woodland in Northern Burkina Faso, representing the first record for the species in this region. Furthermore, we identified factors contributing to the degradation of the woodlands. Firstly, the increase of monotheistic religions (Christianity and Islam) comes along with changed practices and rules governing sacred sites. Secondly, exploitation for agriculture and firewood due to urbanization and demographic increase present a major threat to these sacred forests, having considerable effects on the dynamics of species within these forests. Even if biodiversity conservation is not the priority objective of local communities, nevertheless traditional practice is a good contribution to it.

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Session 14: Human ecological dimensions in sustainable utilization and conservation of tropical rainforests - PosterP14-05

Preservation of remnant dry forest vegetation and tree planting measures to support the ecological development of Valley View University (Accra, Ghana)

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Valley View University (VVU), a private university operated by the Seventh Day Adventist Church lies within the dry forest zone of the Accra plains; an area strongly affected by urban sprawl. The campus covers 120 ha. Considerable portions of it are yet undeveloped and covered with either native vegetation or shrubland composed of exotic species. The VVU has committed itself to a holistic, ecological and sustainable development. Framed within a BMBF-project, VVU started in 2003 with the introduction of rain-water harvesting and waste-water management including the separate collection of human excreta to serve as fertilizer in agricultural fields. The further development of the campus was designed in a detailed 'ecological masterplan'. VVU is thus well prepared for the envisioned increase of student numbers in the upcoming years. However, further development will include extensive building activities that will finally claim large portions of the yet-undeveloped land. As part of a recent project within the German Climate-Change Initiative, an ongoing study of the existing vegetation will support the distinction of areas that should be preserved to secure ecological sustainability in terms of biodiversity. Additionally, a large number of trees will be planted to improve microclimatic conditions and to enrich tree species diversity.

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Session 14: Human ecological dimensions in sustainable utilization and conservation of tropical rainforests - PosterP14-06

Perceptions, use and availability of woody species in the Senoufos' region (South-Western Burkina Faso)

L. Traoré, K. Hahn-Hadjali, R. Wittig, A. Thiombiano

The study was conducted in four villages (Niankorodougou, Dakoro, Kawara, and Kankalaba) of the Leraba province of Burkina Faso. In total, 60 interviews were carried out with members of the Senoufo ethnic group. They were questioned on their use of natural vegetation in the categories firewood, construction, livestock fodder, edible fruits, vegetable sauce, handicraft, and medicinal purposes. Furthermore, each informant was asked for (1) which woody species is not used for firewood and why, (2) the frequency of plant collection and (3) the perception of the availability of plant resources. The study reveals the utilization of 79 species from 68 genera and 33 families. This result can be split in the following way: firewood (22 species), construction (15 species), livestock fodder (11 species), edible fruits (24 species), vegetable sauce (5 species), handcraft (15 species) and medicine (15 species). There is only one species which is not used as firewood, Combretum molle, because of its religious meaning as "totem" for the Senoufo people. There are some species (8 species) those use differs from one family to another. The interviewed people show different opinions concerning the availability of useful plants, but the majority rates a good availability.

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Session 14: Human ecological dimensions in sustainable utilization nd conservation of tropical rainforests - PosterP14-07

Conservation of Biodiversity in Ethiopian Church Forests

M.D. Lowman and A. Wassie Eshete

Ecosystem of Ethiopia are vastly understudied and degrading rapidly due to human activities. Much of the natural landscape has been cleared for agriculture or fuel, with one notable exception: the sacred landscapes surrounding churches. In early 2009, we organized a workshop for the bishops and clergy of northeastern Ethiopia, to explain the importance of their stewardship on these lands. Through this educational process, we now have a working group of ecologists and over 90 religious leaders to promote conservation of Ethiopian church forests. We have designed protocols to survey the biodiversity of selected church forests, using relative inexpensive techniques, and will also be teaching the Sunday school children how to become citizen scientists and undertake subsequent stewardship of these forests. Further, we will undertake extensive surveys of invertebrates, with a special focus on pollinators and other useful insects. Future plans to assist the bishops with fencing of their church forests to promote biodiversity conservation are in process, again based on educating the local residents to understand the value of their remaining conservation areas. Our project illustrates the importance of partnerships between ecologists and local citizens, with a focus on harnessing the energy and enthusiasm of children.

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Session 14: Human ecological dimensions in sustainable utilization and conservation of tropical rainforests - PosterP14-08

"Life after logging - The BioDec Guiana Project - Analyzing amphibian diversity patterns in selectively logged tropical forests of the Guiana Shield, an overlooked biodiversity hotspot at the crossroads between utilization and protection."

R. Ernst & R. Thomas

Timber harvesting is currently the most common commercial utilisation activity in tropical forests. Even though the forests of the Guiana Shield have had among the lowest deforestation rates of the world, with very little change over the past decades, rapid economic and social changes increase pressures on these relatively well-conserved forest ecosystems. Guyana is at a crossroads concerning decisions and trade-offs among utilization, conservation and preservation of its forests and thus substantial parts of the country's biodiversity.Results of our studies on amphibian communities in the forest of central Guyana and West Africa suggest that human activities that lead to changes in the structure of a habitat, such as logging, not only alter the composition of organisms that form a particular assemblage (through trait-dependent extinctions and invasions) but rather alter the dynamics of the entire system. Functional differences between species, rather than number of species per se appear to be the decisive factor in sustaining desirable ecosystem states and thus in maintaining important ecosystem services. Commonly used diversity measures, such as species richness or species diversity may therefore not adequately reflect actual losses of diversity following human disturbances. Because biological diversity appears to play a substantial role in ecosystem resilience required to safeguard essential ecosystem functions in the face of environmental change, we call for a critical revision of common diversity assessment approaches. In spite of the alarming effects of even low impact harvesting methods (e.g. selective logging) on amphibian diversity, we found some indication that amphibian communities may have the potential of recovery, given that 1: original logging was conducted in a sustainable manner, 2: remaining forest stands maintain sufficient connectivity among each other to allow recolonization of true forest species, and 3: adequate recovery periods are provided. However, systematic long-term studies are needed in order to specify recommendations with regard to harvesting cycles and recovery potential of the forest communities. One step towards filling this data gap is the recently implemented "Biodiversity Dynamics and Ecological Cascading in Logged Tropical Forests of the Guiana Shield Project (BioDEC Guiana)" presented here. The most proximate measure to

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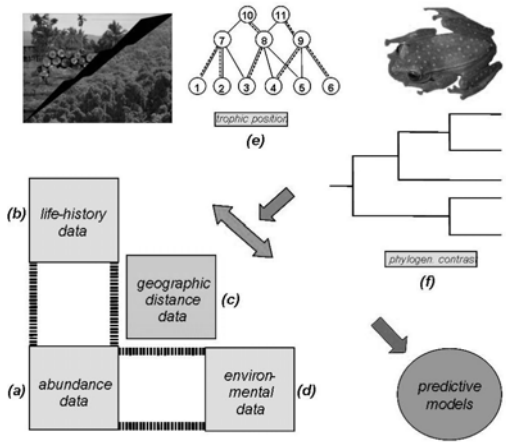
be taken until these data are available, however, is the protection of the remaining pristine forest sites, not only to guarantee the long-term viability of particular species or populations at risk, but also to maintain one of the Guiana region's most precious resources as a whole, its biodiversity.

Figure 1: BioDEC Guiana research strategy.



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Session 14: Human ecological dimensions in sustainable utilization and conservation of tropical rainforests - PosterP14-09

Understanding impacts of fragmentation and human disturbance on tree species community in tropical forest fragments

S. Pütz, J. Groeneveld, L.F. Alves, J.P. Metzger & A. Huth

Anthropogenic land use in the tropics leads to massive habitat destruction and following habitat fragmentation, e.g. of the Brazilian Atlantic Forest (Mata Atlântica), one of the biodiversity hot spots in the world. 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.

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Session 14: Human ecological dimensions in sustainable utilization and conservation of tropical rainforests - PosterP14-10

Production of Carapa oil (Carapa spp., Meliaceae) in southern Mali: traditional values and economic potential

N. Weber

Trees of the genus Carapa (Meliaceae) occur in tropical Africa and America. On both continents, they constitute an important source of non-timber forest products (NTFPs). Our study on the production of oil from Carapa seeds was conducted in southern Mali, where the distribution of Carapa trees is restricted to gallery and ravine forests that provide a year-round water supply. The oil of the Carapa tree is traditionally appreciated for its medicinal and insect repellent character, but the local oil production is in decline due to the introduction of chemical substitutes. Only recently, Carapa oil was discovered to be an effective biological insecticide to protect organic cotton against insect pests. In the frame of the economic importance of cotton for Mali and the increasing organic cotton market, the demand for Carapa oil is expected to rise significantly in the near future. To correspond to the guidelines of organic cotton cultivation, the production of Carapa oil as biological insecticide needs to combine economical and ecological interests by creating small-scale incomes for local communities as well as raising awareness for the conservation of Carapa trees and their habitats.

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Session 14: Human ecological dimensions in sustainable utilization and conservation of tropical rainforests - PosterP14-11

Can local people help conservationists locate rare species?

M. Padmanaba, N. Liswanti, I. Basuki, D. Sheil

Classic biodiversity survey often requires complicated methods and current trend indicates that indigenous communities are encouraged to play role in the process of natural resources management. Such participation from grass root offers benefits and promising legitimate for conservation. We interviewed 52 key informants and showed them several pictures of plants and animals representing rare species. A sketch map was also shown to see how they could recognize and locate where those species usually occurred. Our informants suggested that sun bear, tarsier and slow loris could be seen mostly solitary in fallow, agriculture field, horticulture and forest especially at night. Proboscis monkey was absent in their area. Clouded leopard, meat flower and black orchid were considered as the rarest species according to all respondents. Local people considered those species less valuable so that they did not pay much attention on their conservation status. This study gave an example on how indigenous knowledge might help conservationists to achieve a more comprehensive biodiversity management particularly in any area where limited resource was the major problem. However, collaboration and dialogue needed to be initiated between natural resources management agencies and existing local system. Key words: rare species, indigenous knowledge, conservationists, biodiversity management

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Session 14: Human ecological dimensions in sustainable utilization and conservation of tropical rainforests - PosterP14-12

Landcape-level Approach Model to Manage the Tropical Peat Swamp Forest in GSK-BB, Riau, Sumatera

Dedy Darnaedi, Endang Sukara, Rochadi Abdulhadi and Yohanes Purwanto

Landscape-level approach model to conserve and manage the tropical peat swamp forest in GSK-BB, Riau, Sumatra, IndonesiaDedy Darnaedi, Endang Sukara, Rochadi Abdulhadi, and Y. PurwantoThe Indonesian Institute of Sciences (LIPI)ABSTRACTThe forests of Sumatra hold one of the worlds' greatest treasures of biodiversity, with thousands species of plants, 200 species of mammal and 580 species of birds identified to date. Species include the Sumatran tiger, elephant, rhino, and the Malay tapir. One of the major landscapes recognized by expert biologists and ecologists is the lowland forest area of Giam Siak Kecil-Bukit Batu wildlife reserve. This area has a diversity of habitats that includes wetlands, peat swamp forests, and alluvial bench forests from inland to the sea, covering a myriad of habitats, elevations, and soil types. This area is remote, with limited human population and expansion, remaining unspoiled and truly unique. Wildlife and local communities depend on access to the forest and its resources, both directly and indirectly. However, due to recent industrial and human development, the area faces various threats including weak wildlife protection and enforcement, illegal logging, land encroachment poaching for agriculture and fires. This situation continues and worsens due to acceleration of climate change with consequences for societies and ecosystems. Accelerated loss of biological and cultural diversity with unexpected consequences that impact the ability of ecosystems to provide services is critical for human well-being and it should be addressed. It is imperative for Indonesia to effectively respond to these emerging challenges. Establishing and practicing rules and legislation and law enforcement are no longer the right choice for the protection of landscape ecosystems. The biosphere reserve concept should be a robust alternative to answer this situation. This concept has proved its value beyond protected areas and is increasingly embraced by scientists, planners, policy makers and local communities to bring a variety of knowledge, scientific investigations and experiences to link biodiversity conservation and socio-economic development for human well-being through multi-stakeholder management. Any initiatives dealing with landscape level conservation mostly come from and carried out by governments. In this presentation we would like demonstrated the initiative of private sector in collaboration with various

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stakeholders dealing with biosphere reserve in Indonesia.Keywords: collaborative management, tropical peat swamp forest, biosphere reserve, Sumatra, Indonesia.

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Session 15: Learning from the past: environmental history and biodiversity development - TalkT15-01

Origin, diversity and biogeography of the flora of the seasonally dry tropical forest in Mexico: perspectives from a biogeographic node in the Isthmus of Tehuantpec (Oaxaca)

E.A. Pérez-García, J.A. Meave & J.L. Villaseñor

Although tropical dry forest is the prevailing vegetation in the seasonally dry tropics of Mexico, in this biome several plant communities can exist under the same climatic regime and even within a single landscape. The biological spectra of these communities are generally dissimilar, given the particular adaptations shown by the different plant species occurring in them. Between-community divergence in composition, physiognomy and phenology allows to conceive them as different plant formations. The hierarchical taxonomic analysis of their component species and their differing biogeographical affinities show that each community hosts different lineages, suggesting that they may have largely independent histories. The geologic reconstruction of the country's territory has revealed possible scenarios and provided a time frame for the evolution of its flora; the study of fossils and recent molecular phylogenies for some important groups (Burseraceae, Cactaceae, Fabaceae, Orchidaceae) have confirmed the presence in North America of ancestors of the modern flora for several million years. Given the uniqueness of the flora of the Mesoamerican seasonally dry tropics and the evidence of its antique history, we conclude that the widely accepted idea of Mexico being a transitional zone between the Nearctic and the Neotropical biogeographic realms needs reconsideration.

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Session 15: Learning from the past: environmental history and biodiversity development - TalkT15-02

Upper Forest Line reconstruction based on modern vegetation structure and composition in the Andes of northern Ecuador

M. C. Moscol & A. M. Cleef

Upper Forest Line reconstruction based on modern vegetation structure and composition in the Andes of northern EcuadorMarcela C. Moscol & Antoine M. Cleef(University of Amsterdam)Abstract. The RUFLE project aimed at the reconstruction of the natural Upper Forest Line (UFL) in the equatorial Andes. Apart from soil characteristics combined with palynological and organic chemical proxies, also patterns of assemblages of vascular plant species composition and structure of the remaining Andean rain forests in northern Ecuador were studied in two reserves: Guandera and El Angel. Thirty three plots located between 3300 and 3700 m were examined along two altitudinal transects crossing the UFL. The phytosociological subdivision using TWINSPAN revealed two forest communities for Guandera and five communities for El Angel on the basis of both floristic composition and cover percentage. The distribution pattern of these forest communities clearly corresponds to a humidity gradient declining East to West from Guandera to El Angel. The high Andean and the Andean rain forest zones of Guandera were not floristically discernable by our analysis at the community level. The Guandera forest patches in páramo (3550-3700 m) are similar in terms of structure and floristic composition to the high Andean forest below the UFL (3600-3620 m), differing only at the level of variant. This indicates that the separation of the forest patch is relatively recent or that the forest patch was easily colonized by direct input from the high Andean forest located at ca. 50 m from the patch. No direct floristic affinity was detected between the forest types identified in our study area and 14 other forest sites of Colombia and Ecuador. The sharp and abrupt present-day UFL in Guandera (at 3640 m) is probably a consequence of frequent and extensive fires. All this suggests that the natural UFL was at slightly higher altitude in the undisturbed setting. In El Angel, the natural UFL as well as the high Andean forest have disappeared by clear cutting leading to a process of “paramización”. Thus the isolated asteraceous forest patches at 3740 m could not be compared to the high Andean forest stands in El Angel. The Andean forest patches in El Angel currently suffer from continuous wood extraction and are becoming depleted.The phytosociological study of páramo grasslands in the relatively undisturbed Guandera Biological Reserve site and the highly disturbed El Angel Ecological Reserve site of northern Ecuador discerns altitudinal distribution

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patterns. The analysis included a field survey following the relevé method of Braun-Blanquet. The study focussed on altitudinal distributions of specific plant communities discernable by our analysis, as well as for traces of human influence in these communities.We examined 72 plots of zonal páramo vegetation located between 3400 and 4000 m altitude. The phytosociological classification by means of TWINSPAN revealed three zonal páramo communities at the association level, which clustered each into one community group (alliance) and one order group (order) on the basis of both floristic composition and cover percentage. The phytosociological order group of Espeletia pycnophylla-Calamagrostis effusa unifies all the zonal bunchgrass páramos ofthe Guandera-El Angel study area. There was no structural subpáramo community detectable in our study area. Thiscan probably be explained by the frequent fires that affect the páramo-forest ecotone and which result into a sharp discontinuity in the vegetation at the upper forest line location in Guandera. For Guandera we described also two distinct zonal páramo communities: a bamboo patch and 'páramo islands' the relatively undisturbedGuandera Biological Reserve site and the highly disturbed El Angel Ecological Reserve site. in high Andean Forest. In El Angel, the floristic composition of subassociation of Paspalum bonplandianum (bunchgrass páramo at 3430–3680 m) of the Gynoxys buxifolia -Calamagrostis effusa community suggests that the vegetation of this subcommunity was probably located on former forested land, This is evidenced by the disappearance of high Andean forest and the upper part of Andean forest, combined with the presence of many native and exotic weedy species. The presence of distinct 'weedy' taxa in the subcommunity of Paspalumbonplandianum was undeniably a response to habitat alteration induced by human activities. On the basis of only phytosociological criteria (including structure and composition) we suppose that the natural UFL was only some 20 m higher in altitude in Guandera and in El Angel páramo at about 3550-3570 m, the uppermost limit of the Paspalum bonplandianum subcommunity of the Gynoxys buxifolia-Calamagrostis effusa community of bunchgrass paramos with Espeletia pycnophylla ssp. angelensis and close to the isolated asteraceous forest patches at 3740 m.

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Session 15: Learning from the past: environmental history and biodiversity development - TalkT15-03

Altitudinal migration of Ecuadorian montane forest during the last 3000 years; is afforestation a correct carbon sink?

H. Hooghiemstra, M. Moscol Olivera, J. Bakker, A.M.Cleef & J. Duivenvoorden

The Ecuadorian Andes is inhabited for almost two millennia and severely deforested. In the frame of the Kyoto Protocol afforestation projects are stimulated to compensate for national carbon emissions. In absence of knowledge of the natural position of the upper forest line (UFL) forest plantations can be found up to 3900 m. The literature offers two hypothesis: (1) a supposed UFL at 4000-4100 m. Deforestation and expansion of agricultural land use allowed the páramo to expand downslope over 300-400 m ('paramización') with the implication that reforestation up to 4000 m can be seen as a kind of restoration activity; (2) a supposed UFL at 3600-3700 m with the implication that afforestation (= making forest where forest was not present before under natural conditions) above 3700 m is discreditable and erasing a natural ecosystem. Innovative multiproxy research along a 3300-4000 m transect showed clearly that during the last 3000 years the UFL had not surpassed 3650 m altitude (Bakker et al. The Holocene 18(2008): 877-893). Páramo grassland above 3650 m represent a natural ecosystem which deserves protection against unjustified afforestation. Baseline studies, documenting the natural setting before human interference, are needed before measurements are being implemented.

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Session 15: Learning from the past: environmental history and biodiversity development - PosterT15-04

Vegetation, biodiversity and fire dynamics on the southern Brazilian highland and their implication for conservation and management of modern Araucaria forest and grassland ecosystems

H.Behling & V.Pillar

Palaeoecological background information is needed for management and conservation of the highly diverse mosaic of Araucaria forest and Campos (grassland) in southern Brazil. Questions on the origin of Araucaria forest and grasslands, its development, dynamic and stability, its response to environmental change such as climate, and the role of human impact, are essential. Further questions on its natural stage of vegetation or its alteration by pre- and post-Columbian anthropogenic activity are also important. To answer these questions, palaeoecological and palaeoenvironmental data based on pollen, charcoal, and multivariate data analysis of radiocarbon dated sedimentary archives from southern Brazil are used to provide an insight into past vegetation changes that allow us to improve our understanding of the modern vegetation and to develop conservation and management strategies for the strongly affected ecosystems in southern Brazil.

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Session 15: Learning from the past: environmental history and biodiversity development - TalkT15-05

Drivers of peatswamp development in the Malay Archipelago: implications for ecosystem stability and carbon sequestration

R. Dommain, J. Couwenberg & H. Joosten

The lowland ombrotrophic peatswamps of Southeast Asia cover approximately 37 million ha and store ca. 55 Gt carbon in Indonesia alone. Two types of peatswamp are distinguished: inland sites located 80-200 km from the coast and coastal sites occurring closer to the sea.Inland peatswamps developed near podzol terraces since about 13000 cal BP, in reaction to rising sea levels. Peat and carbon accumulation of these interfluvial peatswamps largely followed the rate of Post Glacial sea level rise. From about 6000 cal BP coastal peatswamps rapidly developed on mangrove deposits as the rise in sea level stagnated. The Mid Holocene phase of coastal peatswamp formation (~6000 and ~4000 cal BP) was furthermore favoured by the regional Holocene precipitation maximum and the low contemporaneous El Niño activity. The lowered sea levels and high El Niño activity during the Late Holocene, caused peat degradation of inland peatswamps while coastal sites continued to accumulate peat at a constant rate. Their resilience to changes in regional hydrology and climate is highlighted by a two to three times higher carbon accumulation rate (~74 g C m-2 a-1) compared to inland peatswamps. Only in modern times have these peatswamps stopped accumulating due to human disturbance.

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Session 15: Learning from the past: environmental history and biodiversity development - PosterP15-01

Environmental history and nature conservancy in Central Sulawesi, Indonesia

W. Kirleis & H. Behling

If development is considered in the long run, palaeo-records and archaeological records show that rainforest partly is secondary forest. In the case of the Lore Lindu National Park in Central Sulawesi it is the modern interface of the rainforest that has been affected by people throughout the last 3500 years. Earliest human interference was related to the first appearance of Neolithic farmers in Sulawesi about 3500 years ago. Separating natural processes of vegetation dynamics from anthropogenic impact was possible for one pollen record in Central Sulawesi. A grassland area at the rainforest border could be identified as being of anthropogenic origin. This evidence is contradictory to the assumption of local people and the nature conservancy management who so far have considered this grassland as natural. The investigation site is located in the southern part of the Lore Lindu Biosphere Reserve and National Park in Central Sulawesi. Although it was declared a Biosphere Reserve in 1978 already and in 1983 partly became a National Park, there is still need to convert the objectives of the UNESCO programme. The determination of complex natural and anthropogenic site histories revealed by pollen analysis may contribute to improve the implementation of this particular Biosphere Reserve.

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Session 15: Learning from the past: environmental history and biodiversity development - PosterP15-02

Vegetation and environmental dynamics as well as anthropogenic impact during the last ~500 years inferred from the Laguna Campana record in southern Ecuador

C. Brunschön, T. Haberzettl & H. Behling

A lake sediment record from Laguna Campana at 2488 m a.s.l. in the Ecuadorian Cordillera Real was used to reconstruct local environmental conditions over the last ~500 years. Pollen-, spore-, charcoal- as well as XRF-analyses focused on the lake genesis, hydrological variations and the development of the surrounding vegetation. Results show that Laguna Campana originated from a landslide, naturally common and anthropogenically promoted in the study area. Human activities as deforestation or slash and burn cultivation impacted the vegetation development during the whole time. After a first dense layer of pioneer grasses developed on open soil, successional stages of secondary upper mountain rainforest forest mainly composed of Alnus and Weinmannia were observed. However, the record shows no signs of regenerated dense forest but rather open vegetation with low trees and a grassy understory. Especially during the last decades, forest proportion in the area was diminished most likely by fire use for cultivations and wood extraction. Hydrological variability was derived from differences in minerogenic input as well as variations in Botryococcus braunii and Sphagnum. After the wettest period triggering the landslide, a time of drier conditions occurred during AD 1850-1950. A return to wetter conditions was observed over the last decades.

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Session 15: Learning from the past: environmental history and biodiversity development - PosterP15-03

Explaining and predicting the impact of global change on forest biodiversity in the Congo Basin: the CoForChange project

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The Congo Basin's tropical moist forests are critically affected by current climate and anthropogenic changes. How, why and where will tree species survive increasing pressure in this region is a challenging issue, which requires an urgent clarification and integration of tree ecological strategies to produce decision-making tools essential for sound management and conservation policies. The CoForChange project, funded by three european agencies in the context of the Era-Net Biodiversa, gathers an interdisciplinary consortium linking 14 institutes from four European and four African countries, and an international organization. The project started in January 2009 and will involve: (i) cross-analysing satellite imagery, extensive forest inventories, maps of the main environmental factors to produce a comprehensive vegetation map; (ii) assessing critical tree species functional traits through field experiments; (iii) linking the status of the current structure/composition/diversity of forests with past climatic and anthropogenic disturbances; (iv) integrating knowledge in a vegetation model to predict the impact of various policy and climate change scenarios. Besides strengthening a wide pool of knowledge on the ecology of the Congo Basin's forests, and providing scientific advances in this field, the project will produce thematic maps and databases helping the prioritisation of environmental activities and regulation in the region.

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Session 15: Learning from the past: environmental history and biodiversity development - PosterP15-04

Late Quaternary environmental dynamics in the Serra dos Carajás, south-eastern Amazônia

B. Hermanowski, H. Behling

The plateau of the Serra dos Carajás in Amazônia is located in the south of the state of Pará, Brazil. This region is affected by the shifting of the Intertropical Convergence Zone (ITCZ) from its winter to its summer position, which is a relevant factor for Amazonian vegetation composition. Nowadays the plateau is covered by edaphic savanna systems whereas tropical lowland rain forest mainly occurs in the surroundings. Our new palynological and micro-charcoal fragment analysis of a 4 m swamp core (6°21'6.20"S, 50°23'36.60"W, 741m asl) indicate cyclic changes between the two dominating vegetation types, tropical rainforest and savanna systems, over > 50,000 years bp. The proportions of tropical rainforest and savanna systems seem to be relatively stable during the late Pleistocene, though at the end of the Pleistocene tropical rainforest decreases. At the transition from the late Pleistocene to Early Holocene tropical rainforest increases again whereas savannas remain stable and during the Holocene the proportions of tropical rainforest and savanna elements again seem to be relatively stable. The occurance of Podocarpus and other mountain taxa at core depths of 160 and 442 cm indicates cooler climatic conditions at the transition from the late Pleistocene to Early Holocene, the variable swamp lake level, as reflected by an increased appearance of Nymphea pollen, could refer to variations in the precipitation regime over > 50,000 years bp, when humid phases alternated with drier phases. It is assumed that these results could not only reflect regional environmental changes but also climatic changes on a larger scale during the late Pleistocene and Holocene.

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Session 15: Learning from the past: environmental history and biodiversity development - PosterP15-05

Late Holocene vegetation, fire, climate and tree line dynamics in the Podocarpus National Park, southeastern Ecuador

*Fernando Rodríguez * and Hermann Behling*

Late Holocene vegetation, fire, climate and tree line dynamics have been studied based on high-resolution pollen and charcoal analysis. Two sediment cores, Rabadilla de Vaca Mire (RVM dated 2100 cal yr BP) and Valle Pequeño bog (VP dated 1630 cal yr BP), were taken at the modern tree line in the PNP southeastern Ecuador. Records reflect relatively stable ecosystems with slight changes in the floral composition during the recorded period.Changes of the proportion between Subpáramo and Páramo are related to lower and higher frequency of fires. At RVM the tree line shows slight shift to higher elevation between 1630 until 880 cal yr BP getting stable after 310 cal yr BP. Human impact is suggested due to the high fire frequency between 1800 - 1600 and 880 - 310 cal yr BP. In VP bog is no evident shifting of tree line. Charcoal records suggest human impact during the last 200 years. High fire frequency is an important factor that reduced the expansion of Subpáramo and UMF and favored the distribution of grass Páramo. Since, there is a clear correlation between fire and vegetation dynamic, it is difficult to detect if climate change played also a significant role in the tree line shifting.

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Session 15: Learning from the past: environmental history and biodiversity development - PosterP15-06

Assessing tropical grasslands in South America

Lisa Schüler & Hermann Behling

During the past, in particular during glacial times, different grassland ecosystems played a much larger role and had a significant larger distribution. Little is known about the past development, biodiversity and dynamic of grassland ecosystems. In this innovative pilot study we attempt to distinguish between different tropical grassland types in South America in space and time based on morphological pollen characteristics of Poaceae.For this purpose >60-80 Poaceae pollen grains of 19 grassland samples were measured concerning their length, width, pore diameter as well as annulus width and height. Samples were taken sites in Páramo vegetation differing in time and from sites in the south-eastern Brazilian highlands (Campos do Altitude) of the same age; additionally, we investigated samples from a Pampa site as well as samples from one Campos grassland site in southern Brazil varying in age.Our results reveal a highly dynamic development of the individual grassland types; they also give us interesting information on Poaceae taxa composition patterns, development and possibly changes in biodiversity within these ecosystems. By means of multivariate data analysis of the complete data set we can observe changes in taxa composition along an elevational gradient in the Páramo grasslands. Moreover, our data provide an indication for the state of the Campos ecosystems in the southern Brazilian highlands during the late Pleistocene which is still an unsolved and controversial issue in palaeoecology.

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Session 16: Cascading effects of hunting in tropical forests - TalkT16-01

Hunting impacts on density dependence of recruitment in a Neotropical palm

P.A. Jansen, M.D. Visser & S.J. Wright

Negative density dependence of recruitment is an important hypothesized mechanism for the maintenance of high tree species diversity in tropical forests. We studied how population-level density dependence in the large-seeded forest palm Attalea butyracea was affected by hunting, which simultaneously affects two major drivers of density dependence: seed dispersal and seed predation. We established 1-ha plots that encompassed a wide gradient of adult palm densities in a protected forest (Barro Colorado Island) and in the hunted but otherwise comparable forest (Soberania National Park) in Central Panama. We measured seed dispersal, seed predation and seedling recruitment by mapping and analyzing seed remains in the soil, mapping seedlings, and inversely model dispersal kernels. We found that seed dispersal was more negatively density-dependent, seed predation less negatively density-dependent, and seedling recruitment success again more negatively density-dependent under hunting. Nevertheless, levels of seedling recruitment were much higher overall under hunting, because host-specific predators did not compensate for lower seed predation by mammals. Thus, hunting increased population-level density dependence in this palm species, but the species nevertheless attained overall higher reproductive success.

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Session 16: Cascading effects of hunting in tropical forests - TalkT16-02

Frugivore loss and recruitment limitation in tropical trees

K.M. Holbrook & B.A. Loiselle

Seed dispersal and especially long-distance dispersal (LDD) is vitally important for the dynamics and diversity of tropical forests. The loss of large-bodied frugivores through hunting is likely to truncate dispersal distances and limit plant recruitment, yet empirical evidence remains scanty. Further, despite the importance of LLD, studies are rare that examine seed movement at the appropriate scale. We combine field observations and genetic fingerprinting to estimate effective dispersal distances using seedling distributions for Virola flexuosa in two lowland tropical forest plots that differ in hunting pressures. To quantify differences in disperser abundance between hunted and non-hunted sites, we surveyed avian frugivores along transect routes. Censuses revealed that in both years surveyed, large frugivorous birds were less abundant at the hunted site compared to the non-hunted site; primate abundances were also significantly lower based on published literature. Mean effective dispersal distances were reduced by nearly 50% (from 196 to 100 m) at the hunted site compared to the non-hunted site and there was a significant decline in LDD. The strong decline in dispersal distances at the hunted site suggests that uncontrolled hunting of important frugivores in tropical forests worldwide may substantially affect the spatial, demographic, and genetic structure of tree populations.

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Session 16: Cascading effects of hunting in tropical forests - TalkT16-03

Too many animals and not enough animals in African parks

John Terborgh and Lisa Davenport

Animal-mediated processes, including herbivory, seed dispersal and seed predation, exert important influences on tree recruitment in tropical forests around the world. When animal communities are distorted through anthropogenic influences, tree recruitment can go seriously awry. We report on recent visits to three African forest parks in Tanzania and Gabon. One of these parks, La Lope in Gabon, supports an intact fauna. The other two are relatively small and suffer from distortions in their animal communities. In one of these (Arusha NP, Tanzania), lions have been absent for a century. Buffalo now enter the forest without fear of ambush and heavily graze the understory, resulting in a nearly total suppression of tree recruitment. The second park, comprising 50 km2 of forest north of Libreville, Gabon, has been heavily poached and is a classic “empty” forest. The ground vegetation consists of dense carpets of seedlings of trees directly overhead. The forest of neither of these parks is likely to be self-perpetuating. If forest regeneration processes are massively distorted in two out of three African parks picked more-or-less at random, one has to be concerned that similar aberrations will appear in many other parks in Africa and elsewhere in the tropics.

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Session 16: Cascading effects of hunting in tropical forests - TalkT16-04

Hunting and seed dispersal in Tropical East Asia

R.T. Corlett

All vertebrate communities in tropical East Asia have been more or less modified by hunting, with the impacts on individual species ranging from a reduction in population density to local or regional extinction. Range reductions in many megafaunal species in prehistory may also be attributable to hunting. Changed vertebrate communities could impact seed dispersal by a quantitative reduction in the removal of ripe fruits and/or by a reduction in seed dispersal quality, including the distance to which seeds are dispersed. A reduction in maximum dispersal distances will be particularly significant in relation to responses to anthropogenic climate change. I review the available information on hunting impacts and seed dispersal in tropical East Asia, and show that current hunting patterns will maximize adverse impacts. I conclude that there should be an immediate regional moratorium on the hunting of large fruit bats, fruit pigeons, and other large frugivorous birds because of their key role in long-distance seed dispersal in fragmented landscapes.

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Session 16: Cascading effects of hunting in tropical forests - TalkT16-05

The hunting footprint of Amazonian forests

C.A. Peres

Game hunting has profound negative effects on the biomass, species diversity and size structure of vertebrate assemblages in otherwise undisturbed tropical forests. Hunting affects primarily large-bodied species that are often preferred by subsistence or commercial hunters and associated with low r-max values. I present a meta-analysis of the structure of game harvest profiles across all hunting studies in Amazonian forests, and evaluate the settlement-level conditions under which game harvest can be more sustainable on a landscape scale. I also consider GIS-based pan-Amazonian models of accessibility of game hunters and nontimber resource depletion in both protected and unprotected forest areas to estimate the intensity and extent to which Amazonian forests are (over)hunted. Not surprisingly, these models show that large forest reserves are intrinsically less likely to be overhunted. Finally, I consider the effects of depleted frugivore populations across the Brazilian Amazon on a functional group of large-seeded plant species that are most likely to succumb to severe dispersal limitation and recruitment bottlenecks.

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Session 16: Cascading effects of hunting in tropical forests - TalkT16-06

Do large vertebrates generate unique ecological patterns that change when species go extinct?

J.M.V. Fragoso

General predictions concerning patterns in seed survivorship, seedling recruitment and plant distribution resulting from different animal diversity and abundance scenarios remain poorly developed. Our work in the Amazon region indicates that seed eating and seed dispersing vertebrate species vary in diversity and abundance across scales of a few to tens of km. Such variance occurs in areas that experience hunting by humans, as well as in unhunted areas. Given existing evidence that plant population and community dynamics do vary with vertebrate diversity and abundance, how do these dynamics change when animal communities vary naturally, when humans hunt animals and when humans introduce free-ranging, seed ingesting domestic and feral vertebrates into the system? And how might we incorporate the ecological interactions mediated by these differing animal communities into predictions of plant community dynamics? For example, might the introduction of exotic species nullify the effects of the population reduction or extirpation of native species? Here I show how animal diversity and abundance vary in areas with and without human impacts and develop a set of predictions that may facilitate the testing of hypotheses concerning pattern in the generation, maintenance and degradation of plant communities linked to different levels of vertebrate diversity and abundance.

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Session 16: Cascading effects of hunting in tropical forests - PosterP16-01

Extirpation of large mammals due to uncontrollable not-always-subsistence hunting in northern Brazilian Amazonia

A. R. Mendes Pontes & A. P. Silva Júnior

Large mammals in the northernmost Brazilian Amazonia remained relatively inaccessible for centuries, although in the last decades human population within wilderness areas has grown at least threefold due mainly to the establishment of fish-bone human settlements. Studies on mammal diversity and abundance in Roraima are relatively recent and the impacts of hunting, totally unknown. For 15 yrs intensive systematic surveys were carried out through the line transect method in Maracá Ecological Station, a well-protected area, as well as in Novo Paraíso, a fish-bone human settlement, where hunting is widespread and legalized. In the impacted area hunting has caused the local extirpation of 19 species, and a sharp drop of 93% in the total biomass of the formerly occurring large mammals. The orders with the most significant losses were Perissodactyla and Artiodactyla, with the former totally extirpated, and the latter, with only 1.1% of the total biomass. Carnivora, nevertheless, had a significant increase of 52.6% in their total biomass in the impacted area. Hunting is legalised and practiced for reasons other than subsistence, uncontrollable, and unsustainable. The area is of high conservation priority and should be transformed in a Reserve of Sustainable Development (RDS).

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Session 16: Cascading effects of hunting in tropical forests - PosterP16-02

Estimating sustainability of hunting: the need of renewal

H. Vanthomme

The "Bushmeat Crisis" receives considerable attention and funding since the 90's. Hunting of wildlife is now seen as one of the main conservation treats facing global biodiversity. In Central Africa, hunting is considered largely as unsustainable thought markets are still daily supplied with bushmeat. Furthermore, for the more common medium and small-sized game species, no sign of large-scale extinctions have been reported.To deal with this contradiction, we review the studies which estimate sustainability of hunting focussing on the uncertainties of these estimations, following the pioneer article of vanVliet & Nasi (2008). We extended the analysis to all methods encountered in the articles reviewed. Using our work in Central African Republic, we illustrate these uncertainties and identify the bias associated with each of them.This review and our experience in CAR stress the need to renew the approach of sustainability of hunting, and not focussing only on impacts on game species. The approach from the small end of the telescope neither provides accurate information on the status of the more common medium and small-sized game species, nor estimates the impact of hunting on the resilience of ecosystems or socio-economics systems. Protocols to tackle these questions are proposed in this communication.

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Session 17: Biofuels, biodiversity and people - TalkT17-01

REDD in the Red: Palm Oil Could Undermine Carbon Payment Schemes

L.P. Koh, R.A. Butler & J. Ghazoul

Mechanisms to reduce carbon emissions from deforestation and forest degradation (REDD) have been gaining momentum as a way to combat global warming, fund forest conservation, and deliver economic benefits to rural populations. However, the economic viability of REDD schemes will depend on the profitability of alternative land uses. Oil palm agriculture has become a major driver of tropical deforestation over the last few decades. Here, we model and compare the profitability of converting forest to oil palm versus conserving it for an REDD project. We show that converting a hectare of forest for palm oil production will be more profitable (yielding net present values of $3,835-$9,630) to land owners than preserving it for carbon credits ($614-$994), which are currently restricted to voluntary carbon markets. Giving REDD credits price parity with carbon credits traded in compliance markets would boost the profitability of avoided deforestation (up to $6,605). Our findings suggest that unless post-2012 global climate policies legitimize the trading of carbon credits from avoided deforestation, REDD would not be financially competitive with oil palm agriculture or other similarly profitable human activities, in which case it would not be able to fulfill its primary function of avoiding deforestation.

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Session 17: Biofuels, biodiversity and people - TalkT17-02

The livelihood impacts of oil palm in Indonesia; missed opportunities for local economic development?

P. Levang and L. Rist

Until the current financial crisis, surging global demand for palm oil led to an enormous increase in the planting of oil palm across South East Asia, including in Indonesia. With this decline unlikely to continue the biodiversity and climate impacts of oil palm expansion continue to receive significant attention. The human side of the issue, highlighted with reports of significant negative livelihood impacts and human rights abuses by oil palm companies, has also led to controversy. Although undoubtedly oil palm development in many locations has led to significant conflict, many Indonesian smallholders have in fact benefited significantly from the higher returns to land and labour afforded by oil palm. An assessment of the livelihood impacts of oil palm development in the context of local economic realities and rural peoples own development aspirations is urgently needed to inform future expansion.

Social conflicts have resulted almost entirely from lack of transparency, free prior and informed consent and equal benefit sharing on behalf of oil palm companies. Thus, in order to favour the development of smallholder friendly oil palm development regimes the conduct of these companies must be improved. We argue that district authorities are key stakeholders in this regard. With vested political and financial interests they frequently play companies and communities against each other impeding progress towards improved company behaviour and positive outcomes for the local community. We present evidence to support the potential for oil palm agriculture to foster local economic development in rural Indonesia and outline how the use of standard development contracts and the drafting RSPO-like regulations at the district level may be an efficient way for securing smallholder friendly oil palm development. Oil palm expansion in Indonesia is set to continue, with the correct policy interventions this may be achieved to the significant benefit of large numbers of rural smallholders.

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Session 17: Biofuels, biodiversity and people - TalkT17-03

Biofuel expansion, land-use and agrarian change in the Amazon

P. Pacheco

Significant expansion of agricultural frontiers is taking place in the Amazon with strong implications for forest conservation, landscape sustainability and economic growth. While cattle ranching is still the main driver of deforestation, feedstock expansion for potential biofuel production (e.g. soybean and sugar cane) has direct and indirect implications on land use change, the magnitudes of which are difficult to determine. I argue that the implications of feedstock development in the Amazon has to be assessed taking into account broader historical trends of agrarian change, as well as specific socio-economic landscape configurations. On one side, agrarian change is linked to agricultural modernization, greater market integration, investments in processing facilities closer to production zones, and land tenure changes. On the other , landscapes configuration relates to the consolidation of agribusiness landscapes in opposition to peasant landscapes. We can expect that feedstock development for biofuels will grow rapidly in agribusiness landscapes where the dynamics of agricultural modernization are more intense. Yet this expansion will also be constrained by cattle ranching development and initiatives aimed at increasing the benefits from forest conservation. This analysis will assess specific landscape change dynamics in Bolivia and Brazil.

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Session 17: Biofuels, biodiversity and people - TalkT17-04

Strengthening RSPO capability to mitigate impacts of palm oil production on biodiversity

T. Maddox S. Persey

The Roundtable for Sustainable Palm Oil (RSPO) was set up by industry and NGOs in response to concerns over the environmental and social impacts of palm oil production. Whilst attracting criticisms from various quarters, it remains one of the most significant channels for mitigating the negative impacts of oil palm on biodiversity, with its membership representing forty percent of all palm oil produced. The Zoological Society of London (ZSL) has been working on oil palm and wildlife ecology issues since 2002. In this presentation we briefly review our work so far and outline why we believe the future for mitigating palm oil impacts on biodiversity depend on working within the RSPO framework. We outline where we believe the primary weaknesses of the RSPO lie, with respect to biodiversity conservation, based on key informant interviews, and we present how ZSL and the Biodiversity Agricultural Commodities Programme (BACP) aim to address some of these issues in a new project in Indonesia.

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Session 17: Biofuels, biodiversity and people - TalkT17-05

Family agriculture and the sustainable standards in palm oil sector

E. CHEYNS

Recently, new international concerns for "sustainable" oil palm, expressed through "multi stakeholder" initiatives, notably the Roundtable on Sustainable Palm Oil" (RSPO), have been raising new questions about the future of family agriculture. The Roundtable, which is geared towards defining a list of sustainable production "criteria", has reintroduced the question of production standards. Family agriculture contributes 30% of global oil palm production. We examine the current situation in which oil palm-based family farms find themselves, focusing on two countries, Cameroon and Ivory Coast. We examine the outcome of the previous phases of family agriculture standardization by Estates and State-owned companies between 1960 and 1990, followed by privatization of the sector. Family agriculture possesses its own rationality which needs to be taken into consideration in discussion of oil palm sustainability. Past experience has shown that standards applicable to strict estate monocultures do not "fit into" a family farm logic. Our analysis of oil palm-based cropping and farming systems a) specifies the logics underlying production practices and highlights their specificity, b) shows the tensions between some norms coming from industrial and monoculture rationality and the rationality of diversification in family agriculture, and c) reiterates the minimum conditions required for family agriculture to achieve the socio-economic reproduction level of the household: access to capital and information, minimum land areas and prices and representation on negotiating bodies.

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Session 17: Biofuels, biodiversity and people - PosterP17-01

Valuing Degraded Lands; Managing for Biodiversity Conservation in an Oil Palm Landscape

L.E.S. Cole

Palm oil, the World's most traded oilseed crop, makes up an important part of energy provision across the globe. Yet the expansion of oil palm plantations is contributing to high rates of tropical deforestation, impacting on biodiversity and exacerbating CO2 emissions. Economics and information shortfalls are driving this continued expansion, and thus strategies directing it into less ecologically-important habitats are urgently needed. Development of degraded lands is currently central in the debate on sustainable palm oil. However, there is a fundamental lack of information about the impact of such development for biodiversity conservation. This project aims to develop a strategic definition of degraded lands in Borneo, Southeast Asia. Palaeoecological techniques will be used to reconstruct past vegetation dynamics on different fallow lands and establish forest recovery rates after disturbance. This information will be used to estimate the cost of different land-use scenarios. Social surveys will identify the land's value to surrounding communities, and assist with the identification of incentive mechanisms that reduce agricultural expansion into mature forest. Overall, this research aims to assess the past dynamics, present use and future potential of degraded lands, and produce a decision-making tool for more sustainable landscape management in this biodiversity and agricultural hotspot.

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Session 17: Biofuels, biodiversity and people - PosterP17-02

Subsistence Foods to Export Goods - The impact of an oil palm plantation on local food sovereignty in North Barito, Central Kalimantan, Indonesia

M.G. Orth

Driven by the increasing global demand for palm oil, large-scale oil palm plantations have replaced natural rainforest, swidden fallows and forest gardens throughout Indonesia. This transformation of the landscape has led to radical changes for the environment, wildlife and human beings. Based on questionnaires, semi-structured interviews, participant observation and focus groups, this study assesses local food sovereignty indicators in three villages in different proximity of an oil palm plantation in North Barito, Central Kalimantan. Their forest and farming lands converted to oil palm, villagers find it more difficult to collect NTFP's. The lack of arable land forces a change from swidden cultivation to intensive farming. Many give up rice cultivation and the diversity of cultivated crops declines, all leading to higher food expenses. Those living in close proximity of the oil palm plantation claim it is more difficult to find clean water. Local food sovereignty has obviously declined for the villages located in close proximity of the oil palm plantation. Where a diversity of subsistence foods used to be cultivated, now only the export crop oil palm is grown; a shift from subsistence foods to export goods.

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Session 17: Biofuels, biodiversity and people - PosterP17-03

Life cycle assessment of Jatropha biodiesel

W.M.J. Achten, J. Almeida, E. Bolle, V. Fobelets, J. Deckers, V.P. Singh, L. Verchot, E. Mathijs & B. Muys

Jatropha curcas L. is a semi-wild deciduous, stem succulent crop producing seed oil suitable to convert in bio-diesel. Unchecked claims on drought resistance, soil erosion, wasteland reclamation and socio-economic benefits have boosted the plantation of Jatropha worldwide. Besides above mentioned unchecked claims the environmental performance of the Jatropha bio-diesel system rests under-investigated as well. Through life cycle assessment (LCA), a cradle to grave environmental impact evaluation, we contribute to the knowledge on this latter point.In this oral presentation we will present the results of our LCA study on Jatropha biodiesel covering the energy balance, the impact on global warming potential, eutrophication potential, acidification potential and land use impact in comparison to a fossil reference system.

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Session 17: Biofuels, biodiversity and people - PosterP17-04

Biofuel versus biodiversity: Ecological impact of sugarcane production on the diversity and community structure of ants in Western Kenya

G. Fischer, F. Hita Garcia, M.K. Peters

Triggered by soaring oil-prices and the idea of “green fuel”, biofuel production is rapidly increasing in many tropical countries, with significant implications for natural habitats, particularly tropical rainforests. The consequences of these land-use changes on Guineo-Congolian insect communities are little understood. Ants are among the most abundant insect groups and of high functional importance. We studied ant communities along a gradient of land-use intensification in Western Kenya, encompassing primary rainforest, low-input sugarcane farming and intensive monocultural sugarcane production. Ant species richness decreased significantly along the gradient, dropping in sugarcane monocultures. Species communities in sugarcane fields showed low overlap with those in forest sites, suggesting that the majority of rainforest species can not be conserved in the agricultural landscape. We also found evidence of response to reduced food-web complexity, the ratio of specialist predators to generalist foragers decreased strongly along our gradient.

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Session 17: Biofuels, biodiversity and people - PosterP17-05

Global climate change issues, biofuel policies and their impacts on local people's livelihoods and biodiversity conservation - A case study from Danau Sentarum National Park, Indonesia

E.L. Yuliani, Y. Indriatmoko, M.A. Salim & I. Fadil

In response to a global agenda promoting bio-fuels, the government of Indonesia supports expansion of oil palm plantations, often in forested or peatland areas. Touted as contributing to climate change mitigation and poverty alleviation, oil-palm plantations are also accused of damaging the environment and local livelihoods. To better understand its impact we studied 18 oil palm plantations surrounding the Danau Sentarum National Park. The study addressed environmental dimensions: forest cover, peat land degradation, potential carbon emission, and potential local extinction of fish species, as well as social dimensions: income and health, conflict, indications of illegality, and strategies by companies and the government to suppress local resistance. The study showed a potential loss of approximately 96,500 ha of peatland containing 128 million tons of carbon and 141,290 ha; income from a USD 15 million per year fish industry; and at least 89 fish species. Furthermore the high use of pesticides endangers local people's health. Horizontal and vertical conflict increased. We conclude that implementation of the Indonesian biofuel policy has worsened deforestation and forest degradation, promoted conflict and illegalities, and put local people's livelihoods and health at risk. It will also reduce biodiversity and release more carbon into the atmosphere.

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Session 17: Biofuels, biodiversity and people - PosterP17-06

Where has the carbon gone? Monitoring biomass and emissions from conversion of rainforest to oil palm in Sabah, Malaysia

A.C. Morel, J.B. Fisher, Y. Malhi

The past 10 years in Sabah has seen an increase in planted oil palm from 0.8 mha to 1.33 mha, making it the center of 30% of oil palm planted area in Malaysia. However, there is nearly no information on what land cover type was replaced by this crop and therefore what carbon emissions from this land use change could be attributed to oil palm expansion. This study uses ground-based forest inventory data collected in 2007 and 2008 across land cover types; these measurements were coupled with radar-based ALOS-PALSAR images from 2008 to derive biomass estimates for the region. Plot biomass estimates were obtained using a number of allometric equations using different combinations of mensuration data (e.g. wood density, dbh and height) to assess which had the strongest correlations with satellite imagery, providing insight as to minimum data required for reliable biomass monitoring. Results of this study will contribute to the ongoing debate regarding the carbon footprint of oil palm cultivation, particularly relevant for palm oil used as a biofuel feedstock, as well as assessing present capability of monitoring above ground biomass for a future reduced emission from deforestation and degradation (REDD) methodology.

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Session 18: Ecosystem engineers in a changing world - TalkT18-01

Alteration of soil labile organic carbon by invasive earthworms (Pontoscolex corethrurus) in tropical rubber plantations

X.M. Zou, M. Zhang

The invasive earthworm (Pontoscolex corethrurus) is commonly found in tropical tree plantations. To understand the long-term impact of this invasive earthworm on soil labile organic carbon (LOC), we examined changes in LOC protected and unprotected by soil aggregates during a 20-month worm-exclusion experiment in rubber plantations of Xishuangbanna, China. We found that the presence of invasive earthworms decreased soil microbial biomass (MBC) and increased LOC (up to 35% of total soil LOC in the surface layer) protected by aggregates in the surface soil layer (0-5 cm). In contrast, the presence of these worms increased soil MBC and LOC unprotected by the aggregates, and decreased LOC and its turnover time protected by the aggregates in subsurface soil layer (5-15 cm). These findings suggest that the invasion of P. corethrurus can redistribute LOC along soil vertical profiles with accumulation of the protected LOC on surface soil layer and the unprotected LOC on subsurface soil layer. This redistribution of LOC along soil profile may affect soil carbon cycling in long-term.

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Session 18: Ecosystem engineers in a changing world - TalkT18-02

Termite impacts on soil properties and processes: improving soil hydrological function in grazing lands of semi-arid tropical Queensland, Australia.

Dawes-Gromadzki, T.Z., A.C. Liedloff & A.M. Brandis.

Healthy soils underpin healthy sustainable landscapes through their effective capture, retention and recycling of water and nutrients. In the semi-arid tropical savannas of Australia where the primary land use is cattle grazing, declining soil health has become a critical issue. Within the Great Barrier Reef Lagoon catchments along north-east Queensland, symptoms include increased soil compaction, reduced water infiltration and nutrient holding capacity, and increased sediment, nutrient and water run-off. Improving soil hydrological function is critical to reducing these effects. We are investigating the functional relationships between termite assemblage structure and vegetation patchiness, soil macropore creation, soil ecohydrology and cattle grazing. Termites appear to be key drivers of soil hydrological function through the creation and maintenance of macropores, which facilitates the capture, infiltration and retention of rainfall. However, patchiness of perennial vegetation and cattle grazing can have marked effects on the structure and functioning of termite assemblages in these landscapes. Termite activity and diversity varies considerably across the landscape, leading to changes in macropore density and soil water capture. Heavy grazing intensity reduces termite activity and macropore density, in turn reducing the ability of these landscapes to capture water. We are also feeding our results into the Savanna.au computer simulation model to predict how changes in soil health due to changes in termite activity affect soil water infiltration and runoff.

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Session 18: Ecosystem engineers in a changing world - TalkT18-03

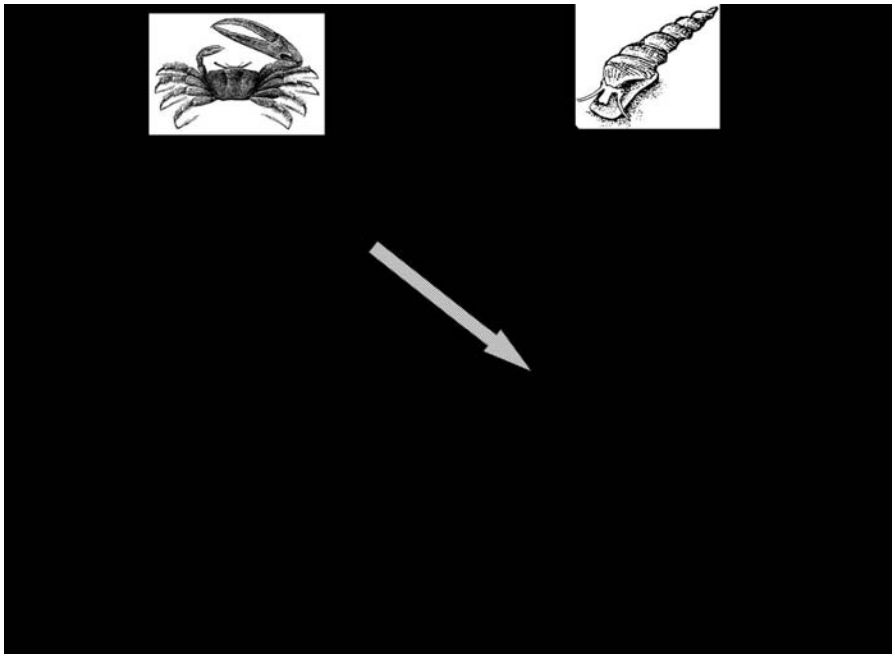
Effects of domestic sewage on survival and bioturbation activities of mangrove fiddler crabs and gastropods; with emphasis on their role for ecosystem functioning in wastewater wetlands

G. Penha-Lopes, E. Kristensen, F. Bartolini, S. Limbu, S. Cannicci, J. Paula

The role of wastewater wetlands is through biological, chemical and physical processes which help decrease the content of organic matter and nutrients from sewage to acceptable levels before it is discharged into surrounding aquatic ecosystems. This approach is, in fact, now a worldwide accepted technology for water pollution control, mainly due to low running cost and high filtration efficiency. Mangrove forests are widely spread in the tropical coasts and are known to provide important ecosystem goods and services for local communities as well as play a key role in nutrient cycling of coastal ecosystems and global carbon cycling. Natural and constructed mangrove wetlands have been found to be very efficient in sewage filtration and prevention of coastal pollution. However, the role of macrofauna in natural and constructed mangrove ecosystems has only recently been addressed. In the present study we show the effects of macrofauna on sediment dynamics and biogeochemistry in pristine and peri-urban mangroves as well as in constructed wetlands where domestic sewage loadings, inundation periodicity and vegetation conditions were controlled. Survival and bioturbation activities, and thus ecosystem engineering potential, of two of the most abundant macrofauna groups in mangrove forest, crabs and gastropods, will be addressed.

Session 18: Ecosystem engineers in a changing world - TalkT18-03

Figure 1: Flow diagram showing the features by which ecosystem engineers affect biological activity and heterogeneity in sediment environments, and consequently the mangrove wetland filtration efficiency.



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Session 18: Ecosystem engineers in a changing world - TalkT18-04

Decomposition processes in Colombian streams: influence of invertebrate shredders, plant compounds, and hydrology

G. Rueda-Delgado & K. M. Wantzen

The influence of shredders, characteristics of hydrology and chemical leaf composition, on the decomposition of terrestrial leaf litter was studied in Colombian streams. Leaf breakdown rates, content of total C, N, P and polyphenols, and leaf-associated aquatic invertebrate assemblages were compared among leaf types in typical 1st-order streams of the Amazonian whitewater floodplain near Leticia and a mountain stream at the Sierra Nevada in the Caribbean. The stream hydrograph was influenced by regular rainfall throughout the year and by seasonal backflooding from the Amazon River. Stream discharge was more variable and breakdown rates were significantly higher when the Amazon was low than during backflooding. In the Caribbean stream, the burial of leaves significantly reduced breakdown rates compared to the other system. In both systems most of the invertebrate taxa (60%) were collectors in all leaf species, whereas shredders were very scarce (0–5%) irrespective of time, place and date. In the Amazon stream-experiment the slowest-decomposing species S. paniculata and Myrcia sp., showed high (R2= 0.999 and R2= 0.994 respectively) and significant (F = 37937, p= 0.003 and F = 186.97, p = 0.046, respectively) correlations between leaf dry mass loss and TP concentrations.

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Session 18: Ecosystem engineers in a changing world - TalkT18-05

Diversity and functional role of termites in West Africa : case studies in Côte d'Ivoire

S.Konaté & K.E. Linsenmair

Termites represent a very important component of tropical soil biodiversity, delivering essential ecosystem services (by e.g. improving soil water content, soil fertility and carbon sequestration). Our study aims to analyse the diversity and functional roles of termites along a climatic and anthropogenic gradient in a West African country (Côte d'Ivoire). Termite diversity was recorded in savannas as well as forest, using a rapid assessment protocol based on standardized transects. Termite biogenic structures and physico-chemical soil properties were analysed to assess their influence on soil water and nutrient dynamics. Termite species richness and functional diversity broadly decrease with increasing aridity (from forest to savannas) and with land use intensification. Fungus-growing termites of the genus Odontotermes play a key role as ecosystem engineers, in the savannas where they strongly influence vegetation structure and dynamics. They achieve this mainly by modifying soil physico-chemical properties and soil water content. In conclusion, in Côte d'Ivoire, the diversity of termites changes with the amount of rainfall. Fungus-growing termites play a key role in maintaining soil fertility and perform some essential ecosystem services, such as carbon sequestration

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Session 18: Ecosystem engineers in a changing world - TalkT18-06

The legacy of termites – How ancient termite nests influence today's vegetation in South Africa

N.S. Kunz & B. Weber

Along South Africa's west coast, the landscape is densely covered by fossil termitaria, so-called heuweltjies. These earth mounds, about 1 m high and 25 m in diameter, cover 14 – 25 % of the landscape. In a field study, we investigated the soil properties on and off heuweltjies and their effects on vascular plant communities. In the heuweltjie center, soils were dominated by finer fractions and had significantly higher pH-values as well as carbon-, nitrogen- and phosphorus-contents than off heuweltjies. In contrast to this superior soil quality on heuweltjies, coverage of perennial plants did not differ significantly between habitats and species diversity even was significantly higher off heuweltjies. Palatability of the observed plants may explain these seemingly odd results: while highly palatable plant species covered greater areas off mounds, moderately palatable species showed higher coverage values on them. Since the area was intensely grazed during the last decades, we expect that a previously rich heuweltjie vegetation has degenerated over time. To prove this, heuweltjie vegetation under varying historical and present grazing regimes will be investigated. Our results show that although heuweltjie-building termites are long extinct, these former ecosystem engineers still influence vegetation composition and productivity of rangelands in Southern Africa.

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Session 18: Ecosystem engineers in a changing world - TalkT18-07

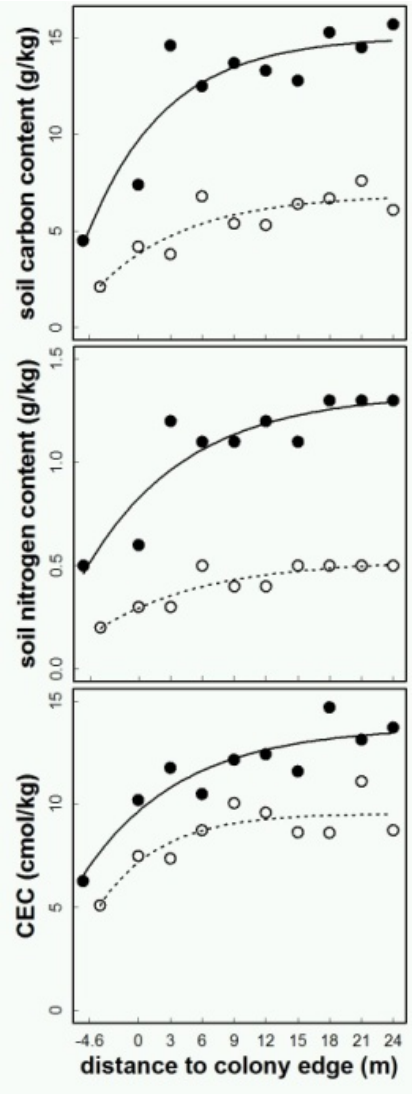
Intensified Ecosystem Engineering in a Fragmented Forest: Soil Perturbations by Hyper-Abundant Leaf-Cutting Ants

S.T. Meyer, M. Neubauer, I.R. Leal, R. Wirth

Leaf-cutting ant nests occur hyper-abundantly along forest edges (up to 5 colonies per ha). These nests are large constructions (can reach 100 m² or more) that drastically alter forest structure and microclimate. Here we studied edaphic changes caused in the top soil by Atta cephalotes nests along transects from nests into the surrounding Brazilian Atlantic forest. Nests showed very low litter cover, which exponentially increased into the forest. Paralleling this gradient, nutrient availability (carbon and nitrogen content, cation exchange capacity) increased into the forest understory. Two soil types (higher clay or sand fraction) occurred at the study site and the clay-rich soil showed consistently a higher nutrient availability over the whole gradient. In contrast to the previously documented high nutrient content in deep nest soil (due to refuse chambers), top soil concentrations at nests were very low. In conclusion, leaf-cutting ants substantially modify the forest, via nest constructions, not only aboveground but also edaphically. These combined nest effects can alter patterns of plant recruitment by impacting germination, survival and growth. On an ecosystem scale, colonies of A. cephalotes concentrated at forest edges act as ecosystem engineers, contributing to a disturbance regime that enables self-replacing pioneer communities at forest edges.

Figure 1: Three measures of soil nutrient availability along gradients from Atta cephalotes nests into the surrounding Brazilian Atlantic Forest (0 marks the edge of the colonies' understory gap, -4.6 the average distance to the centre of colonies). A clay rich soil (closed circles; 5 colonies pooled) and a soil with a higher sand content (open circles; 3 colonies pooled) occur in the study area. Lines represent best fit exponential models.

Session 18: Ecosystem engineers in a changing world - TalkT18-07



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Session 18: Ecosystem engineers in a changing world - TalkT18-08

Nucleated succession by Phoenix pusilla, an ecosystem engineer facilitates dry forest species in the arid Coromandel coast of India

V.Kinhal & N.Parthasarathy

Facilitation by nurse plants -important eco-system engineers- resulting in nucleated succession, was tested as the mechanism of reforestation in grazing lands of fragmented tropical dry evergreen forest (TDEF) landscapes on the south-eastern coast of India. Indication that Phoenix pusilla, an endemic shrubby palm, was the nurse plant, was obtained from traditional ecological knowledge (TEK) of a south Indian tribe. Spatial association of woody plant species with Phoenix pusilla; and facilitation of seed germination, seedling emergence and establishment of two TDEF species, by amelioration of soil and micro-climatic conditions by the palm was tested in an experiment over eight months. Decrease in soil temperature (by 50%) and radiation (by nine times), increase in organic matter content and water holding capacity under nurse plants as compared to open interspaces were recorded. Seedling counts were ten times more and seedling height was twice taller under Phoenix pusilla, than in open areas. Phoenix pusilla was associated with a significantly greater abundance (20%) of woody plants and more with primary (11) than secondary (two) tree species. The mosaic landscape initiated by Phoenix pusilla, can provide important refuge for forest species in populated rural areas and their role in regional processes in fragmented forests merits investigation.

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Session 18: Ecosystem engineers in a changing world - TalkT18-09

Does forest fragmentation turn leaf-cutting ants from 'good' to 'bad' ecosystem engineers?

R. Wirth, I.R. Leal, M. Tabarelli, and S.T. Meyer

We explore the symposium's theme by asking how anthropogenic landscape alterations impact ecosystem engineers and modify their functional significance. As a prime example, we compile quantitative results on the manifold impacts leaf-cutting ants (LCA) exert on forest structure, microclimate, edaphic conditions, plant performance, and floristic and functional signature of plant assemblages. For example, nest constructions and herbivory substantially increase light availability. Comparing forest edge and interior in fragmented Atlantic Forest, we demonstrate how anthropogenic disturbances affect LCA colonies and populations: Ants (i) harvested twice as much foliage per colony in edge forest, (ii) reduced (>2-fold) their foraging areas, and (iii) greatly increased in colony density (8.5-fold). On an ecosystem level these findings translate into a dramatic rise in the proportion of impacted forest (high light levels in 0.6% of interior versus 6% of edge forest) and overall herbivory damage (6% versus 36% of available foliage removed, respectively). In synthesis, ecosystem engineering by LCAs is strongly context-dependent: While in undisturbed forests regional habitat diversity is enhanced through the creation of high-resource patches, anthropogenic forest transformation (high-light environments with dominance of light-demanding species) causes synergistic feedback mechanisms turning LCAs into a large-scale disturbance that promotes floristic and functional impoverishment of modern forests.

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Session 18: Ecosystem engineers in a changing world - PosterP18-01

Leaf-cutting ants act as a filter for seedling establishment in Brazilian Atlantic Forest

P.S.D. Silva, I.R. Leal, R. Wirth & M. Tabarelli

Leaf-cutting ants (LCA) have been frequently considered as key species in tropical and subtropical America due to their direct and indirect effects on vegetation. Here, we investigated the influence of Atta cephalotes on seedling density, richness and composition in an Atlantic forest remnant of Alagoas State, Brazil. We assessed all seedlings (individuals ≤ 50 cm) in 360 plots of 1m² randomly allocated and subdivided within the foraging zones of 15 Atta colonies and 15 areas without ants (controls). A total of 1862 seedlings from 108 morphospecies were recorded on the plots. Mean seedling density observed on Atta foraging zones was half the density found on control areas. Moreover, seedling richness on foraging zones was 60% of that found on controls. Based on ordination and similarity analyses, a remarkable change on seedling composition was observed on foraging zones when compared to controls. Our results suggest that LCA act as an ecological filter for seedling establishment, playing an important role in plant community dynamics. We expect an increase of LCA impact in degraded and secondary forests – habitats where these ants may become hyperabundant – amplifying the already drastic changes on plant assemblages caused by human disturbances (CNPq, CAPES, DAAD).

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Session 18: Ecosystem engineers in a changing world - PosterP18-02

Fungus-gardening ants help fertilize nutrient deprived tropical soils

Christian Rabeling & Manfred Verhaagh

Human agricultural activities contribute to the deprivation of nutrients from tropical soils and within a few years time diverse rainforests can turn into barren lands. Non-herbivorous fungus-gardening ants (Formicidae: Attini) seem to counteract this development and may facilitate the regeneration of biochemically impoverished clay soils in the Central Amazon Basin. In forest agroecosystems near Manaus, Brazil, we observed high densities of fungus-gardening ant colonies from the genera Mycocepurus and Trachymyrmex. To determine the quantitative effect these soil nesting ants have on their environment we mapped the densities of their colonies, identified the underground architecture of their nests, determined their nutrient intake per colony and approximated the metabolic rate of the ant's fungal mutualist. After multiplying these factors and subtracting the biomass lost in the ant and fungal metabolism, it appears that lower attines have a biomass intake that is comparable to the intake of leafcutter ant colonies. In contrast to leafcutter ant colonies, lower attines occur in high densities and the chambers of their nests are evenly distributed in the soil matrix, suggesting that lower attines do not only increase the availability of nutrients, but also disperse nutrients more evenly in the soil matrix than the herbivorous leafcutter ants.

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Session 18: Ecosystem engineers in a changing world - PosterP18-03

Canopy trees as ecosystem engineers in a Seasonal Semi-deciduous forest in Brazil

F. M. Souza, S. Gandolfi & R. R. Rodrigues

In tropical forests, the interactions between canopy and understory plants are still poorly known. We investigated how deciduousness and dispersal syndromes of canopy tree species could influence the understory tree community in a Seasonal Semideciduous Forest located at Caetetus Ecological Station Reserve, in central-western São Paulo state, Brazil. In a 10.24 ha permanent plot, we sampled all overstory trees (canopy and emergent trees) and the trees with diameter at breast height equal or greater than 4.8 cm under their crowns (understory trees). Deciduous canopy trees showed higher relative abundance and proportion of early secondary species under their crowns than evergreen trees. Autochorous canopy trees presented higher relative abundance of conspecific individuals under their crowns, while there was no difference between wind and animal-dispersed canopy trees. The relative abundance of animal-dispersed trees in the understory did not differ among dispersal guilds, but estimated zoochorous species richness was higher under zoochorous canopy trees. The results suggest that canopy trees may act as ecosystem engineers by creating different light microhabitats in the forest understory and also by their different capabilities of attracting dispersers. Thus, canopy trees may promote facilitation or inhibition of the development of some groups of species, affecting community organization patterns.

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Session 18: Ecosystem engineers in a changing world - PosterP18-04

Termites as key element in soil restoration (Zaï system)

D. Kaiser, S. Konaté, M. Lepage & K.E. Linsenmair

A temporal cross-section of the traditional rehabilitation system Zaï was studied in northern Burkina Faso (Ouahigouya, 13°32'N, -2°22'E, Sub-Sahel, precipitation 400-600 mm/a) to determine the role of termites in soil restoration. The aims were a) to characterize the activity of termites in the main succession stages of the Zaï system (degraded soil, millet field, young and old Zaï-forest), b) to assess the effect of the foraging holes on soil water infiltration and c) to quantify soil-turnover (bioturbation) during foraging via soil "sheetings". In each of the four study sites, 9 experimental plots, each comprising four sub-quadrates of 1 m2, were used to stimulate the foraging activity of termites with locally available organic materials (Aristida hay, Bombax wooden blocks, compost and a control without any amendment). After four weeks a) all sheeting soil was collected and separately weighed according to the different termite genera and b) the openings of foraging holes were counted and their diameter measured. Additionally, water infiltration was measured in selected quadrates with double ring infiltrometers.Our experiment shows clearly that termite activity is a decisive component in the restoration process and that directing and inducing this activity will be a promising tool for optimizing the Zaï practice.

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Session 18: Ecosystem engineers in a changing world - PosterP18-05

Termite Mound Vegetation Patterns along a Climatic Transect in Western Africa

A. Erpenbach, A. Thiombiano, B. Sinsin, R. Wittig and K. Hahn-Hadjali

Abandoned termite mounds are known as “Islands of Diversity”. They show a specific floristic composition and vegetation structure, pronouncedly differing from the surrounding savanna matrix. They increase species and habitat richness. However, it remains open if, and to which extent, different types of surrounding savannas affect the specific mound vegetation and how the mound vegetation differs along a climatic gradient. Thus, termite mound vegetation patterns are currently being assessed in different savanna types along a climatic transect from the Sudanian zone in Northern Benin to the Sahel in Northern Burkina Faso. Although termite mound vegetation is clearly distinct from surrounding savanna vegetation, our preliminary results also indicate variation of species composition according to surrounding savanna types. Furthermore, species composition on mounds changes along the climatic transect. Some species restricted to termitaria in one part of our transect (e.g. Combretum aculeatum) are occurring under different climatic conditions in the savanna matrix. However, we also find that some species are confined to termite mounds all along the transect (e.g., Capparis sepiaria). We hypothesize that termitaria as microhabitats extend the ranges of several species, therefore being partly azonal.

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Session 19: Land-use change at local and landscape scales: biodiversity, ecosystems and livelihoods in the tropics - TalkT19-01

Biodiversity conservation on a crowded planet: reconciling agriculture with ecology

S.A. Bhagwat

Over a third of earth's land surface is currently under some form of agriculture. It is increasingly recognised that this highly anthropogenic landscape is also important three reasons: (a) to provide habitat for species outside strictly protected reserves; (b) to maintain connectivity between protected areas so as to allow transfer of individuals and genes across populations; and (c) to provide livelihoods to people who depend directly on nature's resources. In many tropical countries biodiversity conservation cannot be separated from poverty alleviation in rural landscapes around protected areas. Agroforestry – intentional management of shade trees with agricultural crops – has emerged as one of the most promising approaches to reducing deforestation in the tropics while enhancing rural livelihoods. Furthermore, it has been suggested that agroforestry systems can alleviate the resource-use pressure on protected areas, enhancing habitats for some wild species and increasing the connectivity of landscape components, thereby making conservation more effective. However, the extent to which agroforestry might provide a viable option for biodiversity management outside formally protected areas remains under-researched. Here, I present a number of case studies that demonstrate the potential of agroforestry systems in biodiversity conservation; and examine the opportunities and challenges in reconciling agriculture with ecology.

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Session 19: Land-use change at local and landscape scales: biodiversity, ecosystems and livelihoods in the tropics - TalkT19-02

Biodiversity conservation, yield and economic incentives in cocoa agroforestry intensification in southern Cameroon

H.B.D. Bisseleua, A.D. Missoup, & S. Vidal

Structurally complex landscapes with high habitat connectivity may enhance the probability of pest regulation. According to the insurance hypothesis, species richness can buffer against spatiotemporal disturbances, thereby insuring functioning in changing environments. Seemingly redundant enemy species may become important under global change. Complex landscapes characterized by highly connected crop–noncrop mosaics may be best for long-term conservation biological control and sustainable crop production, but experimental evidence for detailed recommendations to design the composition and configuration of agricultural landscapes that maintain a diversity of generalist and specialist natural enemies is still needed. The current trend to reduce or eliminate shade cover raises concerns about the potential loss of biodiversity. However, few studies have assessed the ecological consequences and economic tradeoffs under different management options in cocoa plantations. Here we describe the relationships between ant ecology (species richness, community composition, and abundance) and vegetation structure, ecosystem functions, and economic profitability under different land-use management systems in traditional cocoa forest gardens (TCG) in southern Cameroon. We calculated an index of profitability, based on the net annual income per hectare. We found significant differences associated with the different land-use management systems for species richness and abundance of ants and species richness and density of trees. Ant species richness was significantly higher in floristically and structurally diverse systems. Our analysis also revealed that herbivory and pod diseases significantly increased with reduced ant richness. Our model did not reveal a clear relationship between profitability and biodiversity. However, we suggest that improving the incomes and livelihoods of smallholder cocoa farmers will require economic incentives to discourage further intensification and ecologically detrimental loss of shade cover.

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Session 19: Land-use change at local and landscape scales: biodiversity, ecosystems and livelihoods in the tropics - TalkT19-03

Chocolate and biodiversity: mission possible

Y. Clough, J. Juhrbandt, J. Barkmann & T. Tscharntke

The relationship between biodiversity, yield and farmer income is of world-wide importance as pressure to intensify land-use increases. Certain forms of agriculture such as agroforestry have received a great deal of attention by conservationists because vegetationally complex agroforests are often very species rich, while contributing to local livelihoods. Surprisingly little adequate data exists to support how biodiversity relates to yield and income in these systems.We fill this gap using data collected in a major cacao producing area in Sulawesi, Indonesia. We conducted a large scale agroecological experiment in combination with an intensive cacao documentation study. Cacao management is currently being intensified, with a shift from well-shaded, species-rich agroforests to unshaded plantations. Our data shows shade is negatively correlated with yield in both the survey and the experimental plots. However, residual variation is high, with worktime and rainfall being even more important. Meanwhile, the biodiversity data collected for plants, vertebrates and invertebrates suggest that other variables than total shade tree cover, including shade quality, are better predictors for species.Our results show biodiversity is not related to cacao yield, which suggests that high yield, high biodiversity targets can be achieved if incentives are provided for appropriate management.

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Session 19: Land-use change at local and landscape scales: biodiversity, ecosystems and livelihoods in the tropics - TalkT19-04

Tobacco farming and ecosystem impacts

H. Geist

Tobacco of the commercial smoking product species N. tabacum is the world's most widely grown non-food crop. Most land under tobacco is located in semi-arid to subhumid (sub)tropical areas of the developing world. Local- to national-scale studies demonstrate the prominent importance and ecological significance of rapid land-cover change, but it is poorly documented at the global scale. Triggered by the public health debate about smoking, it has been suggested that tobacco poses a particularly difficult environment-development dilemma due to land use interventions such as high-intensity farming and the usage of wood in curing (to dry green leaf): soil/water degradation, vegetation/biodiversity losses and human diseases (pesticide poisoning, green tobacco sickness, inhalation of biomass particles). Search for evidence is presented as part of an Ecology into Policy grant provided by the British Ecological Society. The work relates to the International Framework Convention on Tobacco Control (FCTC) which has been put into practice in 2005 to address, among others, the socio-ecological losses of tobacco farming (article 18) and require parties to the convention to explore alternative, sustainable (non)agricultural livelihoods (article 17).

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Session 19: Land-use change at local and landscape scales: biodiversity, ecosystems and livelihoods in the tropics - TalkT19-05

Ecological and social interactions in sustainable agroforestry management: Cocoa in Ghana

M.E. Isaac

Farm management strategies in regions of high biological and economic risk require solutions for enhanced agroecosystem functioning and sustained rural livelihoods. This may be achieved with agricultural diversification employing both ecological and social agroforestry principles. Accordingly, this research investigates agroforestry systems at multiple scales, employing cocoa-shade systems in Ghana as a case study. An examination of cocoa biomass production, nutrient uptake and soil fertility was undertaken to determine nutrient resource interactions in both early and mature agroforestry systems. When fertilizers are undesirable or unavailable, intercropping of appropriately selected shade trees will not competitively suppress early growth of cocoa, but will improve light regulation, sustain nutritional status of cocoa saplings and increase cocoa biomass as the farm matures. Concurrently, the transfer of knowledge on agroforestry management practices was determined with social network analysis; locally derived and externally sourced agrarian information on farm management circulates through distinctly structured informal advice networks. As an analytical concept, management processes offer an entry point into understanding human interactions with the environment. Results were incorporated into a management framework presenting strategies for scaling-up results to the landscape level, decentralizing agroforestry management and increasing resilience by employing a systems approach to local and regional agrarian practice.

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Session 19: Land-use change at local and landscape scales: biodiversity, ecosystems and livelihoods in the tropics - TalkT19-06

Drivers of intensification in smallholder cacao agroforestry in Central Sulawesi, Indonesia

J. Juhrbandt, N. Binternagel, J. Barkmann, H. Faust

Agroforestry systems have repeatedly been praised as potential win-win situations in terms of economic returns and biodiversity, although the intensification of this land use system may also raise trade-offs. Intensification is not only subject to economic incentives and land scarcity but is also expected to be driven by various properties of farming households and their land. The 'cocoa boom' in Indonesia in the 1990s resulted not only in an expansion in cropping area around the Lore Lindu National Park (LLNP) in C. Sulawesi, but also in an ongoing intensification of cacao agroforests, primarily by removal of shade tree cover. Driving factors of this intensification strategy are poorly investigated so far. To fill this gap, we surveyed yield, management, inputs, household characteristics as well as plot structure parameters on 144 cacao plots, covering the entire intensification gradient.Intensification by removal of shade trees partly goes along with an increased use of material and labour input. A range of farm properties including farm size, farm diversification and soil fertility and household characteristics such as poverty affect the propensity to intensify the management of agroforests. Understanding patterns in these key parameters is thus central to help conserve biodiversity-friendly agroecosystems at the margin of the LLNP.

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Session 19: Land-use change at local and landscape scales: biodiversity, ecosystems and livelihoods in the tropics - TalkT19-07

Yield gap and intensification of tropical grain production

K. Neumann,P. Verburg, E. Stehfest, C. Mueller

Global grain production has increased dramatically during the past 50 years, mainly as a consequence of intensified land management and introduction of new technologies. For the future, a strong increase in grain demand is expected, which may be fulfilled by further agricultural intensification rather than expansion of agricultural area. Little is known, however, about the potential for intensification and its constraints. In the presented study we analyze to what extent the available spatially explicit global biophysical and land management-related data is able to explain the yield gap of grain production in the tropics. We combined an econometric approach with spatial analysis to explore the maximum attainable yield, yield gap, and efficiencies of wheat, maize, and rice production. Results show that the actual grain yield in some tropical regions is already approximating its maximum possible yields while other regions show large yield gaps and therefore tentative larger potential for intensification. Differences in grain production efficiencies are significantly correlated with irrigation, market accessibility, market influence, agricultural labor, and slope

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Session 19: Land-use change at local and landscape scales: biodiversity, ecosystems and livelihoods in the tropics - TalkT19-08

Managing trade-offs between agriculture and the environment in West African agro-forestry ecosystems

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Session 19: Land-use change at local and landscape scales: biodiversity, ecosystems and livelihoods in the tropics - TalkT19-09

Conservation at the landscape level: the role of the agricultural matrix

I. Perfecto

The conservation of biodiversity has often been seen as fundamentally antagonistic to agricultural development. Currently the situation in the tropics, in which most of the world's biodiversity resides, is one of fragmented landscapes in which forest fragments exist in a sea of agricultural activity. Recent ecological theory associated with metapopulation biology suggests that the landscape as a whole must be incorporated into any meaningful biodiversity conservation program. The implications of this fact are explored with respect to the kind of agriculture and the kind of rural society necessary for successful conservation programs.

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Session 19: Land-use change at local and landscape scales: biodiversity, ecosystems and livelihoods in the tropics - TalkT19-10

Agricultural intensification and the breakdown of autonomous ecosystem function

John Vandermeer

Traditional modes of agricultural production frequently provide for ecosystem services that may be lost upon technification. In the case of coffee production in Latin America the ecosystem service of pest control has been shown to be a consequence of complicated ecological interactions involving multiple components at multiple scales. The technification process of eliminating shade from coffee has interrupted a major component of this interaction web and interrupted the autonomous control provided by the traditional system.

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Session 19: Land-use change at local and landscape scales: biodiversity, ecosystems and livelihoods in the tropics - TalkT19-11

An ecosystem service approach to coffee production in a landscape mosaic

V.E. Boreux, S. Krishnan, C.G. Kushalappa & J.Ghazoul

Native forest fragments contribute substantially to the productivity and quality of coffee plantations, and improve the economic returns derived from them by providing pollination services. In the mosaic landscape of Kodagu, South India, coffee is traditionally grown under shade trees, so the landscape offers an almost continuous tree cover connecting forest patches. Quantifying the ecological contribution of the full landscape to coffee crop provides the basis for an integrated management of the landscape. In this context we are investigating (i) the pollination service provided by different landscape elements to coffee plantations, (ii) the factors affecting the quality of these ecosystem services. We present our first data on insect visitation, fruit set and final production of coffee, under different shade and soil conditions, and different landscape settings.

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Session 19: Land-use change at local and landscape scales: biodiversity, ecosystems and livelihoods in the tropics - TalkT19-12

Biodiversity in primary forest and different natural forest land use types in Nabanhe Natural Reserve, China

Mo X.X.,Zhu H.,Wang H,Zhou S.S.

Land use/ land cover change is the most important factor causing biodiversity loss, especially in the tropics. During the past 20 years, tropical seasonal rain forest accelerates decrease and degradation in Xishuangbanna, Yunnan, even some protected areas were involved. Based on Landsat TM 1988 and 2007 data, we studied the land cover changes in Nabanhe National Nature Reserve, which shows that the most intensive changes occurred in those areas under the latitude of 900m where the tropical rain forest most possibly distribute. Then plots were set to study the three different land use types in natural forest (relative undisturbed rainforest, Amomum villosum cultivated rainforest, 20 years old secondary forest) below 900m elevation. We found that under long-term artificial interference, the Amomum villosum cultivated forest present more evenness in species disturbed and community structure, and secondary forest show highest equality of structure but a marked variation in species evenness after one time but fierce disturbance on the contrary. On the whole , the result indicates that species richness gradually drop down from undisturbed to cultivated, and secondary forest. It also shows notable absence of resource plants in the disturbed types, i.e. timber trees and medical herbs.

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Session 19: Land-use change at local and landscape scales: biodiversity, ecosystems and livelihoods in the tropics - TalkT19-13

Profitability of land-use options for smallholders in Southern-Ecuador

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In Southern Ecuador there is an accelerated land-use change from fragmented forest to crop and cattle farming. The main driver of this conversion is the higher profitability of animal husbandry compared to other land uses. Establishing pastures decrease the local biodiversity of the region, which is one of the worlds' hotspots. If left unmanaged the pastures are overgrown with the bracken fern and thereby lose their economic value. Additionally natural succession is delayed. We investigate this problem from the perspective of small-holders, who have two main strategies to combat the invasion of the bracken fern: agroforestry and the planting of a more robust grass species Setaria sphacelata (Mequerón). In agroforestry management systems (AFMS) trees are planted in or alongside the pasture. Additional revenues can be obtained from the planted tree (e.g. Guarango, Caesalpinia spinosa). In a corss-sectional analysis we sampled 130 households within the biosphere reserve "Podocarpus – el Cóndor" in Southern Ecuador. A Cobb-Douglas type production function shows the significant benefits on gross margin of AFMS, whereas no positive impact of Setaria could be found. There, the positive effects of bracken repression are counterbalanced with a lower nutritional value. However the implementation costs are lower compared to AFMS.

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Session 19: Land-use change at local and landscape scales: biodiversity, ecosystems and livelihoods in the tropics
- TalkT19-14

Addressing connectivity for multiple species in multiple landscapes allows better predictions of species sensitivity to fragmentation: an example from birds of the Atlantic Forest, Brazil

G. Pe'er, M.M. Hansbauer, K. Henle, C. Banks-Leite, A. Martensen, J.P. Metzger, K. Frank

The sustainability of animal populations in fragmented landscapes and their response to environmental changes are strongly affected by their capacity to move across heterogeneous landscapes. Yet tools are lacking for understanding and predicting the complex animal-landscape interactions that determine landscape connectivity and how it differs across species and landscapes. We present a spatially explicit, individual-based model (IBM) of connectivity which takes into account differences between species both in habitat requirements and in behaviour. One of the model's novel attributes is in separating everyday movements from rare dispersal events, and random movements from directed ones (gap-crossing between forest fragments). We use the model to investigate connectivity for birds of the Atlantic forest in Brazil. By varying the response of species to forest edges, we show that the separation into different behavioural responses provides a far better understanding of connectivity, alongside predictions of the sensitivity of species to fragmentation. We discuss the potential of the model and the approach to address the responses of tropical forest species to anticipated land-use changes, and to support conservation decisions within conservation and restoration projects.

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Session 19: Land-use change at local and landscape scales: biodiversity, ecosystems and livelihoods in the tropics
- TalkT19-15

Spider web density in cacao agroforestry in relation to different management strategies on tree, plot and landscape scale

K.Stenchly, Y. Clough & T. Tscharntke

Web-building spiders are recognised as ubiquitous and functionally important components of terrestrial ecosystems. However studies on the functional role of spider communities and the impact of vegetation structure, landscape context and the presence of other predators such as ants on spider web-density especially in complex tropical agroecoystems such as agroforests are still underrepresented. We used data we collected in Sulawesi, Indonesia, within 420 cacao trees of 42 different managed cacao plantations to determine the relationship of five web building spider guilds to habitat variables and presence of a dominant ant species at three different spatial scales (tree, plot and landscape). Further we evaluated the impact of web-density on two important cacao pests. The densities of webs of different types are differentially affected by habitat variables while most frequently recorded webs were of the line- and orb-web types. Web density was positively related to canopy openness at the tree scale and to a higher number of shade trees at the plot scale. At the landscape scale the elevation determined the distribution patterns of web building spiders. High densities of lattice- and tangle-webs were weakly associated with reduced herbivore damage to cacao pods.

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Session 19: Land-use change at local and landscape scales: biodiversity, ecosystems and livelihoods in the tropics
- PosterP19-01

Carbon stock changes with relation to land use conversion in the highlands of Tigray, Ethiopia

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Reduced emissions from deforestation and degradation are emerging as a strategy with big potential for mitigating climate impacts. This study analysed the effects of the conversion of free grazing lands to exclosures on ecosystem carbon sequestration in Tigray, Ethiopia. Replicated paired exclosures and adjacent free grazing lands were sampled. Three church forests were also sampled as a positive control. Soil carbon (C), carbon from woody and grass species as well as selected site and vegetation characteristics were determined. These were attained through standard procedures of soil analyses and destructive sampling of the identified sample plants. Significant ($p < 0.01$) differences in soil-C concentration and stock, and woody species carbon were found between exclosures and adjacent free grazing lands. These differences were primarily attributed to the difference in amount and properties of input materials, inherent soil properties (% clay) and soil erosion. This was verified by the significant ($p < 0.05$) correlation between soil – C with the measured site and vegetation characteristics. The general trend in the total carbon stock increased in the order of: free grazing lands (34.8 Mg ha-1) < five year – old exclosure (67.3 Mg ha-1) < 10 year – old exclosure (77.6 Mg ha-1) < 15 year – old exclosure (80.9 Mg ha-1) < 20 year – old exclosure (102.5 Mg ha-1) < church forest (123.1 Mg ha-1). Our results show that the conversion of free grazing lands to exclosures has a significant potential to increase carbon sequestration, even in strongly degraded free grazing lands, both through additional below and above – ground carbon storage. Expanding exclosures on degraded free grazing lands can thus contribute to mitigation of climate change, if the local people will be sufficiently compensated. Key words: carbon stock, church forest, exclosures, free grazing lands, land use conversion

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Session 19: Land-use change at local and landscape scales: biodiversity, ecosystems and livelihoods in the tropics
- PosterP19-02

Factors that influence coffee production in the fragmented landscapes of S. Kodagu, India

K. Smitha & J. Ghazoul

In this paper we have made an effort to analyze the factors that influence coffee productivity in Kodagu, S. India, a tropical landscape composed of a matrix of coffee plantations, paddy fields, scared groves (forest fragments) and human settlements. Though studies elsewhere have shown that pollination by bees noticeably enhances coffee yield, in South India the contribution by bees towards increase in coffee yields seem to be less pronounced. The time of flowering seems to have a significant effect on pollinator visits. Pollinator diversity and fruit-set was high in places where flowering was initiated by sprinkling systems which emulates rain. Sites that were not irrigated mass flowered, and the pollinator visits were very few. It is clear that there is a deficit in the pollinator abundance which is influencing the pollinator visits in sites where there is mass flowering; the pollinator visits are negligible when coffee mass flowers. The effect of distance from the forest edge was not detected due to staggered flowering.It is important to understand the factors that influence the diversity and abundance of pollinators of coffee like, quality of habitat, availability of forage and nesting sites and migratory patterns (Apis dorsata) and develop methods to increase pollinator visits to coffee.

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Session 19: Land-use change at local and landscape scales: biodiversity, ecosystems and livelihoods in the tropics
- PosterP19-03

The biodiversity consequences of converting native grassland into exotic pastures: using dung-beetles to assess the changing agricultural landscapes in Minas Gerais, Brazil

S.Almeida,J.Louzada, C.Sperber & J.Barlow

Brazil has one of the largest bovine livestock in the world. In Minas Gerais, farmers traditionally use native grasslands of Brazilian savanna to graze their cattle. However, over the last decades exotic grasses have been introduced to increase carrying capacity, and to negating the fire management on the native grasslands. We used dung beetles to investigate the consequences of native grassland replacement by exotic grasses, and to examine the importance of time since fire in the remaining native pastures. We collected 4996 individuals of 66 species. There was no significant difference in species richness between systems, but exotic pastures tended to have lower beetle abundance. Time since last fire did not influence richness or abundance in native pastures. The age of exotic grassland did not affect beetles richness, but had significant negative relationship with beetle abundance. There were differences in the species composition between systems: the youngest exotic pastures were most similar to the native pastures, while the native pastures with the longest time since the last fire were most similar to the exotic pastures. Our results are important for landscape management, and reveal how the ongoing conversion of native grasslands into exotic pastures is causing widespread loss of biodiversity.

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Session 19: Land-use change at local and landscape scales: biodiversity, ecosystems and livelihoods in the tropics
- PosterP19-04

Simulating changes in bird species distributions over one century - Extrapolations for forests in western Kenya based on land-cover change data -

T. Lung, N. Farwig, M.K. Peters, K. Böhning-Gaese & G. Schaab

Combining land-cover change data and field observations allows for landscape-scale habitat and biodiversity assessments over time, but is often neglected. In an interdisciplinary approach, we extrapolated field data on (a) the abundance of ant-following birds and (b) on species richness and composition of bird communities recorded in different forest types of Kakamega Forest. The extrapolations were based on a long-term forest cover change series covering the 20th century, derived from satellite imagery, aerial photography and old topographic maps for five timesteps between 1912/13 and 2003. Ant-following bird abundance was modelled with a simultaneous autoregressive (SAR) model taking into account army ant distributions and a spatially explicit small-scale forest fragmentation index derived from the forest cover data. Bird community data were directly related to forest classes as distinguished in the time series and also applied to spatially-explicit re-/deforestation scenarios. Extrapolation results over time for ant-following birds reveal tremendous losses in abundance (58%) caused by loss of natural forest (31%) and fragmentation, whereas declines in species richness of bird communities are moderate due to compensation effects by forest plantations. Thus, we demonstrate the value of extrapolating local-scale findings to landscape-scale distributions over time for forest management struggling with human-nature interferences.

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Session 19: Land-use change at local and landscape scales: biodiversity, ecosystems and livelihoods in the tropics
- PosterP19-05

Weevil diversity along tropical forest edges

A. Mercado Cárdenas, C.M. Buddle, H. Barrios

Deforestation and habitat fragmentation threaten the biodiversity in tropical forests, especially along the edges. Forest adjacent to manmade habitats with a lower structural contrast should be less affected by edge effects. Weevils (Coleoptera: Curculionidae) were studied along the edges in a tropical lowland forest in Panama. Their species richness and composition was assessed along transects adjacent to small shaded coffee plantations and adjacent to traditional cattle pastures. Weevils were collected at five distances from the edge into the forest (0, 10, 50, 100, 250 m) between May 2007 and March 2008. 268 species (1644 specimens) were collected. Weevil species richness, compared using rarefaction, was higher in the forest adjacent to coffee plantations. Similarity of assemblages between transects was evaluated using Morisita-Horn index and non-metric multidimensional scaling. The high β-diversity of weevils reflects a high turnover of species and distinct weevil assemblages observed according to the adjacent habitat. Thus the impacts of the adjacent habitat type are more relevant on the composition of weevil assemblages in the forest than the distance to the edge. Small coffee plantations, with low structural contrast to the forest can help maintain higher species diversity in tropical forest edges.

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- PosterP19-06

Impact of Land use change on land snails of the Western Ghats

N.A. Aravind & K.P. Rajashekhar

The anthropogenic influences on patterns of land use are a primary component of many tropical landscapes. This land use and land cover change is gaining recognition as a key driver of environmental change around the globe. We have studied impact of this land use change on land snail community in the central Western Ghats, India. We selected two plantation- Areca and Acacia and a farmer managed forest called Haadi and compared with evergreen forest serving as control. The results show that diversity, richness and abundance were higher in evergreen forest compared to other land use types. The Shannon diversity was found to be high during early monsoon, but species richness and abundance is higher during post monsoon except for Acacia plantations. The rank abundance curve for pooled samples shows that in the evergreen forest, the community is dominated by very few species, which occurs in very high abundance. Six species dominate the land snail community in all habitats. They contribute > 60 per cent of the land snail abundance. The community composition is very different in Areca plantations compared to other land use types. Thus land use patterns have significant impact on land snail fauna.

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Session 19: Land-use change at local and landscape scales: biodiversity, ecosystems and livelihoods in the tropics
- PosterP19-07

The effect of periodical burnings in open-savanna soil chemical properties

Pivello, V.R.; Oliveras, I.

Fire is a periodical event in open savannas, caused both by lightning but especially by human activities, and its consequences on physical environment are still little understood. We analyzed long-term fire effects in the surface (0-10 cm) soil (Dark-red Latosol) of an open savanna (campo-sujo physiognomy) in the IBGE Ecological Reserve (Brasilia, DF, Brazil), in five 200m X 200m plots subjected to periodical experimental fires for 20 years. Three plots received biennial fires (beginning, middle and end of dry season), one was burned every four years (middle of dry season) and the other was a control plot. Soil was collected in February/08 (wet season) and July/08 (middle of dry season), and chemically analyzed for pH, organic matter, N, P, K, Ca, Mg, S, Mn, Al+H, Cu, Zn and Fe. We grouped all fire treatments and applied one-way ANOVA to compare fire and no-fire treatments. The concentration of most elements in the soil was lower in the burned plots, showing some loss of nutrients due to recurrent burnings and the alkaline effect of ash. Also, a seasonal effect was detected as the amounts of most elements were higher in the rainy season, probably due to the input of elements via rainfall.

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- PosterP19-08

Fire effects on herbaceous nutrient contents in open savanna

Oliveras, I.; Pivello, V.R.

Fire is a frequent disturbance in cerrado ecosystems and it alters vegetation composition of such communities. We studied the effect of fire on nutrient content of a grassland community (monocotyledons and dicotyledons) in Brazilian open savanna (campo sujo). Four sites have been burned with different fire frequencies (every two or four years) since and an adjacent site that has not burned for more than 40 years were sampled. Herb layer aerial biomass was clipped in 1m x1m plots in February (wet season) and July (dry season) 2008. We found that fire alters biomass and nutrient content in both monocotyledons and dicotyledons, showing different seasonal patterns. Biomass was always higher in the burned plots. In the wet season, monocotyledons of burned sites showed a lower nitrogen content but did not differ significantly in any other element compared to the unburned site. In the dry season, however, most nutrients (N, P, K, Cu, Mg, Cu, Mn, S, Zn) were significantly lower in the burned sites. Dicotyledons showed the reverse pattern: while in the wet season their nutrient content was higher in the unburned plots, only differences in nitrogen, potassium and iron were found for the dry season. Seasonal differences should be taken into account when planning for managing savanna grasslands with fire.

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- PosterP19-09

How to improve small-scale farmers' livelihood in the tropics: implications of planting regimes for growth performance of native timber trees in pasture-reforestations

M. Plath, K. Mody, C. Potvin & S. Dorn

Establishment of tropical timber tree plantations is proposed as a development tool by the Kyoto-Protocol's Clean Development Mechanism serving as long-term livelihood for livestock farmers. Native tree species may be more adapted to local environments and show more positive effects on local biodiversity and ecosystem processes than exotic species. However, establishment of native timber trees may be impeded by insect herbivores, and knowledge on improving success of pasture-reforestation with native timber trees is scarce. We investigated the effects of different planting regimes on growth and survival of three native tree species (Anacardium excelsum, Cedrela odorata, Tabebuia rosea) in Panama. Planting regimes were established on former pasture as 'monoculture', '3-species-mixture' and 'control' (3-species-mixture protected by insecticides). Tabebuia showed best performance in all planting regimes. Mortality was highest in Cedrela, possibly due to high susceptibility to drought and unfavorable small-scale environment. Growth of all three species was highest in the insecticide-protected control plots, and no difference between mixture and monocultures was found. Planting blocks representing different environmental conditions showed strong variation in tree performance. The findings suggest a relevant impact of insect herbivores and of small-scale heterogeneity of growth conditions on tree performance.

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- PosterP19-10

Agro-economic modelling of farming systems in rural South-West China

A. Rinn, E.-A. Nuppenau. K. Berghoff

Deforestation and agricultural intensification reduce natural habitats in rubber plantations of a nature reserve in Yunnan province, China, and have an impact on floral and faunal diversity and traditional land use. Policy makers need decision support for land use planning. Within the interdisciplinary project LILAC Chinese and German researchers developed a GIS based modelling framework for integrated land use planning. It comprises an agro-economic, ecological and social model for land allocation. This presentation emphasises the economic model, because land use decisions in the study area are mainly driven by economic considerations.Our model is based on linear programming. On local scale, we collected detailed economic household data in 2007-2009. By using cluster analysis (SPSS) we identified three main farming systems: Rubber farming, Cash oriented diversified farming and Extensive diversified highland farming. These farming systems are program¬med with GAMS. Hereby we analyze decision making towards cropping, livestock, and agro-forestry in the different systems. We further identified driving forces (such as price and technology changes) causing land use dynamics. The economic programming model is integrated in a GIS modelling and current land use practices are analyzed and scenarios of land use change are evaluated with regard to economic, ecological and social impacts.

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- PosterP19-11

Qualifying and monitoring the habitat status of West African forest species

K. Sabellek, S. Da, J.H. Sommer, T. Landmann, A. Thiombiano, W. Barthlott

The aim of our study was to develop an improvement of classical distribution modelling that describes potential distribution ranges. This new approach enables to estimate habitat quality of forest species by combining potential distribution and land cover data. Time series data allow a continuous and repeatable monitoring of changes. The focus area is the Volta river basin in West Africa, concentrating on representative species of West African forests. Species localities and environmental variables were used to model potential distribution areas applying the MaxEnt approach. The frequency of high resolution satellite data was calculated per 0.1 degree grid cell to map forest cover changes and measure habitat quality. By superimposing modelled potential areas of species and the frequency of forest cover, information on actual habitat quality of respective species was derived. Our results show that between 1990 and 2000 the area of suitable habitats for selected species predominantly decreased due to human-induced land cover changes. Within protected areas, changes occur in a much lower extent and even show an opposite direction.

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- PosterP19-12

Distribution of specialist and generalist bird species in a forest-agriculture mosaic of Madagascar

E.A. Martin, S.M. Carrière

In addition to the loss of biodiversity, functional homogenization of communities due to human modification of ecosystems is an important threat to ecosystem functioning in tropical areas. By replacing habitat and/or resource specialists with generalist species, able to adapt to a variety of environments including highly disturbed ones, land use change may sever specialized interactions such as seed disperser mutualisms. This is particularly an issue in Madagascar, where ongoing land use change tends to rapidly convert forest tracts into heterogeneous agricultural mosaics. In order to test the effects of human land use on the functional traits of bird communities, we used 393 point counts in forest and agricultural habitats of a landscape mosaic. By calculating a Species Specialization Index, we compared levels of habitat and diet specialization with bird responses in abundance to habitat disturbance. Despite high variability of results, we found that habitat generalists tend to be most frequent in heterogeneous habitats, with habitat specialists in homogeneous and less-disturbed areas. Current land use decisions should take into account the implications of such changes for the long term evolution of ecological functions, particularly those involving the maintenance of endemic island species.

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- PosterP19-13

Responses of vertebrate feeding guilds to forest fragmentation in the Neotropics – A Review

D. Vetter, M. M. Hansbauer, Z. Végvári & I. Storch

Tropical forest ecosystems are threatened by ongoing fragmentation. However, fragmentation effects on tropical forest species still are poorly understood: Species' responses seem to be highly variable. In Neotropical birds, some feeding guilds seem to be especially vulnerable to forest fragmentation, whereas little is known about fragmentation sensitivity of mammals. We reviewed responses of terrestrial vertebrate groups to forest fragmentation in the Neotropics. We assumed that there is no difference in vulnerability across vertebrate groups but across feeding guilds. The ISI Web of Science was searched for international peer-reviewed articles on tropical forest fragmentation that use a spatial or temporal control. We extracted data on the studied vertebrate groups, feeding guilds, parameters, study designs and recorded fragmentation effects. Linear Mixed Models were used to assess the relationship between fragmentation effects on a species (response variable) and all other (random) variables. We obtained about 1000 species datasets of which more than 50% showed a negative response to fragmentation. The reported fragmentation effects were influenced by all variables. Those groups that were affected most (herpetofauna, insectivorous and carnivorous feeding guilds) might act as model species for conservation practice. Further, we recommend choosing study parameters and study design cautiously.

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- PosterP19-14

Threats to persistence of a rare endemic orchid in Madagascar

K.E. Theiss & K.E. Holsinger

Plant and animal species face many threats to survival including land use changes, disruption of mutualisms, and climate change. Threats from land use are especially great in the tropics where poverty often leads to destruction of forests and other wild ecosystems. Here we document threats to persistence of a rare Malagasy orchid, Erasanthe henrici. Erasanthe henrici grows in highly fragmented forest patches throughout central Madagascar where anthropogenic fire, timber harvest, and clearing of land for agriculture pose threats to the remaining forest. The remaining forest is isolated to different degrees and receives different levels of legal protection. Data collected from 2006-2009 show that fruit are rarely or never set in southern populations, while fruit set is greater than 50% in northern populations, suggesting that pollinators are more common or more effective in the northern part of the species range. Legal protection of forest reserves reduces the frequency with which plants are collected for the horticultural market. Long-term persistence of Erasanthe henrici will require effective protection of its habitat in the northern part of its range, but populations in the south may be doomed to extinction unless an effective pollinator can be introduced.

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- PosterP19-15

Groping in the fog – aquatic bioindicators in montane cloud forests and pastures in Ecuador

Amelie Bücker, Andrea Encalada , Martin Sondermann, Lutz Breuer, Hans-Georg Frede

Montane cloud forests are among the most important ecosystems for sustaining life in tropical regions, but they are also one of the most endangered, facing fast degradation due to deforestation and conversion to pasture and crop land. Along with the degradation of rivers, stream flora and fauna are under growing pressure by habitat change and the introduction of invasive species. Macroinvertebrates are particularly sensitive to changes in habitat health and are often indicators for distinct water conditions. Benefiting from this fact, the use of macroinvertebrates as “bioindicators” has become a regular method for water quality assessments in Europe and North America. In the tropics, we are still short of a bioindicator system as a cheap and easy to apply method for detecting water quality changes.We investigated different forested and deforested tributaries at altitudes of 2000 to 3100 m a.s.l. in the South of Ecuador. We observed clear changes in diversity and community patterns between pasture and forest streams. Although in-stream variability was high, the overall community structure was significantly altered by deforestation. Especially taxa which are mostly referred to as sensitive to water quality changes such as Ephemeroptera and Plecoptera showed distinct patterns. For that reason we conclude, that the use of bioindicators definitely seems to be feasible in tropical headwater streams.

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- PosterP19-16

Functional diversity along a post-disturbance successional gradient in a Mexican tropical dry forest

R. Bhaskar, T. Dawson, $ P. Balvanera

Variation in plant functional traits is an under-studied but important aspect of diversity in tropical forests, with links to ecosystem processes and functioning. The diverse seasonally dry tropical forests in Mexico are threatened by rapid and extensive conversion to pasture; it is therefore critical to understand what impact human land use has on functional diversity in secondary forests.In the state of Jalisco, on the Pacific coast of Mexico, long-term research sites have been established within a chronosequence of regenerating pastures that vary in years since abandonment (2-4, 6-8, 11-15) and within adjacent undisturbed forest. We measured 4 key ecological traits: plant height, wood density, leaf size, and specific leaf area (SLA) to provide insight about the strategies among co-occurring woody species in resource use, particularly of light and water. Aspects of the trait distribution, including the mean, range and variance, were compared across the three regenerating stages and with the mature forest. Younger secondary sites had lower mean and range of SLA values; the oldest secondary stage, however, was indistinguishable from the undisturbed forest. This progressive trend towards values similar to undisturbed forest suggests functional diversity can recover with time.

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- PosterP19-17

Deforestation and the decline of the army ant Dorylus wilverthi in western Kenya over the past 90 years

M.K. Peters, T. Lung, G. Schaab

We derived a density distribution model for the forest-dependent army ant Dorylus wilverthi, a keystone species of Congo-Guinean rainforest, and used it to predict the consequences of deforestation in a western Kenyan landscape over the past 90 years. Forest cover within a distance of 1400 m explained 58% of the variation in the colony density of D. wilverthi. The model predicts that the density of D. wilverthi exponentially increases with increasing forest cover and that colonies are absent from landscapes with less than 11% forest. Between 1913 and 2003 forest cover declined by 32% in the area, which is predicted to have led to a 52% decline in the population size of D. wilverthi. Under a worst-case future scenario, in which the forest area would be restricted to the strictly protected national/nature reserves of Kakamega Forest, the population size of D. wilverthi is expected to drop to only 9% of the 1913 level and two of the reserves would probably be too small to hold viable populations. This demonstrates the need of strict protection also for the forest cover outside the national/nature reserves in order to ensure the long-term conservation of D. wilverthi in Kenya.

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- PosterP19-18

Impacts of Biofuels on Tropical Ecosystems: Lessons from Southeast Asia

L.P. Koh

Oil palm agriculture has been blamed for deforestation and biodiversity loss in Southeast Asia. Here, I address the following questions: Is oil palm agriculture really destroying tropical biodiversity? Can we make oil palm plantations more hospitable for forest-dwelling species? Using FAO land-use data, I show that between 1990 and 2005, 55-59% of oil palm expansion in Malaysia and at least 56% of that in Indonesia occurred at the expense of forests. Conversion of either old-growth or secondary forests to oil palm results in substantial declines in butterfly and bird diversity, whereas conversion of degraded habitats such as rubber plantations to oil palm is very much less damaging. In Bornean oil palm plantations, oil palm growers could marginally increase the species richness of butterflies and birds in oil palms by changing management practices such as encouraging epiphytes in their plantations or preserving forest remnants. However, the magnitudes of these biodiversity enhancements are low relative to undisturbed tropical forests. Unless future expansion of oil palm is restricted to degraded habitats, such as pre-existing croplands or anthropogenic grasslands, rising global biodiesel demand is likely to exacerbate the high rates of forest conversion and threats of extinction to species in major oil palm-producing countries.

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- PosterP19-19

Impact of Agricultural Practices on Vegetation Dynamics in Pendjari Biosphere Reserve Land use Area (Benin, Western Africa

Assédé, E.S, M. Kouton & B. Sinsin

Biosphere Reserve of Pendjari (BRP) represents one of the pristine natural environments in West Africa. Adjacent farmland is subjected to high anthropogenic pressure. The aim of the study is to show effects of agricultural practices on vegetation dynamic in BRP. Four transects were set starting from the periphery of BRP running to the protected area. Phytosociological relevés were done using Braun-Blanquet method. The history of fields and fallows were studied by semi structured interviews. Detrended Correspondence Analysis reveals an anthropogenic disturbance gradient from savanna areas to the cropland and post-cultural sites. Agriculture, housing and hunting are the main land use practices and can be seen as adjustment to local needs in the periphery of the BRP. However, crop production is dominated by pesticide application whose overuse affects vegetation. Thus, vegetation disturbance caused by interactions of plant species and anthropogenic activity results in the dominance of widespread ruderal species. The range of widespread species increases from natural savanna in the protected area to cropland. These results support the process of increasing vegetation disturbance with decreasing distance to the Park. It's necessary to improve the agricultural practices in collaboration with local people around BRP.

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- PosterP19-20

Local people's perception on erosion and soil degradation in Karimama township in Northern Benin

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Erosion and soil degradation are a major threat for the sustainable use of land resources in Karimama district. The development of appropriate restoration strategies requires the identification of the main factors causing erosion and soil degradation. This evaluation is based on local people's perception in Karimama. About 136 people of different socio-cultural group's from 14 villages around Karimama were interviewed. Data were collected using structured and semi-structured interviews. The questions focused on causes of erosion and erosion factors, land use practices in the Park and its periphery. Principal Component Analysis and hierarchical classification are performed using SAS. The analysis of the questionnaires shows that anthropogenic pressure like deforestation (75%) and establishing of new farms (88.97%) are kept as the major causes of erosion by the interviewed persons. Factors affecting erosion are slope, run-off, inadequate plant cover and improper farming methods. This study indicates that sustainable strategies in restoration of degraded areas in the W National Park and its periphery should respect anthropogenic and natural causes of soil erosion.

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- PosterP19-21

Ethnobotany and social context use of Pentadesma butyracea Sabine in Benin

C.M.A. Avocèvou-Ayisso & B. Sinsin

Pentadesma butyracea (Clusiaceae) is a multi-purpose non-timber forest resource. In particular, butter for cooking and cosmetics is produced from its almonds. We assessed variations in plant use knowledge between sociolinguistic groups. Moreover, a stakeholders' analysis was carried out (i) to identify and categorize actors who intervene in the species' management; (ii) to highlight convergences and divergences of actors' interest. 200 respondents from seven sociolinguistic groups (Anii, Nagot, Kotocoli, Waama, Ditamari, Natimba and Fulani), were interviewed. Nagot people have the highest use value for bark and root, the two most sensitive parts for plant survival. Leaves are mostly used to treat fever and wounds or consumed for lactogenic effects, whereas roots and bark are used to treat stomach pain. P. butyracea is a non-explicit property rights resource. Three main categories of actors are identified in the resource management: actors having destructive actions in short-term on species viability (logging companies, farmers), actors having destructive actions in medium- and long-term (fruit harvesters, other parts collectors, cattle breeders) and actors that intervened in species natural stand regulation (landowner, forest agent, local authorities). There were convergences of interests between actors of the same category, while conflicts of interests were detected between actors of different categories.

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- PosterP19-22

Assessing land use impact on the structure and dynamic of five fodder tree species at W National Park and its surrounding area in Benin

L. Houessou & B. Sinsin

Fodder trees have been studied at the W National Park and its surrounding area in Benin. A quantitative ethnobotanical method based on structured interviews was used to evaluate local use-preferences of fodder tree species. In total, 68 cattle breeders were interviewed. They were asked to mention preferred fodder tree species and the abundance/rarity of them in the study site. Size class distribution, regeneration, pruning intensity and the density of the five most important fodder tree species were studied with linear transects in the protected and non-protected area.Results reveal that local inhabitants use 14 tree species as fodder trees. The five most important fodder trees are in descending order: Afzelia africana, Pterocarpus erincaeus, Khaya senegalensis, Stereospermum kunthianum and Lonchocarpus laxiflorus. The tree densities of the studied species differ significantly between the protected and non-protected area ($p < 0.003$). The pruning assessment and the size class distribution (J-shaped structure) of the five fodders trees reveal that the viability of the fodder trees is negatively affected in the non-protected area. Therefore, we defined specific actions for conservation and sustainable use of fodder trees in this area.

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- PosterP19-23

Threat on African Plant Diversity by Land Use and Climate Change

K. Sabellek, J.H. Sommer, R. Schaldach, W. Barthlott

Ecosystems are affected by global change as an influential driver of diversity loss. Increasingly erosion of species numbers has been observed during the last century. This study estimates the risk for plant diversity on continental Africa during the next 50 years. Plant diversity patterns are modelled on the basis of documented plant distribution data and environmental parameters using a maximum entropy model (MaxEnt). For future estimations predictions for climate change were integrated. Future scenarios derived from a multiple-scale land use change model "LandShift" show the areas required for cropland and livestock farming during the next five decades. An increasing demand of land use areas results from an estimated human population growth from 800 Million to 1900 Million and an increasing need of food (Geo-4, Markets First Scenario). We analysed the spatial interaction between plant diversity patterns, climate and land use change in future scenarios. Currently, more than 25 % of Africa's area is influenced by extensive agriculture. Before 2050 more than 50% will be affected. The changes demonstrate a rapidly increasing impact on "natural" habitats and show a tremendous loss of non transformed areas, implying a serious threat to biodiversity in future.

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- PosterP19-24

Mangroves and aquaculture in Chilaw (Sri Lanka): perspectives for the abandoned shrimp farms

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Mangroves are (sub)tropical forests of the intertidal zone. Worldwide, mangrove forests are disappearing at an enormous rate. Deforestation for construction of shrimp ponds is one of the main causes. Since the 1970s, there has been an exponential increase in the number of shrimp farms in the tropical coastal areas. Through the outbreak of diseases and a fluctuating export trade, many farms are being abandoned only 5 to 10 years after construction. In this study we focus on the mangrove restoration potential of the abandoned shrimp farms in Chilaw Lagoon (Sri Lanka).Based on remote sensing and fieldwork, land-use change analysis found out a mangrove decline of 43% due to the construction of shrimp ponds. In August 2006, 82% of the shrimp farms were abandoned. On the field, we saw that mangrove vegetation is not spontaneously recovering. Because the abandoned shrimp ponds are excluded from the brackish lagoon, terrestrial vegetation is encroaching. The first management practise should be to break through the dykes to reintegrate ponds in the hydrology of the brackish lagoon system. At last, based on characteristics of the abandoned shrimp ponds, their history and the land-use map we could define the most suitable ponds for mangrove restoration.

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- PosterP19-25

Introducing the concept of a biodiversity evaluation tool for the Greater Mekong subregion

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The Greater Mekong Subregion is a widely known hotspot of biodiversity, which faces drastic changes due to growing human population and advances in infrastructure and economy.Within the framework of the “Living Landscapes China” LILAC project, we are currently developing a biodiversity evaluation tool based on the combination of approaches from landscape ecology with detailed empirical data concerning species diversity and habitat characteristics of tropical plant and arthropod communities into a Geographic Information System. We use field data in order to assess different spatial and qualitative aspects of species diversity and distribution throughout the research area.The aim of this tool is to provide scientists and policy makers with information about the current state of biodiversity in their research area or administrative region and enable them to predict the likely impacts of agricultural land use changes on structural and ecological diversity when evaluating possible future land use scenarios.

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- PosterP19-26

Conservation versus degradation and sustainable use of termite mounds in the Pendjari region (Benin): causalities and scopes for intervention through a farming system analysis approach

E-A. Nuppenau, G. Ogoudedji

In African savannah ecosystems, fungus growing termites are considered ecosystem engineers and the dead termite mounds harbour a specific floristic composition and thereby increase the phytodiversity in savannahs. Moreover, termites and termite mounds revealed to be multipurpose utilisation for local communities (termites and mushrooms for human food and chicken feed), mounds for soil fertilisation, fungus and health care plants' nutrition, traditional ceremonies and construction). Recently, researches implemented by BIOTA West Africa teams observed the decreasing of termites mounds in the populated area of Pendjari region. We present the approach used to improve the economic recognition of ecosystem services of termites that eventually will lead to less degradation of termite population by the farmers.A farming system analysis approach is developed to determine the alternatives in land use for modelling farmers' decision making against termite mounds. An bio econometric model is simulated to show to the farmers how, the modification of existing farming systems integrating ecosystem services of termites can contribute to more sustainable land use practices.All results may provide guidelines for the management of mounds in the farming system at farm and landscape levels.

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Session 19: Land-use change at local and landscape scales: biodiversity, ecosystems and livelihoods in the tropics
- PosterP19-27

Influence of habitat degradation on hypogaeic Guineo-Congolian ant communities

F. Herchen, G. Fischer, F. Hita Garcia, M.K. Peters

The equatorial rainforests of Africa are rapidly disappearing, being replaced by secondary forests and agricultural land. The consequences of these land-use changes for insect communities are little understood and this is especially true for the below-ground living fauna. In this study I used oil-baiting to investigate the influence of habitat degradation on soil-living ant communities of a Guineo-Congolian rainforest in Western Kenya. Ants are important elements of the soil macrofauna and are indicators of soil health. Analysis of the obtained data showed a significant reduction in ant species richness along the habitat degradation gradient, which was particularly generated by a loss of predators and foraging specialists. Further investigation through ordination techniques indicated strong differences in community composition between the forest and the farmland sites, and also between extensively and intensively managed farmland, while primary and secondary forests showed similar ant species compositions. This study shows that deforestation and intensification of land-use has strong impacts on the soil macrofauna and that secondary forests in the vicinity of undisturbed habitats can harbour a high percentage of species from primary forests.

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Session 19: Land-use change at local and landscape scales: biodiversity, ecosystems and livelihoods in the tropics
- PosterP19-28

Comparing the effects of forest fragmentation in tropical and temperate zones: lessons and perspectives from studies in Brazil and Germany

C. Dohm, S. R. R. Pinto, D. G. P. Lima, I. R. Leal, M. Tabarelli & R. Wirth

Forest fragmentation is known to affect key functions of ecosystems. Here we present a tentative comparison of fragmentation effects between two highly fragmented landscapes, the Atlantic Forest (NE Brazil) and the Northern Palatinate Forest (SW Germany), with a focus on forest communities and plant-herbivore interactions. Substantial differences in the nature of edge effects appeared to result from prevailing land use practices and the distribution of plant functional groups. While human impact is greatest near tropical forest edges, temperate edges are released from intensive forest management. Tropical forest edges and fragments are functionally and floristically impoverished due to elevated abundance of fast-growing pioneer species – a tiny fraction of the overall diversity. In contrast, the floristic diversity of temperate tree assemblages was greater near the edge probably because the relative proportion of shade-intolerant, economically unprofitable species is much higher. These differences in plant community composition may translate into different patterns of species interactions, as indicated by preliminary results on herbivory rates. We discuss the potential of comparative studies on fragmentation effects in tropical versus temperate forests to enhance our fundamental understanding of ecological processes in anthropogenic landscapes of both biomes.

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Session 19: Land-use change at local and landscape scales: biodiversity, ecosystems and livelihoods in the tropics
- PosterP19-29

Determining factors of dung beetle (Coleoptera: Scarabaeidae: Scarabaeinae) distribution in a Cerrado landscape, Minas Gerais, Brazil

S.Almeida,J.Louzada & C.Sperber

Cerrado composes a mosaic of vegetation physiognomies, each being degraded by anthropogenic intervention, such as the introduction of extensive monoculture. Although Cerrado is the second most extensive biome in Brazil, few studies have been conducted with dung beetles. Of these, none have evaluated the determinants of dung beetle distribution in its natural habitat mosaics. Our aim was to evaluate the factors determining the distribution of dung beetles in a Cerrado landscape, utilizing vegetation, soil and altitude as causal factors. We conducted this study in Serra de Carrancas (Minas Gerais) in four phytophysiognomies: forest, savanna, altitudinal grassland and rupestrian field. Species turnover between phytophysiognomies accounted for 60% of regional diversity. Species composition in forest patches differed significantly from other phytophysiognomies. Each phytophysiognomy possess characteristic species, in total 52 species were sampled. Proportion of sand in the soil is negatively correlated with the number of species. Our results indicate that phytophysiognomies and sand proportion are responsible for community structure and composition. In addition, the phytophysiognomic mosaic of Cerrado landscape accounted for the majority of regional diversity. Therefore, the maintenance of dung beetle diversity depends on the maintenance of habitat diversity. Our findings have important implications for conservation in Cerrado landscapes.

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Session 19: Land-use change at local and landscape scales: biodiversity, ecosystems and livelihoods in the tropics
- PosterP19-30

Ecological evaluation of small holder rubber plantations based on understory plant inventories in Nabanhe National Nature Reserve (NNNR), Xishuangbanna, China

J.X. Liu, G. Langenberger,J. Sauerborn

The expansion of rubber plantations is thought to be the very most serious threat to the local biodiversity in Xishuangbanna, Yunnan, China, belonging to one of the most important biodiversity hotspots on earth. Unfortunately the knowledge base on understory plants existing in rubber plantations and their ecological role is rare. In our study, we adopted 5×5m2 plots to investigate the understory plants in small-holder rubber plantations in NNNR. Information like total coverage of the plants, separate coverage of each layer, life form and abundance of each plant species were collected in the field, and whether a plant species is endemic or exotic were checked using data from literature. By comparing the understory vegetation of rubber plantations with adjacent forest/forest patches the strength of effect of rubber plantation on plant biodiversity was calculated.

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Session 19: Land-use change at local and landscape scales: biodiversity, ecosystems and livelihoods in the tropics
- PosterP19-31

Species diversity and distribution of longhorn beetles (Cerambycidae) in a cultivated landscape of Xishuangbanna, Yunnan, SW China

M. Lingzeng, A. Weigel, M. Cotter, K. Martin

The landscape of the southern Yunnan is naturally covered by tropical forest (which belong to the Indo-Burma hotspot), and traditional land use systems are established in that region since centuries. In the recent years, however, the cultivation of rubber plantations increased to a large degree in that area, predominately realized by sacrificing natural forest areas. In the Xishuangbanna prefecture of Yunnan, rubber plantations now cover 20% of the total land area, whereas forest cover was reduced to less than 50% and that of primary rainforests to 3.6%. Most of the land below 800-1000 m is already covered by rubber plantations and resulted in the transformation of entire landscapes. The present study deals with these effects on the diversity and distribution of the longhorn beetle fauna.

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Session 19: Land-use change at local and landscape scales: biodiversity, ecosystems and livelihoods in the tropics
- PosterP19-32

The threat of southern Bracken: Current status of the modelling approach.

B. Silva, J. Bendix, K. Roos, D. Göttlicher, R. Rollenbeck, T. Nauss & E. Beck

A modelling approach to investigate a grassland-pasture competition on a local is the subject of the study presented here. Based on climate and vegetation interactions competition between two species is examined. These species play an important role in land use issues in a mountain ecosystem located on the tropics of South America. Their ecological relationships and competitive advantages are hypothesized and can be explained through the model being developed. Most of the biophysical background of this model has been structured by reengineering existing global scale SVAT models. Plant functional types are used and their attributes are calculated with regard of climate forces. Consistent atmospheric inputs and parameterization were derived from field surveys. Currently, the development activities are focused on biomass gain through leaf photosynthesis. At this point intriguing questions are raised about conceptual problems, abstraction level and scaling. In the future this study shall provide insights in vegetation mechanisms, allowing a long term perspective to land management practices.

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Session 19: Land-use change at local and landscape scales: biodiversity, ecosystems and livelihoods in the tropics
- PosterP19-33

Climate Change, Landscape dynamics, Land use and Natural Resources in the Atlantic Forest of Rio de Janeiro

J.C. Torrico

The research project addresses the objectives of methodological advancement and applicability of results in decision-making at the interface of environmental management and economic progress in the Brazilian Mata Atlântica region. The principal intentions to carry out this project are derived from the considerations of the actual causes and processes of landscape change under the influence of global change, in particular of future climate conditions. The research approach is structured into five main modules (Fig. 1 and Fig. 2) comprising six work packages. These are: I. Land use systems (WP 1: Land use), II. Forest systems and bioindicators (WP 2: Bio-ecological assessment), III. Soil and water dynamics (WP 3: Geo-ecological dynamics, WP 4: Water resources management, IV. Participative research in rural development (WP 5: On-farm research) and V. Integrated modelling, database management for DSS development (WP 6: Spatial integration). The main expected products of this project will be beneficial both for Brazil and Germany. Brazilian institutions and stakeholders will receive planning tools and decision support systems based on innovative and actual research considering all the three aspects of sustainability to optimize landscape planning, agricultural production systems and nature conservation. The German applicants will have the chance to improve basic, applied and transferable research on the assessment of the status and the dynamics of complex ecological systems, climate change effects on natural and agricultural systems, the analysis of the interaction of forest with a rural environment and the integrated modelling methodology. Furthermore, the strengthening of international and multidisciplinary networks in the respective fields of German research is essential to maintain the high level scientific standard of the applying Universities. Both countries will as well benefit from the human resources development within an academically challenging international research program.

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Session 20: Biodiversity theories - Talk T20-01

What is beta diversity and what have we learned about it in tropical forests?

H. Tuomisto

A wide variety of different phenomena have been called beta diversity over the years. An extensive literature review has revealed that in the current ecological literature, beta diversity is being defined in dozens of different ways. Many of the definitions actually lead to quantifying phenomena that are not correlated with each other. Therefore, differences among studies in conclusions concerning "beta diversity" may often be due to methodological differences rather than to biological differences among organism groups or geographical regions. This makes it rather challenging to obtain an overview about what has been learned about patterns in beta diversity, and about the processes that affect beta diversity in nature. In my presentation, I will briefly justify the use of one particular definition as true beta diversity. I will also provide an overview of the knowledge accumulated on true beta diversity in tropical rain forests, especially in Amazonia.

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Session 20: Biodiversity theories - Talk T20-02

Properties of alpha and beta diversity indices in communities organised by dispersal and/or niche assembly rules – a simulation study

O.J. Hardy, G. Dauby, M. Rejou-Mechain

Different theoretical frameworks have been proposed to partition biodiversity into intra-site and inter-sites components with the aim to better describe its organisation and better infer the underlying processes. These frameworks include the additive partitioning of Gini-Simpson diversity index, as done in population genetics, and the multiplicative partitioning of "true diversity" measures expressing "effective numbers of species". However, the statistical properties of some of the proposed indices are unknown. Moreover, it is yet unclear how to obtain insights into the processes structuring biodiversity from observed patterns. We present a method to obtain essentially unbiased estimates of the effective numbers of species. Then, using simulated datasets, we show how limited dispersal and ecological specialization in a heterogeneous landscape affect spatial patterns of beta diversity. Results are also compared to theoretical expectations for a neutral model. They show that the impact of niche differentiation on beta diversity increases substantially under dispersal limitation. They also indicate that the additive partitioning of Gini-Simpson diversity can provide quantitative estimates of dispersal limitation that are fairly robust with respect to niche differentiation.

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Session 20: Biodiversity theories - Talk T20-03

The paradox of soil generalist tree species

J. Born, R. Pluess, R. Nilus, D. Burslem & J. Ghazoul

Understanding the mechanisms by which high species diversity in the tropics is maintained remains unresolved. The niche-assembly hypothesis predicts that coexistence is permitted by fine partitioning of a heterogeneous environment by different species. A fundamental challenge to this hypothesis is the occurrence of generalist species that occupy a wide range of conditions. Generalists, by definition, tolerate a wider variety of environmental conditions, but in any particular environment are at a selective disadvantage compared to specialists adapted to that environment. Thus specialists should always exclude generalists, yet this is clearly not the case. How then are generalist tree species able to persist with specialists if the niche-assembly model of species co-existence is assumed correct? We explore this by investigating the performance of six Shorea (Dipterocarpaceae) species (two soil generalists and four soil specialists) on two soil types, using a reciprocal transplant experiment and a nursery experiment. We present first data on the growth and mortality, the investment in secondary defence compounds and susceptibility to herbivory, under two soil and two light treatment combinations. We predict that trade-offs exist such that specialists adapted to particular soil types have higher growth rates than generalists but are more susceptible to herbivory or drought.

Session 20: Biodiversity theories - Talk T20-03

Figure 1: Herbivory pressure on Shorea seedling.

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Session 20: Biodiversity theories - Talk T20-04

Conservation and management of the biodiversity in a hotspot characterized by short range endemism and rarity: the challenge of New Caledonia

R. Pellens & P. Grandcolas

New Caledonia is a peculiar hotspot, a small island, relatively isolated from any continent, with moderately high mountains and a complex orography. Its biota is very rich in endemic species but highly endangered, particularly by three main threats: fire, mining and invasive species. Recent research on phylogenetics and biogeography indicated that the biota of New Caledonia is characterized by short range endemism, with three main patterns: (I) species endemic to the regiobns of New Caledonia; (II) short range endemics with parapatric/allopatric distributions; (III) short range endemics with disjunct distributions. We developed a model based on the frequency and spatial distribution of the threats to understand how they could affect species with contrasting patterns of endemicity. Our analysis show that in the case of large scale habitat destruction, regardless of the biogeographical pattern of endemism the chances of survival of rare species with small scale ranges are quite low. In the case of threats that are more delimited in area, the loss of a disjunctly distributed species is more problematic with respect to the loss of phylogenetic diversity. Grandcolas, P. et al. 2008. Phil. Trans. R. Soc. Lond., B, 363, 3309-3317.Pellens, R., Grandcolas, P. 2009 In: Conservation of natural resources. Nova Publishers, in press.

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Session 20: Biodiversity theories - Talk T20-05

Exploring the impact of phylogeny and neutral processes on tropical ant communities

M. Pfeiffer & D. Mezger

Assemblages of tropical organisms are famous for their high species richness and the large numbers of rare species that they include. Up to now two models have been favoured in the discussion about composition of tropical species communities: Neutral theory predicts a random composition of these assemblages in contrast to classical trade-off-based niche theories that stress the impact of environmental factors. The influence of phylogeny is unknown for most systems since only few phylogenetic analyses of tropical communities have been conducted yet, even though many of the interacting species are closely related members of the same genera and knowledge on phylogenetic relationships has been much improved for many clades.We investigated the impact of neutral and phylogenetic processes on community composition and patterns of beta diversity in a well studied assemblage of tropical leaf litter and soil ants from Gunung Mulu National Park, Sarawak for which we have already analysed the impact of spatial and environmental factors on community structure (Mezger & Pfeiffer, talk in the same session). Here we report on the species-genera relationships in this community and use phylogenetic supertrees and null-models to explore the phylogenetic structure of the assemblage and the phylogenetic basis of community niche structure.

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Session 20: Biodiversity theories - Talk T20-06

Can spatial aggregation of tropical forests trees be predicted by species attributes?

M. Rejou-Mechain, N. Bourland, O. Flores, R. Fétéké, A. Pasquier, J.L. Doucet & O. Hardy

Niche differentiation, dispersal limitation and historical processes have been identified as factors influencing the spatial patterns of species. Their relative importance, which differs according to spatial scales, is the subject of much debate. In this study, our objective is to understand which processes drive the spatial aggregation of adult tree species and at which scale they act. We used large scale forest inventories (10,936 0.5-ha plots spread over 6100 km²) conducted in five tropical forest sites in Central Africa. We focussed on 122 tree species (300,089 individuals > 30 cm dbh) for which we compiled attributes that might correlate with aggregation patterns (diaspore type, shade tolerance, wood density, growth rate, mating system, phytogeographic distribution). We quantified the strength of species aggregation at the local (0.2-1 km), meso- (1-10 km) and landscape (> 10 km) scales. The strength of species aggregation at the largest scales was higher in presence of a macrogeographical edaphic gradient. Species aggregation was consistent across sites and showed a weak but significant phylogenetic signal. However, species showed substantial variation among sites and species aggregation was not correlated with any of the species attributes tested. Hence, historical and environmental factors might be the main drivers of species aggregation.

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Session 20: Biodiversity theories - Talk T20-07

Light-dependence of growth rates across a tropical lowland rainforest community

N. Rüger, S.P. Hubbell & R. Condit

Many hypotheses about species coexistence involve differential resource use and tradeoffs in species' life history traits. However, quantifying resource use in highly diverse communities is often challenging. We use a hierarchical Bayesian approach to quantify the variation of light dependence of growth rates across >250 woody species in a 50-ha long-term forest census plot in Panama. Available light was estimated for each individual tree from yearly vertical censuses of vegetation density.In low light, most species grew very little or not at all, while growth rates in high light varied strongly. The majority of tree and shrub species showed a moderate increase of growth rates with increasing light availability and only few species responded strongly positive to increasing light. Growth rates at standardized size and light conditions correlated strongly with maximum growth. Thus, our results suggest that the majority of tree species in this community grow slowly and respond weakly to increases in resource availability, while a few species grow fast and are able to efficiently exploit higher light conditions. This supports the hypothesis that niche differences with respect to light availability do not play a decisive role in maintaining high number of non-pioneer tree species in tropical forests.

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Session 20: Biodiversity theories - Talk T20-08

Bryophytes across the Amazon Basin

S. Mota de Oliveira, H. ter Steege

The Amazon forest has been the source of interesting data for testing biodiversity theories, particularly neutral theory. We include a group with very low dispersal limitation to this scenario: bryophytes. Epiphytic bryophytes of tropical forests show a strong gradient in species composition from the base to the top of the host trees, indicating an important role of niche assembly at the local scale. In order to investigate the building of local communities from a regional perspective, we sampled communities of epiphytic bryophytes along a height gradient on host trees in nine localities across the Amazon Basin. Diversity patterns across the basin differ from other groups by showing peaks of richness at the Northeast (French Guyana) and Western (Ecuador) geographical extremes and lower number of species along the transect Eastern – Central Amazonia. Local communities are neither a random draw from the metacommunity nor influenced by climatic conditions, but rather having their composition driven by local community dynamics. Local communities are therefore drawn all over the Amazon from the same metacommunity but establish according to the microenvironmental filtering along the host trees.

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Session 20: Biodiversity theories - Talk T20-09

Linking tree species spatial distribution and recruitment limitation in a tropical forest

C.X. Garzon Lopez, S. Bohlman, P.A. Jansen, E. Medina & H. Olff

Spatial processes such as dispersal limitation (stochastic process) and the spatial arrangement of environmental conditions (deterministic process) are critical in the structure and dynamics of tropical forest communities. However, it is not known to what degree observed spatial patterns of tree species distributions are determined by aforesaid stochastic versus deterministic processes. Recruitment, resulting from stochastic and deterministic processes, is controlled by the number of seeds produced, the ability to disperse to sites available, and the local conditions that influence the probability of seed germination and growth. For this study, at Barro Colorado Island (Panamá), we selected plots of high and low density of three canopy tree species (based on previously created tree distribution maps) and recorded tree density, seed arrival, and seed predation to investigate seed dispersal and survival. To examine seedling establishment, we planted seeds and measured seedling survival and growth and quantify dispersal limitation and its effect in plant species recruitment. Experimental results show that dispersal limitation is also important in determining species distributions. Combining these results to the previously measured effect of the spatial arrangement of environmental conditions at large scale is a vital step to disentangle the mechanisms that determine tropical plant species spatial structure.

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Session 20: Biodiversity theories - Talk T20-10

Analyzing phylogenetic relationships among species: a new tool for ecology and biogeography studies.

I. Parmentier & O.J. Hardy

Analysing the phylogenetic structure of communities adds an evolutionary dimension to the interpretation of community structure and can help understanding the relative role of stochastic and deterministic factors shaping species assemblages. Rain forest inselbergs combine strong ecological gradients at the local scale and insular properties at the regional scale. We used this model to compare the effects of ecological sorting and of distance dispersal on species turnover and on the phylogenetic structure of plant communities. Similarity between vegetation plots depended on both microhabitat differentiation and spatial distance, while phylogenetic clustering only appeared between plots from differentiated microhabitats and increased with ecological distance. This result indicates that species turnover is probably due to dispersal limitation rather than to regional-scale variations in environmental factors. Hence, phylogenetic structure analysis can help disentangle the effects of ecological sorting and dispersal limitation on species assemblages. To estimate the time-scale of the processes generating the phylogenetic structure, we investigated how lineage similarity changes with increasing age in the phylogenetic tree. For ecologically much differentiated plots, high similarity levels were only reached at the proximity of the root of the phylogenetic tree. Hence, ancient diversification exerts an impact on the assembly of current plant communities.

Session 20: Biodiversity theories - Talk **T20-10**

Figure 1: Inselbergs in the African rain forest are partially covered by edaphic grasslands. They can be considered as "xeric islands".

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Session 20: Biodiversity theories - Poster P20-01

Disentangling regional and local tree diversity in the Amazon

J. Stropp, H. ter Steege, Y. Malhi, ATDN & RAINFOR

The Amazon rainforest is one of the most diverse and extensive forests in the world. So far, its regional and local tree alpha-diversity have been explained by current environmental factors such as rainfall seasonality and soil fertility. However, environmental factors have been far from stable in history. Understanding regional and local tree alpha-diversity requires hence a proper historical perspective. Here, we partition tree alpha-diversity into its regional and local components. We hypothesize that regional diversity is influenced by large-scale and long-term processes, whereas local diversity is mainly regulated by small-scale and short-term processes. We analyze the most extensive dataset of tree inventory plots on the Amazon Basin and the Guyana Shield. We find that palaeo-climatic stability and long-term large-scale ecosystem dynamics explain 31% and 14%, respectively, of regional tree alpha-diversity. Actual rainfall seasonality is correlated with regional tree diversity (19%), but we argue that this is of little consequence for the evolutionary drivers of regional diversity. Actual ecosystem dynamics explains 17% of the variation in local tree alpha-diversity. Our results suggest that reliable predictions of future changes of species diversity require an approach which considers evolutionary and ecological processes at the scale at which they are relevant.

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Session 20: Biodiversity theories - Poster P20-02

Environmental and spatial parameters determine community structure and diversity of ant assemblages in four Bornean rainforests

D. Mezger & M. Pfeiffer

A central question in ecological theory is to find the factors that structure species composition of local communities of interacting organisms. We studied community structure of tropical ants in leaf litter and soil in four types of lowland rain forest in Gunung Mulu National Park, Sarawak, Malaysia, to explore whether community structure is shaped by environmental parameters and which factors are crucial for community patterns. Using Winkler extraction we found a total of 206 ant species, with 68 to 130 species in the single forest types. Indicator species analysis with Monte Carlo randomisation proofed that 53 species were characteristic for a certain forest type. Community structure was significantly influenced by environmental parameters and spatial patterns. From 24 recorded parameters soil volume, number of surrounding trees and leaf litter coverage had the largest influence. Analyzing different soil layers we found 28% of the species to be restricted to the soil, while only 3 % were found in the leaf litter layer. As all species were positively associated, we reason that competition was a less important factor. Thus ant communities in Mulu NP seem to be composed of species with narrow niches that enable many species to coexist, maintaining high diversity.

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Session 20: Biodiversity theories - Poster P20-03

Consequences of Flower Size Variation for Species Coexistence in Tropical Forest Trees

C.Kettle, C. Maycock, J. Ghazoul, P. Hollingsworth, L.Soon-Leong, E.Khoo and D. Burslem

The relative role and importance of niche- and dispersal-assembly mechanisms in the maintenance of the high species diversity of tropical forest tree communities continues to generate debate and controversy. This debate would be reconciled by evidence that functional traits and trade-offs equalize per-capita fitness among species. We examined floral trait variation, and its association to flower and fruit production, pollination biology and the spatial genetic structure of adult trees, among ten coexisting species of Dipterocarpaceae at a site in northeast Borneo. We found that flower size was a fundamental trait that determined body size of the major pollinators, pollen dispersal distance, pollination success and the spatial genetic structure within species. Smaller flowered dipterocarp species had smaller pollinators and a lower mean pollen dispersal distance than their larger-flowered confamilials. Limited gene dispersal generates fine-scale spatial genetic structure, a higher frequency of short distance pollination events thus leads to increase frequency of inbreeding. These patterns were associated with reduced pollination success in small flowered species. We conclude that differentiation in flower size leads to partitioning of pollinators, with different dispersal potentials, and presents a potential mechanism that contributes to equalisation of fitness within this ecologically and economically important clade of tropical tree species.

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Session 20: Biodiversity theories - Poster P20-04

Coexistence of tropical tree species - towards a unified spatial theory of biodiversity

A. Huth, T. Wiegand

We will present the approach of a new large project funded by the European Research Council (Spatiodiversity). This project will use advanced spatial statistical methods, process-bases modeling techniques and large inventory data sets to get a new understanding of the role of biodiversity for structure and stability of tropical forests. Therefore, we will analyse spatial patterns of tree species richness and reconstruct these patterns with dynamic forest models of different complexity. In the presentation we will give several examples of the used techniques, e.g. the individual species area relationships (ISAR).

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Session 20: Biodiversity theories - Poster P20-05

Role of Environmental and Spatial Factors in Determining Large Scale Patterns of Neotropical Primate Community Structure: Comparing Diversity Metrics

M.M.Gavilanez & R.D.Stevens

Ecological and spatial factors are potential mechanisms influencing assembly and structure of communities. Although changes in spatial composition along environmental gradients are well known phenomena, spatial relationships are less clear. We investigated the relative importance of environmental vs. spatial factors in determining variation in primate community taxonomic and phylogenetic structure across the Neotropics. Sites with known community composition were selected from the literature. Variance partitioning analyses were used to decompose variation into effects due purely to local environmental factors, purely spatial factors and correlated effects. Total amount of variation explained by environmental and spatial variables was high and significant, yet proportions explained differed among metrics (R2adj 0.362taxonomic; 0.543phylogenetic). Environmental factors independently accounted for significant proportion of variation only for taxonomic metrics. For both metrics, pure spatial effects were important predictors. Different gradients for taxonomic and phylogenetic structure highlight the value of including information about species evolutionary relationships when analyzing variation among communities. Environmental characteristics accounted for more variation in taxonomic structure and spatial characteristics accounted for more variation in phylogenetic structure. This pattern suggests operation of different contemporary and historical mechanisms through space and time. In particular, uncertainty as to the specific mechanisms causing spatial structure warrants further investigation.

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Session 20: Biodiversity theories - Poster P20-06

Patterns of Trait Variation and Phylogenetic Structure in Inga (Fabaceae) Communities in Panama and Peru

K.G. Dexter, R.T. Pennington, T.A. Kursar, P.D. Coley

We examine the phylogenetic and trait structure of tropical tree communities at a low taxonomic level (within the genus Inga: Fabaceae) in two locations: Panama and Madre de Dios, Peru. In Panama, we assess patterns within subplots of the 50 ha forest dynamics plot on BCI, while in Peru, we examine patterns for multiple communities in diverse habitat types scattered across a 150 by 200 km area. In Panama, we find evidence for phylogenetic overdispersion (closely related species co-occurring less often than would be expected by chance), while in Peru, we find phylogenetic underdispersion. In Peru, using species-level data on ecological traits related to resource-use, we assessed whether co-occurring species differ more for these traits than expected by chance. This does not seem to be the case. However, we did find that co-occurring species in both locations differ more for herbivore-defense traits than expected by chance. Thus, regardless of the phylogenetic structure present, it seems that coexistence in Inga communities may be mediated by divergence in herbivore defense strategies.

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Session 20: Biodiversity theories - Poster P20-07

The Utility of the Useless: neutral biodiversity theory

Rampal S. Etienne

In this poster I will show the utility of an obviously oversimplified theory of biodiversity.

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Session 20: Biodiversity theories - Poster P20-08

The allometry of diversification

Rampal S. Etienne, Sara N. de Visser, Han Olff et al.

One of the most striking patterns observed among animals is that smaller taxa are generally much more diverse than larger taxa (Fig 1A). Classic macroevolutionary explanations state that net diversification rates must be smaller for large animals, either because the speciation (origination) rate declines with body size, or because extinction rate increases with body size (or both). Here we develop a new mechanico-statistical method to reveal the underlying allometries of speciation, extinction and diversification from diversity data, assuming the prevailing stochastic birth-death model of diversification. We apply this method to a data set of a wide range of taxa within the Metazoa (from insects to mammals) compiled from the literature.

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Session 22: Climate effects on regeneration dynamics - what can they tell us about climate change? - TalkT22-01

The contribution of drought tolerance, pests, and competition in shaping species distributions along the Malay-Thai Peninsula

J.L. Baltzer, S. Bunyavejchewin, S.M.N. Noor and S.J. Davies

Both abiotic and biotic factors contribute to the turnover of plant species. Along the Malay-Thai Peninsula there is a gradient of rainfall seasonality that contributes substantially to tree species distributions and correlates with richness. The strength of drought imposes limitations on the northern limits of tree species via differential physiological desiccation tolerances. It is hypothesized that in regions of greater richness, biotic pressure should be greater and thus impose equatorial distribution limitations. The relative strength of this limit compared with differential competitive abilities is less clear. In this study, we established a reciprocal transplant experiment across this gradient using species whose distributions were restricted to aseasonal forests and those which traverse the seasonality gradient. Growth, mortality and herbivore damage were monitored over a 20-month period. Species having broader distributions capable of tolerating seasonal drought were predicted to show reduced competitive ability as a consequence of stress tolerance-performance tradeoffs and be more susceptible to pest pressure in more diverse, aseasonal forests than aseasonal forest species. The reciprocal transplant showed little evidence for differential herbivore damage between the two groups. However, there were substantial differences in competitive ability with geographically restricted species having greater growth potential suggesting that differential competitive ability may contribute more strongly in the aseasonal forests.

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Session 22: Climate effects on regeneration dynamics - what can they tell us +about climate change? - TalkT22-02

Processes at the forest-savanna boundary in central Brazil

A.C. Franco, D.R. Rossato, E. Geiger & W.A. Hoffmann

Much of the seasonal tropics are composed of a mosaic of savanna and forest. At the savanna-forest boundary, there exists a dynamic balance between forest advance and its retreat. Forest expansion onto the savanna will depend on the establishment rates of forest tree seedlings, which is constrained by low nutrient availability, drought, and fire. We compared seedling establishment success of co-occurring savanna and forest species in a Cerrado region of central Brazil. We also compared patterns of leaf phenology, stem radial growth and fire-induced mortality of savanna and forest trees. Fire appears to be an absolute constraint to the expansion of forest. Water and nutrient availability may reduce the success of forest species, but these factors appear unable to completely exclude forest establishment in savanna. Despite the limiting resources in savanna environments, invading forest species tend to present higher growth rates and larger and denser crowns than savanna species, which enhance shading. Thus, we provide strong evidence that savanna and forest species represent distinct functional types and that the rate of forest expansion is dependent on the local pool of forest species available to establish in the adjacent savanna in the absence of fire. CNPq, NSF, FINATEC, Mellon Foundation.

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Session 22: Climate effects on regeneration dynamics - what can they tell us about climate change? - TalkT22-03

Changes in seedling dynamics and requirements within forests found along a rainfall gradient in Jamaica; how will this affect seedling establishment in a changing climate?

K.P. McLaren, S. Monroe, D. Luke, C. A. Sharma, B.S. Wilson, M.A. McDonald, J. Healey.

Changes in seedling dynamics and seedling requirements for successful establishment and growth, were assessed in forests found along a rainfall gradient in Jamaica. The forests include a wet forest over limestone (approx. 6000 mm of rainfall per year), a moist forest over limestone (approx. 3800 mm of rainfall per year) and a dry forest (approx. 700 mm of rainfall per year). Seedling dynamics became increasingly linked to moisture availability as the severity of rainfall seasonality increased. Previous research highlighted the importance of facilitation in the successful establishment of seedlings within a dry forest. Facilitation appears to become increasingly important with a decrease in rainfall, and seedling distribution appears to become shade dependent with increasing aridity. Thus, gap dependence decreased in importance with a significant decrease in rainfall. The implication of the importance of facilitation in a changing climate is discussed.

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Session 22: Climate effects on regeneration dynamics - what can they tell us about climate change? - TalkT22-04

Dipterocarps and El Nino

D.P. Bebber

Influences of insect herbivory and drought on tree seedlings in the family Dipterocarpaceae were investigated in the Danum Valley Conservation Area in Sabah, Malaysian Borneo, during the 1997-8 El Niño-Southern Oscillation event.Herbivory of seedlings in primary forest was correlated with increased leaf abscission and mortality, but only small numbers of seedlings were severely defoliated. Seedling mortality was elevated during the drought period, though leaf production of seedlings that did not die increased. Herbivory increased when rains returned. Seedling growth was negligible throughout the study.The root boring beetle Xylosandrus morigerus (Blandford) (Curculionidae: Scolytinae) attacked Parashorea spp. seedlings during the drought. The distribution of attack was patchy and the outbreak ceased when rains returned. Experimental root damage caused high mortality during drought but not during normal rainfall. Other damage types did not increase mortality. Artificial drought imposed by reduced root volume indicated that decreased defoliation rates during drought may be due to reduced leaf flush.The findings of the study are consistent with the theory that herbivore guilds react differently to changes in forest water status. Potential relationships between ENSO, climate change, and tropical forest regeneration are discussed.

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Session 22: Climate effects on regeneration dynamics - what can they tell us about climate change? - TalkT22-05

Partitioning of understorey light and dry-season soil moisture gradients among seedlings of four rain forest tree species in Madagascar

R. C. de Gouvenain, R. K. Kobe and J. A. Silander, Jr.

We looked for evidence of light and soil moisture partitioning among seedlings of four native Malagasy tree species, the pioneer, gap-adapted species Harungana madagascariensis and the three shade-tolerant species Ocotea cymosa, Stephanostegia capuronii and Uapaca ferruginea. 480 seedlings were transplanted in experimental plots within the Tampolo littoral forest and grown for 2 years. Growth rates increased with increasing light availability for all species, and with increasing dry-season soil moisture for H. madagascariensis. With increasing light availability, survival increased for H. madagascariensis, S. capuronii and U. ferruginea but decreased for O. cymosa. While dry-season soil moisture did not influence the growth or survival of the shade-tolerant species, it interacted with understorey light in its effect on the performance of H. madagascariensis, which performed better in wet soils at high light than in dry soils in shade. Rank reversals in species performance suggested that three of the four tree species partition resource gradients as seedlings, mostly light and secondarily dry-season soil moisture. There was only partial agreement between the performance of transplanted seedlings and the distribution of natural seedlings of the same four species with respect to light and soil moisture, suggesting that the success of tropical tree regeneration can only be partly accounted for by seedling performance across resource gradients.

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Session 22: Climate effects on regeneration dynamics - what can they tell us about climate change? - TalkT22-06

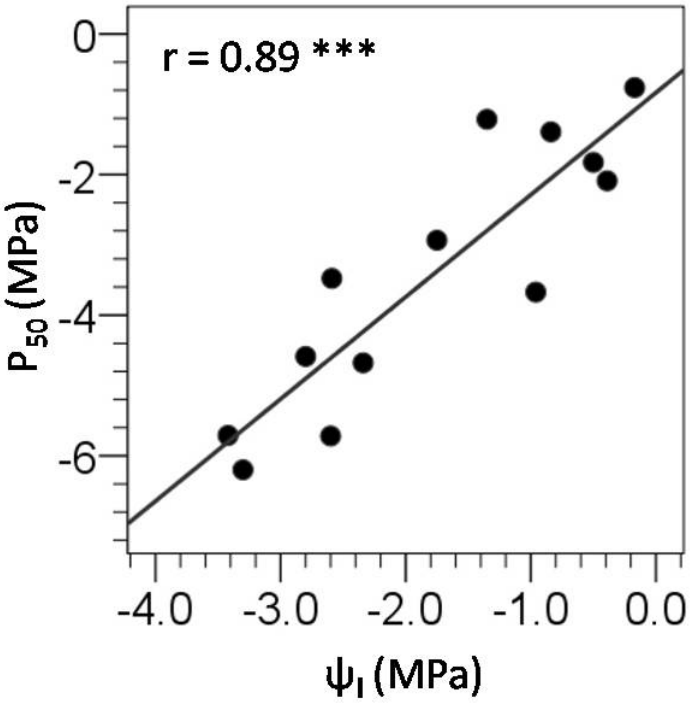
Hydraulic properties of 40 dry forest tree species in relation to drought-tolerance

L. Markesteijn, L. Poorter, F. Bongers, H. Paz & L. Sack

In tropical dry forests drought is a major influence on tree growth and survival. When soils dry out it becomes increasingly difficult for plants to acquire and supply water to the leaves and balance transpirational demands. The way in which trees deal with this problem will depend largely on their hydraulic architecture. In this study we address how plant hydraulics explain species drought-tolerance and how hydraulics in turn can be explained by species functional traits. In a deciduous dry forest in Bolivia, we measured dry season leaf water potentials (ψL) and hydraulic conductivity of saplings of 40 tree species. With vulnerability curves we determined the xylem potential at 50% loss of hydraulic conductivity (P50) of 13 species and we measured wood density (WD), maximum vessel length (VL), leaf dry matter content (LDMC) and specific leaf area (SLA) of all. ψL showed a strong positive relation with P50 and was thus assumed to be a good proxy for drought-tolerance (fig. 1). We found clear patterns between hydraulic properties and drought-tolerance. Species that tolerate low ψL had a lower sapwood-specific (KS) and leaf-specific (KL) hydraulic conductivity, denser wood and shorter vessels with a higher LDMC. SLA showed no clear trend with ψL. KS and KL were themselves negatively related to wood density and to a minor extent positively related to vessel length. These results suggest that hydraulic architecture influences drought-tolerance of dry forest tree species, through a trade-off between hydraulic efficiency (high KS, KL) and hydraulic safety (low P50, high WD, short VL).

Session 22: Climate effects on regeneration dynamics - what can they tell us about climate change? - TalkT22-06

Figure 1: Relation between the xylem potential at 50% loss of hydraulic conductivity (P50) and the midday leaf water potential (?L) of 13 dry forest tree species. Its Pearson correlation coefficient and level of significance is given. ***, P < 0.001.



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Session 22: Climate effects on regeneration dynamics - what can they tell us about climate change? - TalkT22-07

Regional variation of dry season intensity affects seedling survival and tree distribution in tropical forests

B. M. J. Engelbrecht

Shifts in rainfall patterns, changes in seasonality and an increased frequency of extreme weather events are expected for the tropics. Correlative approaches have been taken to extrapolate consequences of global climate change on tropical forest communities. However, sound predictions rely on an understanding of the mechanisms underlying species distributions. Using a pronounced rainfall gradient across the Isthmus of Panama as a model system, I examined the effects of variation of dry season intensity on seedling survival, and how such effects translate into species distribution patterns. Extensive transplant experiments of seedlings of 36 tree species showed that mortality was consistently higher in the dry than in the wet season across the entire gradient, with mortality increasing with the length and intensity of the dry season. Species occurring in forests on the wet side of the isthmus showed a strong decrease of survival with increasing dry season intensity, underlining that drought is shaping their distribution. In contrast, no home-advantage was evident for species associated to the dry side, and the factors limiting their distribution remain open. The results underline that shifts in precipitation patterns will have profound and complex impacts on tree species distributions, community composition and diversity in tropical forests.

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Session 22: Climate effects on regeneration dynamics - what can they tell us about climate change? - TalkT22-08

Seasonal and spatial variation in water availability drive habitat associations in a tropical forest

L.S. Comita & B.M.J. Engelbrecht

Associations with topographic units or soil types that vary in water availability are widespread in plant communities, yet the underlying mechanisms are poorly understood. We hypothesized that differential seedling performance across habitats, particularly during the dry season and in dry years, leads to habitat associations in seasonal tropical forests. We assessed performance of 36 native tree and shrub species in Panama across the dry and wet seasons in two topographic habitat types during an El Niño year. We found significant effects of season and habitat on seedling growth and mortality, with large variation among species. Species' mortality and growth rates correlated significantly with drought sensitivity, but only during the dry season in the dry plateau habitat. Slope specialists had significantly higher survival in the slope versus plateau habitat during the dry season, while plateau specialists showed no performance differences between habitats. Overall, our results support the idea that seasonal and spatial variation in water availability, particularly in dry years, drive seedling dynamics, which in turn shape local species distributions. Predicted shifts in rainfall patterns caused by global and regional climate change are therefore expected to alter the dynamics, composition and diversity of seasonal tropical forests.

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Session 22: Climate effects on regeneration dynamics - what can they tell us about climate change? - TalkT22-09

Tree seedling regeneration in East-Africa affected by spatial distribution of abiotic factors: Three different experimental approaches

M. Oesker, R. Gliniars, H. Todt, W. Musila & H. Dalitz

A shift in climate pattern will have an influence on the species composition. Climate changes will be followed by changes in the competition between species and can on long term alter the diversity of an ecosystem. To predict these, long term changes in tree seedling regeneration need to be investigated. In different research approaches in an East African rain forest tree seedling growth and mortality were monitored, whereby at the same time abiotic factors like light, water and nutrient distribution were observed. The three different approaches include long-term seedling monitoring in the forest since 2002, planted seedling monitored under specific climatic situations in a natural environment and under controlled abiotic conditions in greenhouse experiments. The different species show different changes. A shift in the competition between the species was observed. Results of the long term monitoring and about the growth and mortality of tree seedlings changes with changing abiotic factors of the environment will be presented.

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Session 22: Climate effects on regeneration dynamics - what can they tell us about climate change? - TalkT22-10

The ticking rank clock - Species rank analysis as a tool to measure system resilience to land use and climate change

A. Augustin, J. Oldeland, M. Finckh

In this study we compare community dynamics along an altitudinal, temperature and precipitation gradient from the High Atlas mountains to the fringe of the Sahara in Southern Morocco, covering Oromediterranean cushion shrub vegetation, Ibero-Mauritanian steppes and Saharan vegetation. Permanent monitoring plots, measuring 100m², were established in 2001, using a pair-wise exclosure design to determine the effects of grazing and climate. On these plots, individuals were annually counted, yielding abundance values for all vascular plant species. In order to identify effects of grazing and climate on regeneration and growth dynamics in communities we analyzed mean shifts of species within their ranked abundances from different subsequent years. Rank abundance curves and rank clocks demonstrate changes in community structure. The reaction to climate variability shows significant differences between the considered communities along the environmental gradients. Land use effects were more prominent in the semi-arid than in the arid environments, where changes due to land use are concealed by annual rain fall dynamics. Rank shift analysis seems a promising tool for monitoring and early detection of possible impact of climate change on plant communities.

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Session 22: Climate effects on regeneration dynamics - what can they tell us about climate change? - PosterP22-01

Population dynamics of Guibourtia copallifera, a rare species in Burkina Faso

A. Gnoumou, K. Hahn-Hadjali, R. Wittig and A. Thiombiano

Guibourtia copallifera (Caesalpiniaceae) is a tree of the Guinean zone, found in South-Western Burkina Faso. In this study, we assess the present state of these rare species with respect to future tendencies. The structure of 17 populations of Guibourtia copallifera was examined. 11 populations are situated in protected areas, six are in non-protected areas. In each population, DBH (>5 cm) was recorded in a relevé of 1000 m², while regeneration was assessed in two subplots of 25m². Size-class distribution of all trees with DBH ≥ 5cm was analyzed with JMP to determine structure and dynamics of the entire population. Size-class distribution of the populations in the protected as well as in the non-protected areas show a positive tendency (Weibull distribution analysis, $1 < c < 3.6$). However, some differences between the two groups can be noticed.We conclude influence of ecological conditions (type of soil, topography, water balance, etc.) and anthropogenic factors (use for medical purposes, construction, crafts, etc.). on associated species composition, physiognomy, tree density, tree cover and regeneration.

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Session 22: Climate effects on regeneration dynamics - what can they tell us about climate change? - PosterP22-02

Ecological impacts of the 2006 post-bleaching mass mortality event on star corals Montastraea annularis and M. faveolata in Culebra Island, Puerto Rico

M.E. Ocasio-Torres, R. Hernández, T. Ruiz, E. Hernández-Delgado

A catastrophic warming event occurred during 2005 throughout the Caribbean Sea that caused an unprecedented mass coral bleaching event in Puerto Rico that was followed by mass mortality of star coral species complex (Montastraea annularis and M. faveolata). It resulted in a severe physiological fragmentation of large coral colonies. Permanent photo-stations were established in 4-6 m deep reef terraces dominated by Montastraea spp. at four sites in Culebra, Puerto Rico. Digital photography was used to document changes in benthic community structure before (2005) and after (2007, 2008) this event. Mass coral mortality caused a 66 to 98% decline in % living tissue cover in Montastraea spp. No significant difference in % living tissue cover loss or in mean fragment size was documented among sites. Fragment density was higher ($p<0.0001$) at Carlos Rosario Beach (130/m2) in comparison to the other sites (25-40/m2). Long-term ecological monitoring is needed to address questions regarding future reef resilience.

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Session 22: Climate effects on regeneration dynamics - what can they tell us about climate change? - PosterP22-03

Structure of three woody species of multipurpose use in Northern Burkina Faso

I. Ouédraogo, A. Ouédraogo, M. Hien, K. Hahn-Hadjali & A. Thiombiano

The impact of a climatic gradient on vegetation structure of three useful woody species was assessed in the Northern Region of Burkina Faso. DBH measurement of Anogeissus leiocarpus and Pterocarpus lucens as well as basal diameter measurement of Combretum glutinosum were carried out in plots of 50x20m. Data analysis showed variable structures. Population structures of Anogeissus leiocarpus and Pterocarpus lucens change along a phytogeographical gradient. In the southern area of the study zone, characterized by more rainfall compared to the northern, they show good population structures describing an “L”curve in this southern area. In the northern part, populations get more and more older characteised by bell-shaped curves . The population structure of Combretum glutinosum shows an identical tendency in the entire study area, meaning that the phytogeographical gradient has no effect on the population structure of this species. The population structures of Combretum glutinosum describe a “L” curve in the study area. All its populations are stable.

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Session 22: Climate effects on regeneration dynamics - what can they tell us about climate change? - PosterP22-04

Diversity and structure of the woody layer of wetland plant communities in Eastern Burkina Faso along a climatic gradient

O. Sambaré, K. Hahn-Hadjali, R. Wittig & A. Thiombiano

The woody layer of various plant communities in relation to different flooding regimes was sampled along a climatic transect crossing the 4 phytogeographical zones of Burkina Faso. Detrended Canonical Analysis (DCA) of 149 phytosociological relevés and 112 woody plant species reveal 8 plant communities which were ranged following the climatic gradient and the topography. Three communities are specific to the South Sudanian zone. One community is specific to the North Sahelian zone. The genera most represented are Combretaceae (12%), Rubiaceae (8%) and Caesalpiniaceae (7%). The dominant life forms are phanerophytes (80.4%) and lianas (14.8). Sudanian (38.4%), Sudano-Zambesian (22,.3%), Paleotropical (9.8%), Sahelian (7.1%) and Guineo-Congolian (7.1%) species are the most frequent phytogeographical types in wetland vegetation. Additionally the size-class distribution of trees with diameter in breast height (dbh) ≥5cm in each plant community was studied. In general, the density in small size classes is higher in comparison to that in big size classes. However, in three plant communities, the stem density is higher in the medium size classes due to human activities. Tree density varies from 458 ± 154 individuals in riparian forests of the South-Sudanian to 294 ± 155 individuals in riparian forests of the North-Sahelian zone.

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Session 22: Climate effects on regeneration dynamics - what can they tell us about climate change? - PosterP22-05

Osmotic potential of six bamboo species planted in the mountainous regions of Northern Vietnam

Viet Ha Tran

The osmotic potential within the plant reflects the water and salt situation of soils. Therefore, measuring osmotic potential is a way to specify not only site conditions but also plant characteristics to match plant species to sites or to diagnose the adaptation of plant species in relation to the site conditions. In theory, the plant osmotic potential is relative minimum at noon due to water lose inside the cells during the daytime to against high temperature while it reaches relative maximum at night when temperature decreases and water in the cells is saturated. In this research, the midday and saturated osmotic potential (measured at noon and in a position of saturated water) of six bamboo species included three monopodial species (Phyllostachys edulis; Oligostachyum sp and Indosasa angustata) and three sympodial species (Dendrocalamus latiflorus; Dendrocalamus barbatus and Dendrocalamopsis sp2) planted in the mountainous regions of Northern Vietnam were measured to assess their site condition and the adaptation towards these sites

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Session 23: Struggle in the Tropics - responses to stress in tropical environments - TalkT23-01

Struggle of plants with crassulacean acid metabolism (CAM) in tropical environments under the action of dynamic networks of stressors

U. Luettge

By contrast, for example, to severely dry desert ecosystems or cold polar regions and high elevations where single stressors such as scarcity of water and temperature, respectively, may dominantly determine the struggle of plants for life, in the tropics the stress typically arises from a dynamic network of several interacting stressors, such as availability of water, CO2, light and nutrients, temperature, the impact of salinity, requiring plastic spatio-temporal responses and versatile acquisition and defence of ecological niches. The mode of photosynthesis of crassulacean acid metabolism (CAM) and its flexible expression supplies plants with potential strategies for both acclimation and adaptation. Thus, CAM plants inhabit diverse habitats in the tropics including various types of moist and dry forests often with particular epiphytic sites, savannas and cerrados, semi-deserts, páramos, and fresh water lakes with submerged CAM plants not to be overlooked. Cacti are CAM plants. Similar to the zoological example of the famous DARWIN-finches, the Opuntia cacti of the Galápagos islands are one of the best botanical examples of adaptive radiation as a way towards speciation starting from a small founder population where one can now even identify an individual island of the archipelago by the Opuntia species or variety occurring. By contrast, it is assumed that the endemic cactus genera of Jasminocereus and Brachycereus, the lava cactus growing on sheer open lava rock, with only one species each on the archipelago still represent founders whose time was not long enough yet for successful radiation and adaptation to isolated niches.Examples will be illustrated and the functions of CAM supporting adaptation and acclimation will be discussed.

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Session 23: Struggle in the Tropics - responses to stress in tropical environments - TalkT23-02

Shade tolerance through resistance and resilience

K. Kitajima, L. Poorter, and P. Jansen

Deep shade of the understory of humid tropical forests is a primary stress factor to small plants. In order to survive, plants in the shaded understory must maintain positive net carbon gain integrated over sufficiently long term. It is overly simplistic to consider this requirement as a matter of optimizing the net balance of photosynthesis minus respiration for several reasons. 1) Natural enemies, including herbivores and pathogens, may strongly impact carbon balance. 2) Temporal changes in light availability due to season and canopy dynamics require resilience, in particular when light availability deteriorates due to gap closure. 3) Tree juveniles strong trade-offs between need to grow fast to reach reproductive maturity vs. to survive until light gaps occur near them. Here, we present evidence for importance of these considerations in discussion of shade as a stress factor from 20-year seedling demography of a canopy tree species, Tachigali versicolory, as well as comparative study of growth, survival and biomass allocation for seedlings of 80 tree species in common garden and shade house in Panama. These data suggest that shade tolerance is commonly achieved through resistance and resilience through allocation to physical defenses and carbohydrate storage.

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Session 23: Struggle in the Tropics - responses to stress in tropical environments - TalkT23-03

Leaf traits of dry and moist forest tree species and the importance of the leaf economics- and leaf size spectrum

L. Poorter, L.Markesteijn, D.M.A. Rozendaal

Leaves are important for the carbon, water, and heat balance of the plant, and hence for plant growth and survival. Species vary tremendously in their leaf functional traits, with important consequences for their distribution along local and regional environmental gradients. We compare 29 functional leaf traits of adult trees of 43 tropical dry forest species and 39 tropical moist forest species, representing most stems in each forest community. Differences between dry and moist forest species were surprisingly small, but when species were weighted for abundance, then dry and moist forest species differed conspicuously in their leaf traits. Many subordinate species with a wide variety of leaf traits may therefore persist in each forest but the common species differ strikingly in their traits. Leaf traits associations were analyzed with a principle component analysis. The first axis was mainly related to leaf size, and reflected a trade-off between scale and biomass efficiency of foraging (the leaf size spectrum). The second axis was mainly, related to leaf lifespan, and reflected a trade-off between leaf productivity and persistence (the leaf economic spectrum). Leaf size overrules therefore more subtle trait variation related to the carbon balance of the plant,. Most of the variation in leaf strategies is found within, rather than between communities, thus enabling species coexistence.

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Session 23: Struggle in the Tropics - responses to stress in tropical environments - TalkT23-04

Leaf traits of woody species with wide distribution in the Cerrado and Amazonian savannas: convergence or divergence of adaptive traits?

C.S. Ferreira, D.R. Rossato, M. Haridasan & A.C. Franco

Quantifying leaf trait relationships across species and across broad geographical ranges can provide information about major dimensions of variation among coexisting species. The study of trait relationships also offers a means of describing the effects of changes in species composition on ecosystem structure and function and of constraints to trait variation imposed by selective forces and evolutionary history. In this study we assessed the extent of geographical variation in leaf traits in ten cerrado woody species. Plants were measured in savanna sites located at Assis (22º 37'S, 50º 23'W), Brasilia (15º 57'S, 47º 55'W) and Alter-do-Chão (02° 29'S, 54° 56'W), spanning a latitudinal gradient of about 20°. At each site specific leaf area (SLA), CO2 assimilation on an area (Amax) and mass (Amass) basis, dark respiration (Rd), stomatal conductance (gs) and leaf N, P, K, Ca and Mg concentrations were measured in five individuals of each species. There were significant differences ($p < 0.05$) among sites for N, K, SLA, Rd, gs and Amax/gs. SLA was positively correlated with Amass, Rd, N, P, K, Ca and Mg, whereas Amass was correlated with leaf N and P. Most relationships displayed elevation shifts among sites or shifts along a common slope. CNPq, FAP-DF

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Session 23: Struggle in the Tropics - responses to stress in tropical environments - TalkT23-05

Research struggles in the tropics - some ideas and experiences

O. Huber

During the past 30 years important advances in botanical exploration of the remote Guayana Highlands in southern Venezuela (South America) have been achieved, the most important of which being the publication of the monumental Flora of the Venezuelan Guayana by Steyermark and collaborators. Likewise, the inventory of the vegetation of this region has reached a high degree of precision with the employment of advanced remote sensing techniques and intensive field explorations carried out during 1975 and 2000. In face of the upcoming global climatic changes it is urgent, however, to begin with detailed ecophysiological and functional analyses of some of the most significant plant communities, both at the species and the vegetation level. Some highly endemic plant communities growing on extremely oligotrophic substrates such as white sands (quartzipsamments) in the upper Orinoco lowlands or similar plant communities growing on the summits of the characteristic table mountains of the Guayana region are in strong need of further study.The present contribution aims to call attention on these urgent problems in tropical ecology, which are further aggravated by an alarming lack of field specialists and an overwhelming bureaucracy hampering modern research activities in one of the most diverse and unique Neotropical bioregions.

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Session 23: Struggle in the Tropics - responses to stress in tropical environments - TalkT23-06

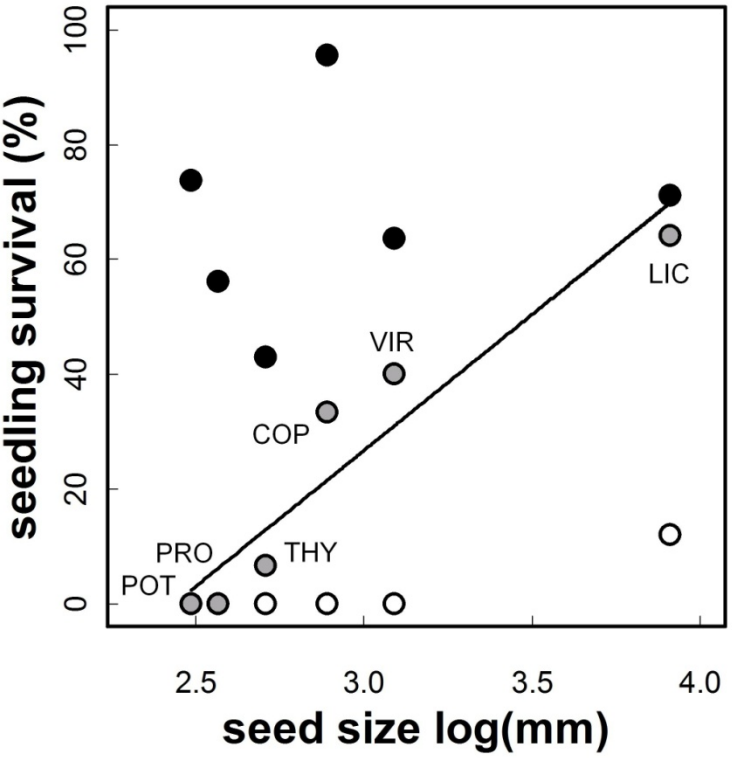
Ecological filters in a fragmented forest: Plant recruitment on and around leaf-cutting ant nests

S.T. Meyer, I.R. Leal, M. Tabarelli, R. Wirth

The concept of ecological filters (ecological variables and processes shaping the local species composition) is promising to understand changes in ecosystem structure and function resulting from forest fragmentation. Here we tested the potential of Atta cephalotes nests, (a hyper-abundant feature of forest edges), to function as ecological filters by comparing growth and survival of transplanted seedlings from six different tree species. Plants on nests showed higher gross leaf gain compared to understory plants. Yet, the growth of roughly twice as much new leaves did not translate into higher net growth of plants due to increased leaf loss on nests. Plant survival differed highly significantly between habitats and species and was generally high in the forest and low on nests, where it correlated strongly with seed size of the plant species tested. Two mechanisms governed the nest effect on plant recruitment: (1) increased light availability and (2) strong cutting pressure. On an ecosystem scale, abundant A. cephalotes nests at forest edges may amplify edge-driven alterations in the forest microclimate. Thereby, Atta promotes light demanding, yet large seeded, plant species, thus contributing to a disturbance regime that enables self-replacing pioneer communities at forest edges.

Figure 1: Correlation between the logarithm of seed size and seedling survival after 18 months in three contrasting habitats. Survival is shown for nest centers (white), nest edges (gray), and the forest understory (black). The line represents a best fit for a highly significant correlation between seed size and seedling survival at the edge of nests ($r = 0.95$, $df = 4$, $p = 0.004$), while there was no significant relationship in the forest ($r = 0.19$, $df = 4$, $p = 0.722$). At nest centers only some seedlings of the largest-seeded species survived. Next to the data points of survival at the nest edge, the species names are given as abbreviations (COP: Copaifera langsdorffii, LIC: Licania tomentosa, THY: Thyrsodium spruceanum, POT: Pouteria sp., PRO: Protium heptaphyllum, VIR: Virola gardneri)..

Session 23: Struggle in the Tropics - responses to stress in tropical environments - TalkT23-06



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Session 23: Struggle in the Tropics - responses to stress in tropical environments - TalkT23-07

Do leaf-cutting ants go undetected? Evidence for delayed induced defence following cumulative herbivory by Atta colombica in lima bean plants.

M. Tremmel, C. Kost, R. Wirth

Leaf-cutting ants (LCA) are amongst the most voracious herbivores of the Neotropics. One observation has puzzled researchers for decades: LCA stop defoliating a tree long before it has been completely exhausted. In this study we test the 'induced defence hypothesis' that explains the observed pattern with anti-herbivore defences, which are induced in the damaged plant upon herbivore attack. We used Phaseolus lunatus as a model plant that is known to emit herbivory-induced volatile organic compounds (HI-VOCs) as a defence mechanism. By combining laboratory dual-choice bioassays with chemical methods, we tested whether continuous LCA herbivory induces the emission of HI-VOCs and if so, whether this affects the ants' foraging decision. Our results showed negligible HI-VOC emission after one day of herbivory followed by a subsequent increase in the amount of HI-VOCs, paralleled by an initial preference trend and subsequent rejection of plants (accumulated herbivory over a 5-day period), respectively. Six of eight compounds of the whole volatile blend correlated significantly with the observed decreased plant attractivity. These findings are the first to show an induced chemical defence after LCA herbivory and we are confident that they may greatly contribute to our understanding of complex foraging patterns in LCA.

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Session 23: Struggle in the Tropics - responses to stress in tropical environments - TalkT23-07

Patterns of Floristic Differentiation among Atlantic Forests and the Influence of Climate II: The Southern Scenario

A.T. Oliveira-Filho, J.A Jarenkow & J.C. Budke

The tree flora of South American subtropical Atlantic forests and neighboring vegetation domains was investigated through multivariate analyses of 331 checklists containing 51,588 occurrence records of 2433 species. Two main aspects were addressed: (1) the species composition of subtropical Atlantic forests was analyzed with respect to the proportion of endemic species and the distribution range of the non-endemics across tropical Atlantic, Amazonian, Central Brazilian and Andean piedmont forests, and chaco vegetation; and (2) the variations in species composition within and among southern Atlantic forests were related to both climatic and spatial variables. Tree species distribution patterns were significantly related to climatic variables regardless of spatial proximity. To a considerable extent, the dendroflora of subtropical forests is a subset of the much richer tropical forests flora, probably extracting species that are able to cope with low temperature extremes. The climate of subtropical Atlantic forests contrasts with that of tropical forests in its higher temperature seasonality. Nearly half of the 121 alleged endemic species are related to 'cool-moist' conditions of montane habitats. The differentiation between subtropical rain, cloud, Araucaria and semi-deciduous forests was floristically consistent and chiefly correlated with temperature fluctuation and temperature extreme records.

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Session 23: Struggle in the Tropics - responses to stress in tropical environments - TalkT23-09

Plasticity and survival of tropical corticolous non-vascular plants at forest fragments

M. Lakatos, B. Hartard, A. Pardow, A. Obregon

The creation of artificial forest edges is commonly associated with changes in microclimatic conditions along the forest margins. Non-vascular plants, as being poikilohydric organisms, are likely to be influenced by changes in abiotic conditions penetrating the forest remnant. We investigated how microclimatic edge effects influence the distribution patterns of non-vascular plants with focus on the ecophysiological performance of lichens. A shift in the abundance of non-vascular plants has been observed from the edge to the interior in a tropical rain forest fragment of Brazil. Cortical and non-cortical crustose lichens revealed both different abundance and physiological adaptations to microclimatic aspects in relation to thallus morphology. The forest edge was shown to represent a higher risk of desiccation to lichens. Here, the abundance of non-cortical lichens was significantly increased and they followed the physiological strategy to efficiently exploit air humidity and exhibit high reflectance for photosynthesis - apparently as protective strategy. Cortical lichens were significantly more abundant at the forest interior, and larger water holding capacities and potentially diurnal dew formation enabled them to maintain prolonged activities which are crucial for exploiting sunflecks at this micro-site.Thus, microclimatic edge effects do affect the distribution of functional types of cryptogams and morphology as well as adaption play a major role in the establishment at distinct microclimatic environments.

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Session 23: Struggle in the Tropics - responses to stress in tropical environments - TalkT23-10

Responses to flooding stress in tropical trees

P. Parolin & F. Wittmann

Within the context of the symposium on “Struggle in the Tropics – responses to stress in tropical environments”, dedicated to Charles Darwin and the discussion on the role of struggle for life and on responses of organisms to stress, this presentation aims at giving an overview of tree reactions to flooding stress in tropical environments.The diversity of morphoanatomical adaptations and physiological and phenological responses to flooding of tropical plants in natural wetlands will be presented, and consequences for plant distribution along gradients of flooding intensity will be analysed.

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Session 23: Struggle in the Tropics - responses to stress in tropical environments - PosterP23-01

So strong is the pressure? Does the periodic flood pulse of the Amazon River induce speciation in floodplain tree populations of Himatanthus sucuuba?

C.S. Ferreira & M.T.F. Piedade

Amazonian floodplains plants withstand annual periods of flooding which can last seven months. To verify if the regularity of the “flood pulse” of the Amazon River can induce speciation, we investigated populations of Himatanthus sucuuba (Apocynaceae) colonizing whitewater floodplains (varzea, VZ) and non-flooded uplands (terra-firme, TF) in the region. In independent experiments we simulated flooding conditions, to evaluate the germination and growth of seedlings from both environments in terms of: 1) Development: growth, biomass and leaf area; 2) Morphology: leaf chlorosis, adventitious roots and lenticels; 3) Anatomy: aerenchyma formation in roots; 4) Chemistry: seed reserves and ADH activity in seedling roots. We also performed molecular analysis: polymorphism in the internal transcribed spacer (ITS) of the ribosomal DNA. The two populations showed significant differences for most parameters evaluated. VZ seedlings had larger seedling mass and greater root concentrations of soluble sugars and starch. TF seedlings did not survive a period of 120 days of submergence, while most VZ seedlings did. Thus, flooding is apparently a feature strong enough to promote phenotypic differentiation among VZ and TF populations. Indeed, molecular analysis showed genetic difference between populations, revealing that different ecological pressures may promote adaptive changes in Amazonian plants to insure establishment. CNPq/PRONEX/FAPEAM/FAPDF

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Session 23: Struggle in the Tropics - responses to stress in tropical environments - PosterP23-02

How diurnal dew formation prolongs photosynthetic activity of corticolous lichens in the tropical understorey

M. Lakatos, A. Obregón, B. Büdel & J. Bendix

Micro-environmental conditions of tropical lowland rainforests are critical to the survival of many plants, bryophytes and lichens in the understorey. Especially the high diversity and abundance of crustose lichens on tree bark in this habitats struggle ecologists since more than two decades. One crucial factor not considered yet is the micro-environmental impact of the substratum – the tree. To evaluate this impact on tropical corticolous lichens, photosynthesis, water performance and microclimate were studied in the understorey of a humid lowland forest in French Guiana. The micro-conditions of crustose lichen thalli differed significantly from that of adjacent ambient conditions and provide benefits for their water status and photosynthetic performance. The thermal conductivity of the bark as well as the evaporative cooling by sunflecks sustained diurnal lichen thallus temperature below the dew point and air temperature respectively at daytime. This induced diurnal dew formation on the lichen‘s surface until early afternoon. Together with photosynthetic reactivation with 70% relative humidity and high photosynthetic capacities at low water content adpressed lichens substantially benefit from their micro-environmental conditions. This hitherto unknown mechanism may also contribute to the water supply of other corticolous organisms such as bryophytes and biofilms, and may thus be a general feature of corticolous organisms in humid-calm and shaded forest habitats.

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Session 23: Struggle in the Tropics - responses to stress in tropical environments - PosterP23-03

Submerged tree seedlings: the case of Nectandra amazonum

P. Parolin & D. Waldhoff

Nectandra amazonum (Lauraceae) is an evergreen tree of Central Amazonian floodplains with very high tolerance of prolonged waterlogging and submergence. During the establishment phase the seedlings have to cope with annual periods of submergence of up to 9 months and flooding water columns exceeding 10m. Seedlings tolerate more than 4 months of submergence in complete darkness without shedding their leaves. Soon after emergence, photosynthetic activity of the leaves attains pre-flood values. In the present study, seedlings of N. amazonum were analysed in the field near Manaus / Brazil and in experiments in the University of Kiel. While waterlogged plants exhibited few adventitious roots, in completely submerged plants adventitious roots added up to 50% of total root mass. Even in complete darkness N. amazonum did not shed leaves under water. New leaf buds were formed under water which allowed leaf expansion as soon as the plants emerged. Five minutes after emersion, submerged seedlings had the same CO2 assimilation and Fv/Fm values as control plants. When compared with other common Amazonian floodplain species, Nectandra amazonum shows almost no differences between flooded and non-flooded plants. The high photosynthetic activity after emersion shows that the physiological function of the leaves is preserved under water.

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Session 23: Struggle in the Tropics - responses to stress in tropical environments - PosterP23-04

Leaf-cutting ant Atta sexdens forrages preferentialy on stressed plants

J.D. Ribeiro-Neto, B.X. Pinho, S.T. Meyer, R. Wirth & I.R. Leal

Forest fragmentation increases the proportion of edge affected habitat which causes a higher abundance of pioneer vegetation, leading to a relaxed bottom-up control of leaf-cutting ant populations (higher resource availability). Also, environmental conditions at forest edges might stress plants and alter their attractiveness to leaf-cutting ants. Therefore, we tested the following hypothesis: (1) Leaf and soil water content increase with edge distance; and (2) Atta sexdens preferentially cuts drought-stressed individuals. To test these hypotheses, we evaluated foliar and soil water content along edge-interior transects in a Brazilian Atlantic forest fragment and tested the foraging preference of the ants by offering vigorous and experimentally drought stressed plants (five different species) in dual choice tests. Soil moisture content increased with distance from forest edges, but leaf water content did not change along transects. The bioassays confirmed a strong foraging preference for all species of stressed plants. While drought-stressed plants were highly attractive to A. sexdens, their availability was not generally elevated at forest edges. Yet, the observed lower soil water content makes edge vegetation more prone to drought stress during dry spells when wilting of edge plants was observed. Therefore drought stress may contribute to the attractiveness of edges to leaf-cutting ants.

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Session 23: Struggle in the Tropics - responses to stress in tropical environments - PosterP23-05

What sets the latitudinal range limits of mangroves?

K. Quisthoudt & N. Koedam

Mangroves are (sub)tropical forests of the inter-tidal zone. The goal of this study is to find out which (combination of) abiotic factors determines their latitudinal range limits and how these factors interact.Since none of the mangrove-species occur in all biogeographic regions, but the study takes place at the global scale, latitudinal limits of mangrove-genera instead of species are considered. We focus on Avicennia and Rhizophora,because they occur in all biogeographic regions. Besides, Avicennia reaches the most extreme mangrove latitudes and Rhizophora species fulfil many mangrove-ecosystem functions. For dispersal, mangrove seeds (propagules) need water as a vector. In order to establish, mangroves need low energy tidal settings and muddy-sandy soils. For growing, mangroves need sunlight, nutrients, water and relatively high temperatures. The factors that can limit mangroves can thus be grouped into climate (sunlight, temperature, humidity), coastal hydrology (currents, wave energy, tidal system) and coastal morphology (substrate, soil type, nutrients, soil water availability, soil salinity). The present study will describe the abiotic situation at the latitudinal mangrove limits and give insight into the globally recurrent patterns with a focus on climate related aspects.

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Session 23: Struggle in the Tropics - responses to stress in tropical environments - PosterP23-06

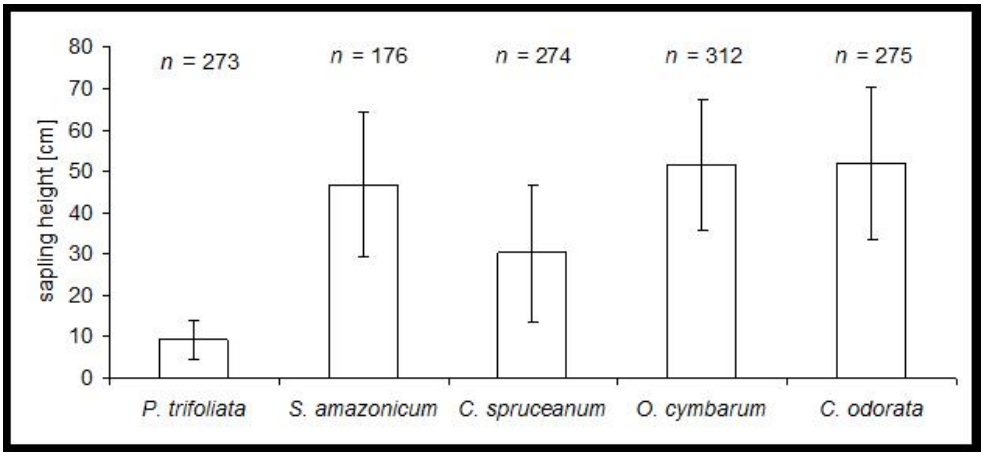
Tree sapling development in mixed plantations of five native timber species in a várzea of the western Brazilian Amazon

N. Soethe, A. Conserva, H. Queiroz, F. Wittmann, J. Schoengart

In a participative reforestation experiment within the UNESCO Ecohydrology Programme, we established mixed plantations of five timber species from high (Cedrela odorata, Schizolobium amazonicum, Calcophyllum spruceanum, Ocotea cymbarum) and low (Piranhea trifoliata) várzea. Plantations were performed in November/December 2008 on a successional gradient of ten rarely inundated agricultural fallow stands and in 18 forest gaps differing in inundation height, all located within the várzea of the Mamirauá Sustainable Development Reserve. First results of sapling development are based on an initial measurement carried out in December 2008 and a second measurement 27 to 34 days later. Height increase during this period was highest for C. spruceanum (40 %) and S. amazonicum (38%), intermediate for C. odorata (21 %) and negligible for P. trifoliata and O. cymbarum (3%). In January, four to eight months after germination, mean tree height was considerably higher for the high varzéa species than for P. trifoliata (see figure 1). Interestingly in the forest gaps, all saplings of P. trifoliata survived, whereas in fallow stands, its mortality was highest of all species (24%). In conclusion, only the fast growing high várzea species are appropriate for reforestation. Sapling development six months after plantation will be discussed in the presentation.

Session 23: Struggle in the Tropics - responses to stress in tropical environments - PosterP23-06

Figure 1: Average sapling height of five different species in the plantations in January 2009, four to eight months after germination. Error bars indicate standard deviation.



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Session 25: Adaptation of agro forestry to climate change: ecological and socioeconomic aspects - TalkT25-01

Agroforestry Management and Climate Change Adaptation: The Case of Coffee in Latin America

B. B. Lin

Predicted consequences of climate change make clear that altered patterns of temperature and precipitation will threaten agriculture in many tropical regions and will require innovative strategies of human adaptation. Recent literature has shown that sustainable agroecological management may improve agricultural resistance to extreme climate events when compared to more intensive forms of agriculture. Agroforestry is one such type of sustainable management that may play a role in protecting small-scale farmers throughout many crop industries by mitigating the effects of climate variability on crop production. The coffee agroforestry system is a prevalent form of agriculture throughout Latin America supporting the livelihoods of millions of farmers. Research has shown that the increased use of shade trees within coffee agroforestry systems has many beneficial effects for farmers including the buffering of coffee plants from extreme of temperature and precipitation fluctuations. Agroforestry may even protect coffee production systems from the effects of tropical storms through decreased physical disturbance to crop plants. These results support the assertion that agroforestry can reduce the ecological and economic vulnerability of many rural farmers. Moreover, traditional forms of agriculture can offer greater potential for adapting to changing conditions than do current intensive systems.

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Session 25: Adaptation of agro forestry to climate change: ecological and socioeconomic aspects - TalkT25-02

Bridging the Gap between Potential and Reality of Agroforestry Projects - Lessons learned from the Bolivian Andes

R. Brandt, I. Hensen, F. Delgado & S. Rist

Climate change is driving a shift toward drier conditions in the semi-arid Bolivian Andes. As a consequence, water conservation strategies have become increasingly important in securing food supplies and rural livelihoods. Agroforestry can potentially play an important role in adaptation strategies to climate change where appropriate practices encompass effective soil-water management. In Andean farming communities, agroforestry already forms part of the mainly traditional land-use systems. Traditional Ecological Knowledge (TEK) and local perceptions concerning the management of agroforestry systems underlie any dynamic processes of revitalisation and innovation which in turn are highly influenced by the economic and socio-political environment. In order to ensure the successful adoption and development of adequate agroforestry incentives, a thorough understanding of local/external interdependences is required. For the present study, informal, semi-structured and group interviews with local and external stakeholders were realized in relation to an agroforestry project in Cochabamba in the Bolivian Andes. Through the qualitative analysis, facilitation and hindrance factors were identified from the respondents pertaining to the adoption and development of particular agroforestry practices. The results, along with observations from other agroforestry projects in the region, demonstrate the fundamental importance of social learning and communicative action in the development of mutual understanding among stakeholders.

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Session 25: Adaptation of agro forestry to climate change: ecological and socioeconomic aspects - TalkT25-03

Response of a Gliricidia-maize agroforestry system to induced drought in southern Malawi

A.C. Kerr, F.K. Akinnifesi & M.S. Torn

Climate change is expected to reduce rainfall and alter its distribution in southern Africa, exacerbating vulnerability of rainfed agriculture. Agroforestry technologies, such as intercropping of maize and the nitrogen-fixing tree Gliricidia sepium, have potential to improve food security in the region. However, these technologies have not been tested under future adverse climatic conditions. Here, we present preliminary results from an experiment using rain exclusion shelters to induce artificial drought in a long-term field trial of maize-Gliricidia intercropping in southern Malawi. We intercepted all rainfall during the last six weeks of the 2008-2009 growing season, creating an abnormally short rainy season (expected to occur more frequently in Malawi's future climate). We examine both patterns and mechanisms of drought impacts on the agroforestry system as compared to maize monoculture. Trees may ameliorate crop water stress by increasing soil organic matter and water-holding capacity, and by moderating microclimate. However, the opposite effect is possible if trees deplete soil moisture in crop rooting zones. We attempt to clarify the relative importance of these factors in the maize-Gliricidia system. This is, to our knowledge, the first such experiment on fertiliser trees; we hope our results will inform subsequent climate manipulation experiments on agroforestry systems.

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Session 25: Adaptation of agro forestry to climate change: ecological and socioeconomic aspects - TalkT25-04

The agroforestry system cacao: an option to reduce social vulnerability related to droughts? - Perception and adaptation of agricultural smallholders in Central Sulawesi, Indonesia

N. Binternagel, H. Faust

Focussing on the dominant agroforestry system cacao in the Indonesian province of Central Sulawesi, we investigate perception and adaptation strategies of agricultural smallholders to El Niño-Southern Oscillation (ENSO) related droughts. In our qualitative case study we use a triangulation of Rapid Rural Appraisal Methods (RRA), semi-structured in-depth interviews (n=82), and participatory observations in six villages and different household types, depending on land use patterns. The analysis shows that all households have been affected by abnormal climatic conditions and stated negative effects on agricultural production. The most common strategies are reactive or ex-post adaptations which do not reduce the vulnerability in the future. But some local farmers show that a productive agroforestry system cacao is seen as more resistant to drought than other crops, especially non-irrigated rice and maize. These households start to change their structural parameters by finding an appropriate degree of shading related to the age of trees, enforcing labour intensity at cacao plots and adjusting the utilisation of inputs like fertiliser on the degree of shading. These innovations lead to improved benefits per hectare and hence create an opportunity to change from reactive adaptation strategies to anticipatory adaptation strategies. Furthermore we reveal that the knowledge transfer is mainly taking place along ethnic lines and local institutions.

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Session 25: Adaptation of agro forestry to climate change: ecological and socioeconomic aspects - TalkT25-05

Drought response of a cacao agroforestry system, Sulawesi, Indonesia

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Agroforestry systems may play a critical role in minimizing the vulnerability of farmers' livelihood to droughts as tree based systems provide several mechanisms that can mitigate the impacts from extreme weather events. Here we use a replicated throughfall reduction experiment to study the drought response of a cacao/Gliricidia stand over a 13-month period. Soil water content was reduced and fluctuated around the permanent wilting point for several months down to a soil depth of 2.5 m. Contrary to our expectations we measured only relatively small non significant changes in cacao and Gliricidia sap flux densities (-12%), cacao leaf litterfall (+8%), Gliricidia leaf litterfall (-2%), soil CO2 efflux (-14%), and cacao yield (-10%) during roof closure. We found evidence in this agroforest that there is complementary use of soil water resources between cacao and Gliricidia. Furthermore, the occurrence of shade trees probably helped cacao tress to cope with drought. We conclude this cacao agroforestry system had the potential for adapting to a considerable reduction in soil water storage. Cacao agroforestry may thus play an important role as a drought tolerant land use in tropical regions where the frequency and severity of droughts is projected to increase.

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Session 26: The advantages of experimental studies in tropical ecosystem research - TalkT26-01

Trends in seedling growth and survival over eight years in a Bornean rain forest

M.P. Eichhorn, D.F.R.P Burslem & R. Nilus

Environmental heterogeneity within rain forests is associated with changes in tree species composition. Adaptations at the seedling stage may drive responses to resource availability and thereby contribute to the maintenance of discrete floristic communities. Based in Sabah, Borneo, we have taken an experimental approach to seek evidence for such niche-specific differences amongst seedlings. A reciprocal transplant experiment was established with 3000 seedlings of five species of Dipterocarpaceae specialised to either alluvial or sandstone soils. These were planted in paired gap and understorey plots in five sites on alluvial and sandstone soils, and half of all seedlings were fertilised, in a fully factorial design. Growth and mortality have been measured at least annually for eight years. All species exhibited enhanced growth and survival in gaps relative to the understorey. Although growth rates were greater overall on alluvial soils relative to sandstone, emerging trends suggest a long-term growth advantage to species on their native soils, combined with reduced mortality. Though initial mortality patterns were driven largely by light conditions, differential survival of species among treatments has latterly assumed a greater role. Our findings demonstrate the importance of long-term observations and experimental studies in assessing the importance of habitat heterogeneity for seedling regeneration.

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Session 26: The advantages of experimental studies in tropical ecosystem research - TalkT26-02

A short-cut to measuring rhizosphere respiration in a lowland tropical forest.

E. J. Sayer

The respiration of fine roots is an important source of CO2 efflux from the soil. In tropical forests, rhizosphere respiration (Rroot) is estimated to contribute between 25 and 75% to total belowground respiration (Rsoil). However, accurate estimates of Rroot are difficult to obtain. Trenching experiments represent a relatively easy, low-cost method to measure Rroot but they are often criticized because methodological artifacts such as root decomposition and regrowth can influence results. I set up a trenching experiment within large litter manipulation plots in a lowland tropical forest to investigate root-litter interactions; I combined two different approaches to measuring respiration in trenched subplots and show that frequent measurements taken before and immediately after trenching not only eliminate most methodological problems, but also yield very similar results to longer-term biweekly measurements. Rhizosphere contributions to Rsoil differed greatly with litter manipulation treatment, reflecting differences in fine root biomass and carbon inputs from litter decomposition; the two approaches estimated Rroot as contributing 32-36% to Rsoil in control plots, 24-28% in litter addition and 40-46% in litter removal plots. I suggest that short-term measurements immediately after root cutting could be used to obtain rapid estimates of Rroot in different seasons and forest types.

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Session 26: The advantages of experimental studies in tropical ecosystem research - TalkT26-03

Influence of litter diversity on decomposition in tropical rainforest (French Guiana)

S. Barantal, M.M. Coûteaux,S. Hättenschwiler

Decomposition is a key process for ecosystem functioning, particularly in tropical rainforests, displaying weathered and impoverished soils. In natural forests, the litter layer arises from multiple plant species and the subsequent litter diversity may critically influence litter decomposition. Though several studies showed non-additive effects of litter mix on its decomposition, they failed to generalize the magnitude or direction of these interactions. To clarify these mechanisms, we manipulated litter diversity in a 21-year-old experimental plantation in French Guiana, including 16 monospecific forest-tree plots and inter-plot zones corresponding to species mixtures, and in a nearby natural rainforest. Litter mix were elaborated with inter-plot litter and placed in litter bags in the corresponding inter-plot zones and in the natural forest area. Litter mass remaining and leaf litter chemical traits were measured. We tested if litter diversity effects were driven by long-term effects on decomposer communities. Hypothesizing that decomposer communities are adapted to inputs of certain litter types, we expected litter diversity to have a greater impact on decomposition in inter-plot areas than in natural forest. We also used a functional approach to test if the chemical dissimilarity improves decomposition in litter mix.Key words: Amazonian lowland forest, litter diversity,litter mass loss, chemical composition, dissimilarity index

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Session 26: The advantages of experimental studies in tropical ecosystem research - TalkT26-04

Tree diversity effects on aboveground nutrient pools of trees in an experimental plantation in Panama

Y. Oelmann, C. Potvin, W. Wilcke

Concern over biodiversity loss in the tropics and the wide-spread use of potentially not site-adapted exotic tree species raised a debate on reforestation with mixtures of native tree species. Mixed plantations of native tree species might contribute to sustainable land use because of complementary nutrient use. Our objective was to assess the nutrient economy of five native tree species and their response to different neighbor trees in an experimental plantation in Panama.Hura crepitans stored more nutrients,and produced more biomass than all other tree species irrespective of its neighbor tree species. In our study , H. crepitans was the least nutrient efficient tree species. H. crepitans produced less biomass in mixtures than in monocultures while Cedrela odorata and Anacardium excelsum – the most nutrient efficient species – produced more biomass independent of stem growth rates because they acquired more nutrients in mixtures than in monocultures.Three-species mixtures had increased mean Ca concentrations in branches and stems and increased K and Ca storage in aboveground biomass compared to monocultures suggesting complementary resource uptake. Our results highlight the need to properly consider species-specific nutrient requirements and species interactions when designing tree mixtures for afforestation.

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Session 26: The advantages of experimental studies in tropical ecosystem research - TalkT26-05

Species-specific response of tree xylem flux to experimental drought in Central Sulawesi

B. Schuldt, V. Horna & Ch. Leuschner

Seasonality of water flux was investigated for common tree species of a Central Sulawesi pre-montane perhumid forest located in the Lore Lindu National Park. Trees were exposed to reduced soil water levels under a partial rainfall exclusion experiment to simulate drought effects and to monitor species-specific short-term responses to water stress. Key research questions were: (1) how sensitive are trees from tropical perhumid forests and how do they acclimate to drought-stress, especially compared to trees from seasonal tropical climates with short or extended seasonal drought, (2) does wood density determine the drought sensitivity of perhumid forest trees and (3) how do tall rainforest trees cope with long pathways under low evaporative demand?Since June 2007 we monitored 95 trees from 8 common tree species. Half of the trees were located under the “Sulawesi Troughfall Displacement Experiment” (STD) and the other half in control areas. We used the constant heated method to continuously monitor stem xylem flux density and conduct parallel measurements of xylem anatomy and hydraulic architecture.After almost 22 months of experimental drought only 25% of xylem flux density reduction was observed in the experimental trees. But the reaction to water stress was species-specific and in some species xylem flux went down to 50 % compared to the individuals located at the control plots.Anatomy and hydraulic architecture observations showed a positive correlation between xylem conductivity and vessel size with tree height. These results reveal a well adapted hydraulic system of tall canopy trees allowing for highly efficient water flow under conditions of low atmospheric evaporative demand.

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Session 26: The advantages of experimental studies in tropical ecosystem research - PosterP26-01

Tree diversity effects on aboveground nitrogen and phosphorus pools in a tropical plantation

F. Zeugin, J. Jansa, C. Potvin & M. Scherer-Lorenzen

As the cover of natural tropical forests has declined over the last decades and the demand for wood products continues to grow, tree plantations have become increasingly important. However, many of the tropical plantations are monocultures of fast growing, mostly exotic species as teak (Tektona grandis), Eucalyptus or Pinus. This has been seen as a problem for system stability, pest control, local biodiversity and long-term nutrient availability.An increase of tree species richness in plantations has the potential to provide multiple benefits including the provision of ecosystem services. But knowledge on how gradual changes in the tree species richness may affect nutrient cycling is still scarce for tropical plantations.In our project, we investigated the effects of increasing tree diversity on nitrogen (N) and phosphorus (P) pools in an experimental biodiversity plantation in Panama over two subsequent years. We tested the hypothesis that, in contrast to monocultures, plots with higher tree species diversity show an increase in tree N and P pool sizes due to complementary uptake of soil nutrients. First results indicate a positive biodiversity effect.

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Session 26: The advantages of experimental studies in tropical ecosystem research - PosterP26-02

Forest carbon dynamics in Papua New Guinea; Selective-logging, El Niño, and REDD

J.C. Fox, C.K. Yosi, R.J. Keenan

Papua New Guinea (PNG) has become the focus of the REDD initiative, but defensible estimates of forest C and C fluxes due to the degradation associated with selective-logging are lacking. Here we report the first defensible estimates of forest C in undisturbed and selectively-logged forest from a large Permanent Sample Plot (PSP) network. The census period spans The El Niño-Southern Oscillation (ENSO) event of 1997/1998; we reveal that ENSO and the associated large-scale wildfires significantly impacted forest carbon dynamics.Average above ground live biomass in trees greater than 10cm diameter (AGLB>10cm) in 135 selectively-logged 1 hectare plots was 66 Mg C ha-1 with a standard deviation (SD) of 19, while for 22 undisturbed plots the average was 139 Mg C ha-1 (SD 33). Although our sample of undisturbed plots is small, they indicate an average reduction in AGLB>10cm from selective-logging of 73 Mg C ha-1 (53%). This is a useful indicative figure for REDD calculations of reductions in forest C due to commercial selective-logging in PNG. Average AGLB>10cm flux in selectively-logged forest was 2 Mg C ha-1yr-1 (SD 2.0) across 80 growing periods, whilst in undisturbed forest it was 1.8 Mg C ha-1yr-1 (SD 2.1) across 7 growing periods. PSP measurements affected by the ENSO event of 1997/1998 were isolated from the main analysis and indicated average flux of -5.5 Mg C ha-1yr-1 (SD 5.4) due to fire induced tree mortality. This result supports the hypothesis that tropical forest fires release significant quantities of C into the atmosphere.

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Session 26: The advantages of experimental studies in tropical ecosystem research - PosterP26-03

Tropical forest soil respiration: unraveling roots and mycorrhizae

A.T. Nottingham, B.A. Turner, M.G.A. van der Heijden, E.V.J. Tanner

Tropical forest soils turnover more carbon each year than soils in any other terrestrial ecosystem. They release about 24 Pg C per year as CO2, a flux referred to as 'soil respiration'. It is important to understand where this CO2 comes from because different sources of CO2 affect the forest carbon balance in different ways. Most studies that have partitioned soil respiration have only defined two sources, root and microbial. No study has made the distinction between respiration derived from roots and arbuscular mycorrhizal fungi (AMF). This is a major omission because AMF, which are widespread in tropical forests, are distinct organisms liable to respond independently to elevated CO2 and temperature. We partitioned soil respiration into AMF, fine-root and microbial sources for one year in a seasonally dry lowland tropical forest in Panama. Of total soil respiration, AMF contributed a considerable 15%, fine-roots contributed 34-46%, but the seasonal variation was driven by microbial sources in response to re-wetting and litter-fall decomposition. Further studies are needed to determine how the contribution of AMF to soil respiration varies in different forests, to enable their inclusion within soil C cycling models as a distinct source of CO2.

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Session 28: DNA Barcodes: applications to forest inventories and community phylogenies in tropical ecosystems - Talk T28-00

Introduction to Symposium

W. J. Kress and D. E. Erickson

DNA barcodes are a potentially revolutionary tool for systematists, ecologists, evolutionary biologists, and conservationists who need to determine with an accurate, reliable, and rapid method the species name of an unidentified whole organism or tissue sample in order to further studies of biodiversity and ecosystem processes. The utility of DNA barcodes for such purposes in the identification of animals has now been demonstrated; work on determining the most feasible gene regions to employ as a DNA barcode for plants is nearly complete. As an identification tool for ecologists investigating ecosystem dynamics and evolutionary interactions barcodes can be efficiently applied to studies of root diversity and distribution as well as plant-herbivore interactions. As an aid to investigations of character evolution and functional trait analyses in tropical forests DNA barcodes may also be used as molecular markers to generate hypotheses of phylogenetic relationships among the plant and animal species in communities .The goal of this symposium is to present the latest results on the application of DNA barcodes to tropical ecosystems to help further our understanding of the evolutionary and ecological processes that have shaped species assembly and interactions in these forests.

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Session 28: DNA Barcodes: applications to forest inventories and community phylogenies in tropical ecosystems - Talk T28-01

Tropical Tree Community Turnover: How DNA Barcode Community Phylogenies and Functional Traits Can Help Elucidate Cryptic Patterns and Mechanisms.

N.G. Swenson, J.C. Stegen, D.L. Erickson, S.J. Davies, J. Thompson, S.J. Wright, J.K. Zimmerman, and W.J. Kress

Providing a mechanistic understanding of the diversity and dynamics of tropical communities remains one of the great challenges in ecology. Strong tests of the mechanistic hypotheses proposed to date will require detailed information regarding the evolutionary history and function of species. In response, community ecologists are increasingly incorporating phylogenetic and functional trait information into their analyses. This approach demands intensive trait collection from 100's of species and the construction of finely resolved phylogenies. To date, our ability to produce trait datasets has outpaced our ability to produce community phylogenies that are resolved within family and genera. Recent work suggests community phylogenies generated from DNA barcodes stand poised to erase this deficiency. Here we utilize DNA barcode community phylogenies and exhaustive functional trait inventories from two Neotropical forest dynamics plots to examine the spatial and temporal turnover in the species, phylogenetic and functional compositions of these forests. The results show that rates of species, phylogenetic and functional turnover are often incongruent suggesting the presence of cryptic deterministic processes that would not be uncovered without a phylogenetic and functional approach. Lastly, we argue that DNA barcodes will play a key role in producing the next generation of community phylogenies representing tropical floras.

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Session 28: DNA Barcodes: applications to forest inventories and community phylogenies in tropical ecosystems - Talk T28-02

Relevance of DNA barcoding in community-wide analysis of leaf functional traits with strong and weak phylogenetic signals

K. Kitajima, J. Westbrook, J. Kress, S. J. Wright

Many leaf functional traits are believed to have evolved in relation to life history strategies and habitat specialization that contribute to local diversity of tropical woody taxa. Phylogenetic comparative methods provide a powerful approach for elucidation of ecological and evolutionary significance of divergence and convergence. However, sole reliance on publicly available information means inadequate tests with insufficiently resolved relationships including many polytomies. Hence, better-resolved phylogenetic relationships hypothesized from DNA barcoding significantly contribute to community-wide analysis of functional traits. Here, we report a community-wide analysis of the divergence pattern of leaf functional traits for 265 woody species that co-occur in the 50-ha forest dynamics plot on Barro Colorado Island, Panama. For a subset of species, we evaluated the degrees of phylogenetic conservatism, as well as trait correlations, with and without incorporation of information from DNA bar coding. Many leaf functional traits including leaf toughness and leaf mass per area exhibited strong convergence between unrelated taxa. In contrast, silicon accumulation exhibited strong phylogenetic signals at family and order-levels; high silicon accumulation was evident at nodes indicated by Moraceae, Piperaceae, Dilleniaceae, and Chrysobalanaceae. Silicon contents vary independently of fiber contents and fracture toughness, which exhibit contrasting patterns of trait divergence across woody angiosperms.

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Session 28: DNA Barcodes: applications to forest inventories and community phylogenies in tropical ecosystems - Talk T28-03

Application of DNA barcodes to community phylogenetics and ecological forensics on Barro Colorado Island, Panama

W. J. Kress, D. Erickson, N. Swensen, F.A. Jones, O. Sanjur, R. Perez & E. Bermingham

The assembly of DNA barcode libraries for species has the potential to be a revolutionary tool in the study of ecology and evolution. The application of sequence data as DNA barcodes is particularly relevant within species-rich natural communities where accurate species identification will enable detailed ecological forensic studies and well-resolved molecular phylogenies will improve investigations of the mechanisms underlying community assembly and functional trait evolution. To date, no studies have effectively applied DNA barcodes sensu strictu in this manner. In this report, we demonstrate that a three-locus DNA barcode approach when applied to 296 woody trees, shrubs, and palms found within the 50-ha forest dynamics plot on Barro Colorado Island (BCI), Panama, results in high rates of species identifications (>98%). These DNA barcode sequences are used to reconstruct a robust community phylogeny employing a supermatrix method for 281 of the 296 plant species in the plot. The three-locus barcode data were sufficient to reliably reconstruct evolutionary relationships and distances among the diverse group of plant taxa in the plot that are congruent with the broadly accepted phylogeny of flowering plants (APG II). We discuss the feasibility of DNA based identifications using different genetic markers, as well as prospects for applications in ecological forensics and further development of robust community phylogenies for tropical habitats.

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Session 28: DNA Barcodes: applications to forest inventories and community phylogenies in tropical ecosystems - Talk T28-04

DNA barcodes as a tool for tree species discovery in diverse tropical forests

C. W. Dick, Kress, J.

Tropical rain forests are the most biologically diverse of terrestrial biomes. Despite the ecological importance and economic potential of tropical trees, an estimated 10% of tropical forest tree species lack scientific names and hundreds of woody plant species in the most intensively studied forest plots remain unidentified. DNA diagnostic tools, including plastid “DNA barcodes” and multi-locus genomic markers, can be applied to tropical forest dynamics plots to facilitate taxonomic discovery. Such genetic surveys, as outlined in this talk, require expanded herbarium infrastructure and linkages in field ecology, population genetics and bioinformatics. The fusion of traditional botany and molecular methods will provide baseline data for understanding both the origin and maintenance of tropical plant diversity.

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Session 28: DNA Barcodes: applications to forest inventories and community phylogenies in tropical ecosystems - Talk T28-05

Collaborative biodiversity informatics: increasing the rate of tropical plant inventory and description

C.O. Webb & T. Triono

The ongoing degradation of natural areas throughout the tropics ever reduces the remaining time to discover and document tropical biodiversity. Simultaneously, an ever-shrinking pool of professional taxonomists increases the time needed to describe and monograph existing collections, let alone the collections we have yet to make. Solutions to this double problem might involve: parataxonomist training and deployment, increased participation of local students, increased use of high-resolution photographs, rapid networking of collections data, DNA barcoding and automated phylogeny generation, and use of the growing toolkit of biodiversity informatics to organize and integrate new collections with old ones. We will describe an ongoing plant biodiversity collection and documentation program at the Gunung Palung National Park in West Kalimantan, Indonesia. Project data can be accessed at http://phylodiversity.net/xmalesia/.

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Session 28: DNA Barcodes: applications to forest inventories and community phylogenies in tropical ecosystems - Poster P28-01

Preliminary molecular phylogeny and biogeography of Neotropical Psidium L. species (Myrtaceae, Myrteae)

I. R. Costa, E. R. Forni-Martins, F. Forest, C. E. B. Proença and & E. Lucas

With ca. 100 species, Psidium (Myrtaceae) is an important component of Neotropical forests and presents a high taxonomic complexity with hybrid species. We carried out a phylogenetic analysis in Psidium aiming to determine its sister group and to assist taxonomic delimitation and understanding of their species. The phylogenetic analysis used Parsimony and Bayesian Inference of 26 species and four DNA regions (ITS, ETS, psbA-trnH, ndhF). To determine the sister group we sampled species of several genera morphologically related to Psidium (Acca, Accara, Campomanesia, Mosiera, Myrrhinium, Pimenta and Ugni). The sampling comprised native species collected in the Amazonia, Brazilian Cerrado, Caatinga and Tropical Atlantic Rain Forest biomes. Psidium was confirmed to be monophyletic and its sister group is Myrrhinium. The cladogram indicates three principal clades, showing a clear biogeographical pattern. The species endemic to the Cerrado vegetation appear in two separate clades, each with good statistical support: one emerges as sister group to a clade comprising species from Caatinga and Tropical Atlantic Rain Forest, while the other cerrado clade is sister to Amazonian species. Future studies will involve increased sampling and will elucidate more detailed biogeographical patterns from Psidium.

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Session 28: DNA Barcodes: applications to forest inventories and community phylogenies in tropical ecosystems - Poster P28-02

A comparison of a morphometric and molecular genetic approach to disentangle species in the hyperdiverse Pheidole genus

S.E.Maurer, G.Fischer, F.Hita-Garcia, M.K.Peters

Accurate species inventories are essential for assessing biodiversity and establishing adequate conservation planning. For inventory data to be immediately relevant, taxonomic ascertainments need to be accelerated at low costs. These improvements are especially needed in order to match the current rate of biodiversity loss. Ants are a highly diverse taxon, performing a variety of important ecosystem services. Pheidole is the most diverse ant genus and a taxonomic challenge even for experts.This poster shows results of a comparative morphometric and molecular genetic approach to unentangle the diversity of Pheidole ant species of a Guineo-Congolian rainforest in western Kenya. We investigate the potential of the two approaches as tools for species identification and compare patterns of intraspecific variation revealed by these approaches.

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Session 28: DNA Barcodes: applications to forest inventories and community phylogenies in tropical ecosystems - Poster P28-03

DNA fingerprints to control the geographic origin of logged timber

B. DEGEN, A.M. HÖLTKEN & A. SEBBENN

Illegal logging is one of the main reasons of deforestation in natural forests and is the cause of high ecological and economic damage. Gene markers are promising tools to control the geographic origin of logged timber. Due to re-colonisation after the last glacial periods and limited pollen and seed dispersal we observe a spatial genetic structure for most species in natural forests. Genetic inventories with extensive and systematic samples over the whole species distribution area are the basis to identify the country and region of timber origin. For the practical application only gene markers that can be easily amplified in DNA extracted from unprocessed and processed timber are usable for geographic timber tracking. This has been successfully tested for microsatellites (cpSSRs, nSSRs) with amplified DNA fragments usually not larger than 500 bp. We present results on genetic inventories with microsatellite gene markers for different tropical tree species (e. g. Tectona grandis, Swietenia macrophylla, Symphonia globulifera) and demonstrate their power as tools for geographic timber tracking. In addition we show simulation results on optimal sample design and give a vision on international cooperation to bring DNA methods into praxis for an effective control of the geographic origin of timber.

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Session 28: DNA Barcodes: applications to forest inventories and community phylogenies in tropical ecosystems - Poster P28-04

Detecting illegal logging of CITES-protected tropical wood species by DNA barcoding

A.M. Höltken, B. Degen & M. Fladung

Extensive illegal logging and trade of CITES-protected tropical wood species necessitates the development of unambiguous species identification methods applicable over the whole chain of custody. Due to the fact that many protected timbers can easily be mistaken for legally harvested tree species because of a very similar wood anatomical pattern and structure, DNA barcoding provides an interesting tool for species differentiation. The choice of the tree species included in the genetic barcoding project was taken out on the basis of the current CITES species list as well as the trade volume and economic importance of the most relevant substitutional timbers. In this presentation we will address the following topics: (1) Special features of DNA-extraction from wood and woody products, (2) Advantages of the chloroplast genome for the detection of informative DNA-sequences for the genetic barcoding, (3) the utilization of the completely sequenced cpDNA genome of Populus trichocarpa (Black Cottonwood) and other plant species as basis for the design of new PCR primers, and (4) an example of a successful development of barcoding sequences for an easy viable genetic differentiation of three mahogany species [Swietenia macrophylla (True Mahogany), S. mahagoni (West Indian Mahogany) and S. humilis (Honduras Mahogany)].

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Session 28: DNA Barcodes: applications to forest inventories and community phylogenies in tropical ecosystems - Poster P28-05

Inferring staphylinid beetle diversity in an African tropical rain forest: a comparison of molecular and morphological approaches

B. Thormann, M.J. Raupach, T. Wagner, M.K. Peters

The capability of DNA barcodes to capture all species of standardized environmental samples and to describe biodiversity patterns has not been tested to date. Here a short nuclear marker (D2, 28S) is used along with a morphological approach to describe the diversity of staphylinid beetles of a Congo-Guinean rainforest in Kenya and to compare biodiversity patterns between primary and secondary forests. Beetles were collected in a standardized design on six transects using pitfall traps. Sequences of 99.06% of all individuals could be obtained, including even DNA from legs of smallest specimens of only ~1.5 mm length. In total 76 molecular operational taxonomic units (MOTU) in contrast to 70 morphotypes were found. Both approaches revealed highly similar biodiversity patterns, with species diversity being equal in both habitats, but divergent species communities between habitats. Therefore, both approaches suggest that secondary forest may not be adequate for the conservation of many primary forest beetle species. The study shows that molecular markers can provide an alternative to morphological methods for studying the biodiversity of hyperdiverse insect taxa. The efficient amplification of the D2 marker and its capability to delimit meaningful units allows its use in future molecular studies on biodiversity.

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Session 34: Impacts of climatic change in the tropics today and tomorrow - TalkT34-01

Global warming and the vulnerability of tropical biota: Where do the thermal specialists live?

W. F. Laurance and D. C. Useche

Much uncertainty exists about the effects of rising temperatures on tropical biota. Many tropical species are presumed to be thermal specialists because they experience only modest variation in temperature during the course of the year, but data on species responses to temperature are limited. Fortunately, it may possible to infer the extent of temperature specialization for entire species assemblages, by evaluating the proportion of any particular taxonomic group confined to a particular elevational zone. By conducting a pantropical meta-analysis of >120 relevant studies, we are attempting to determine whether high-, mid-, or low-elevation tropical biota exhibit the greatest degree of elevational specialization. Although a direct comparison of the absolute number of elevational specialists among elevational zones would be confounded by other variables (such as the area and productivity of available habitat in each zone), we can avoid this complication by assessing the proportion of elevational specialists within each zone. Where possible, we will explicitly test for differences among major taxonomic groups (e.g. endothermic vertebrates, ectothermic vertebrates, invertebrates, plants) and geographic regions in their patterns of elevational specialization. This study should help to reveal the taxa and regions with the greatest concentrations of elevational and thermal specialists in the tropics.

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Session 34: Impacts of climatic change in the tropics today and tomorrow - TalkT34-02

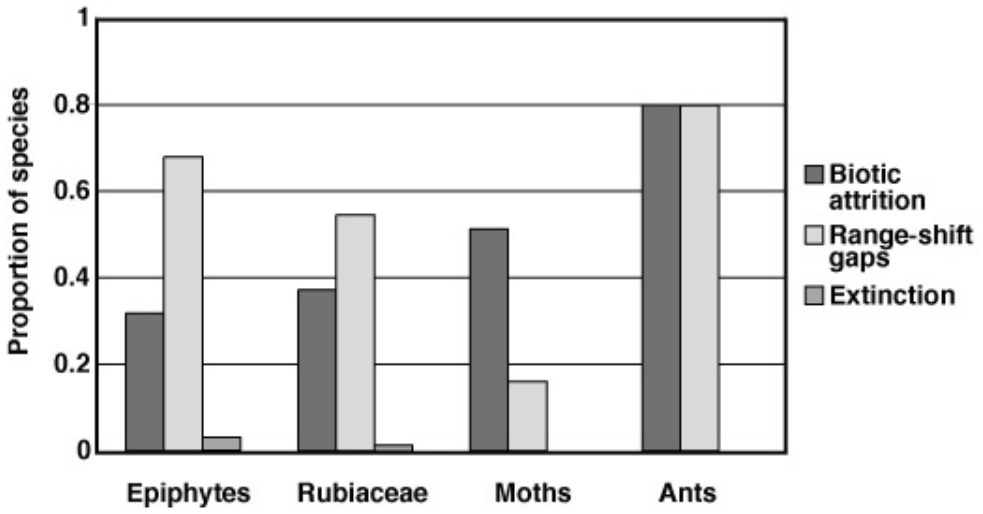
Range-shift Gaps and Lowland Biotic Attrition in a Warming Tropical Climate

R. K. Colwell

As Earth's climate warms, space or resources released by latitudinal (poleward) or elevational (upslope) range shifts by species now living in the temperate lowlands may be appropriated by other species from lower latitudes—which are already adapted to warmer temperatures. In contrast, there is no ready pool of immigrant species from warmer lower latitudes or lower elevations to replace temperature-sensitive species in the lowland tropics. Moreover, evidence is accumulating that many lowland tropical species may already be living near their upper thermal tolerances, after five million years of adaptation to cooler temperatures than present. In short, tropical lowland biotas may face a level of net lowland biotic attrition without parallel at higher latitudes Because the latitudinal gradient in mean annual temperature is flat within the tropics, poleward range shifts are not feasible for most tropical species. Upslope range shifts, where possible, are more likely, but narrow elevational ranges mean that a large proportion of tropical species face early gaps between current and projected elevational ranges. The challenges posed by projected elevational range-shift gaps are exacerbated by habitat fragmentation and by discordant shifts of interacting species, including competitors and mutualists.

Session 34: Impacts of climatic change in the tropics today and tomorrow - TalkT34-02

Figure 1: Proportion of species at risk of lowland attrition, range-shift gaps, and mountaintop extinction for four groups (2000 species) on the Barva Transect (0 to 2600 m) in Costa Rica, from a 600m upslope shift in thermal zones.



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Session 34: Impacts of climatic change in the tropics today and tomorrow - TalkT34-03

Comprehensive assessment of species vulnerability to global climate change: vertebrate biodiversity of the Australian tropical rainforests

S.E. Williams

Global climate change is the most significant current threat to biodiversity in the rainforests of the Australian Wet Tropics. Impacts on biodiversity, both negative and positive, will be diverse, complex and interactive, as will the biotic responses. We provide a framework to assess the vulnerability of species to global climate change that considers the diverse factors that determine the key elements of sensitivity and exposure. Sensitivity of a species is mediated by the potential for ecological and evolutionary responses as well as species and ecosystem resilience. Sensitivity is then balanced against exposure where changes to regional scale conditions may be tempered by habitat buffering at finer spatial scales. The framework is then completed with explicit recognition of adaptive management and feedback mechanisms that will follow any realised impact. All of these components affect the relative vulnerability of a species and need to be considered in any comprehensive assessment of the impact of climate change on biodiversity. Objective prioritisation of vulnerability is the first step towards planning efficient adaptation strategies the maximise benefits and avoids wasting management resources on unnecessary actions. I will present this framework and illustrate with examples from the tropical rainforests of the Australian Wet Tropics bioregion

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Session 34: Impacts of climatic change in the tropics today and tomorrow - TalkT34-04

Uphill movements of moth assemblages in response to global warming in Mt Kinabalu, Borneo

I.C. Chen, H.J. Shiu, S. Benedick, J.D. Holloway, V.K. Chey, H.S. Barlow, J.K. Hill, C.D. Thomas

Tropical Lepidoptera might be expected to undertake altitudinal increases in response to recent anthropogenic climate warming. We repeated an elevation transect survey of Geometrid moths in Mt Kinabalu, Borneo, after a 42 year interval. We concluded that the average elevations of the moth assemblages had shifted ~67m upward with significant uphill movements at both upper and lower margins. Vegetation and geological transitions appear to have constrained shifts in the upper limits of some species, many of them endemic. Our findings, in combination with the high diversity and thermal sensitivity of tropical insect, suggest that biological impacts in tropical area might be underestimated. We urge similar resurvey studies in the tropics. Being the highest mountain within Sundaland biodiversity hotspot, Mt. Kinabalu is an important potential refuge to lowland species colonizing upward, and provided that foothill vegetation remains available.

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Session 34: Impacts of climatic change in the tropics today and tomorrow - TalkT34-05

Factors influencing species responses to climate change and our ability to predict these responses

K. J. Feeley, M. R. Silman

We must be able to predict the responses of tropical species to future climate change in order to mitigate extinctions. Numerous studies use the relationship between species occurrences and current climatic variables to map distributions and to project these distributions into the future. By comparing current and future distributions, rates of habitat loss and extinction risks are then estimated. This approach suffers from many limitations especially when applied to tropical systems. More than 90% of tropical species have too few collections to be included in distribution models. Furthermore, many records exhibit geo-referencing errors which mischaracterize the conditions under which species occur. For example, errors inflate the temperature tolerances of Amazonian and Andean plant species by an average 3-4oC. Filters can minimize geo-referencing errors but inherently reduce the number of usable species and in our example disproportionately eliminate species from the Andes Hotspot. Even for well-collected species, current distributions may be poor indicators of fundamental climatic niches. Models estimate that species from lowland Amazonia have narrower climatic niches than highland species, but fundamental niches may be larger allowing lowland species to persist despite rising temperatures and reducing biotic attrition. Finally, the ultimate fate of species will depend on many factors other than climate change such as species interactions land use change.

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Session 34: Impacts of climatic change in the tropics today and tomorrow
TalkT34-06

Climate change and conservation on Borneo: promoting landscape connectivity.

J. K. Hill

Many species are shifting their distributions to track climate warming. Even with the most stringent reductions in green house gas emissions there is a commitment to future warming. Thus it is imperative to incorporate adaptation of biodiversity to climate warming into conservation planning. Most adaptation methods are focussing on increasing landscape connectivity, and we present data for butterflies on Borneo to examine if this approach is feasible. We have incorporated information on forest cover and butterfly diversity into reserve design software to examine the degree to which currently Protected Areas on Borneo incorporate high levels of landscape connectivity and species diversity. The results show that many high quality forested areas are not protected, and I discuss possible solutions for future-proofing conservation under climate warming**.**

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Session 34: Impacts of climatic change in the tropics today and tomorrow
TalkT34-07

Impacts of climatic variability and hurricanes on lemur demography in Madagascar

A.E. Dunham & P.C. Wright

The tropics are an important element in the dynamic process of global climate-change, however understanding climate patterns and potential impacts in the tropics has been difficult due to a paucity of long-term data, especially in the old-world tropics. In the southeastern rainforest of Madagascar where we have 50yrs of weather data, and 22yrs of demographic rates of Propithecus edwardsi lemurs. We used these data to evaluate associations of global oceanic cycles, hurricanes and climate variability with long-term demography of lemurs. Results link regional rainfall variation with global climate cycles and with variations in fecundity, a key demographic parameter in an endangered primate. In the last 49yrs monthly precipitation averages demonstrated significant increase in variability of dry season rainfall and notable increases in extreme wet-period frequency. SOI values were related to higher rainfall and more months of extreme rain within a year. ENSO phases were positively associated with the number of extreme dry months in the following year during the lemur's peak lactation period. We found that hurricanes, extreme rainfall conditions, and increasing frequency of drought have had significant negative effects on lemur reproduction with negative consequences on population viability.

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Session 34: Impacts of climatic change in the tropics today and tomorrow
TalkT34-08

Indirect impacts of global climate change on mangrove-Associated biodiversity

E. M'rabu, J.Bosire, S.Cannicci & F. Dahdouh-Guebas,

Periodic episodes of heavy rainfall arising from global climate change pose a reasonable threat to the integrity of mangrove ecosystems. Mangrove macrobenthos, which are residents of mangrove areas throughout their adult life, stand to be highly affected by the increasing frequency and intensity of events like the 1997-98 El-Niño rains. This event led to massive sedimentation due to erosion of terrigenous sediments causing mangrove die-back in many areas along the Kenyan coast. Mwache Creek, a peri-urban mangrove forest in Mombasa, was the most affected resulting in mangrove death over about 200 ha. We compared functional biodiversity in El-Niño impacted sites with reference sites (i.e. natural forests) in order to assess the impact of climate change to mangrove associated biodiversity. Transects from sea to land were laid in both impacted and reference sites, and relevant physico-chemical variables were measured and mangrove biodiversity determined as an indicator of ecosystem change. Mollusc densities and diversity were found not to be significantly different between treatments (impacted vs. reference sites) whereas crab diversity was significantly higher in reference sites as opposed to impacted sites. Faunal diversity of molluscs in impacted sites was found to be sustained by invasive shrubs whereas crab densities and diversity was highly reduced by mangrove die-back.

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Session 34: Impacts of climatic change in the tropics today and tomorrow - TalkT34-09

The rainfall distribution at forest and pasture areas in Amazônia: present and future

G. Fisch

The rainfall distribution is a key element for the sustainable of the tropical forest cycles. As Amazonian tropical forest is being replaced by pasture for agricultural and cattle activities, it is important to know (and quantify) how the rainfall will modify (if any) due to this land use change. The sites are close together (distance around 80 km) in order to eliminate differences due to mesoscale or synoptic atmospheric phenomena and the measurements were collected during 4 years. The rainfall higher than 1 mm/h during the rainy season (January- March) showed a maximum frequency earlier at pasture (at 14 Local Time - LT) than at forest (at 16 LT), being the afternoon period (from 13 until 18 LT) comprises 30% of the rainfall events. The comparison of the total rainfall (for the whole rainy season) showed that it is 28% higher at forest than at pasture. The deforestation has been studied using a General Circulation Model developed by the Hadley Center (United Kingdom). The rainfall at forest was always higher (15%) than at pasture. The significant difference is associated with the length of the dry season: increased from 2 months (June-July) for forest to 4 months (May-August) for pasture.

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Session 34: Impacts of climatic change in the tropics today and tomorrow - TalkT34-10

Long-term tree community dynamics in a Mexican tropical rain forest: global warming sings?

Martínez-Ramos, M.

With the increase in greenhouse gasses to the atmosphere two important phenomena are affecting tropical forests: i) CO2 fertilization available for photosynthesis, and ii) changes in rainfall and environmental temperature regimes. Several long-term studies have suggested that these atmospheric changes are inducing increased growth and mortality rates, and faster forest turnover rates. This paper use a study case in Southeastern Mexico to explore these ideas considering the observed changes in growth, mortality, and forest turnover of tree communities along 15 years (1994 to 2008). Every tree with DBH > 10 cm were monitored every year in fourteen 20 x 250 m permanent plots, established among four landscape units varying in soil drainage. Overall, tree community density decreased 17% along the fifteen years because mortality rate was higher than recruitment rates, particularly in sites with high soil drainage. However, community basal area increased 6%, which suggest that the forest was undergoing a thinning process. We discuss whether these trends are emerging from natural long-term temporal fluctuations in the tree community dynamics or are influenced by the contemporary global warming effects.

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Session 34: Impacts of climatic change in the tropics today and tomorrow - PosterP34-01

GLORIA in the Andes of Bolivia: Monitoring and comparing the high Andean flora in two protected areas

S.G. Beck, C. Garcia, R.I. Meneses & S. Halloy

The Central Andes have been identified as areas where climate change will proceed more quickly. As we do not know the effect to biota, we started in 2006 to study the vegetation in two geological and climatically different target regions by GLORIA (Global Observation Research In Alpine Environments) basic methods with 4 summits in the western (Sajama) and 4 in the eastern (Apolobamba) range of the Andes of Bolivia from 4190 to 5200 m. Detailed species cover sampling and frequency counts of vascular plants, bryophytes and lichens has been recorded beside temperature measurements 10 cm below substrate surface. Main objectives are to compare species composition and life forms, identification of generalists, restricted and endemics species, beside those which are tolerant and those which are sensible to climate change. Preliminary results indicate that in general the plant cover is diminishing going up hill, a patron/pattern observed in both sites, but these apparently depends more on the geological substrate, micro climate and history of the site than to the altitude. Lichens compared to vascular plants are indicating different ways. At the highest summits recent colonization was registered due to the retreat of glacier.

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Climate change and the biogeochemistry of an Andean montane forest

J. Boy, J. Knuth, R. Rollenbeck, C. Valarezo & W. Wilcke

Successful conservation of tropical montane forest, one of the most threatened ecosystems on earth, requires detailed knowledge of its biogeochemistry. Of particular interest is the response of the biogeochemical element cycles to external influences such as element deposition or climate change. Therefore the overall objective of our study was to contribute to improved understanding of role and functioning of the Andean tropical montane forest. In detail, our objectives were to determine the role of long-range transported aerosols and their transport mechanisms for the element budget of Andean tropical forest. In a whole-catchment approach including three 8-13 ha microcatchments under tropical montane forest on the east-exposed slope of the eastern cordillera in the south Ecuadorian Andes at 1850-2200 m above sea level we monitored at least in weekly resolution the concentrations and fluxes of Ca, Mg, Na, K, NO3-N, NH4-N, DON, P, S, TOC, Mn, and Al in bulk deposition, throughfall, litter leachate, soil solution at the 0.15 and 0.3 m depths, and runoff between May 1998 and April 2003. We also used meteorological data from our study area collected by cooperating researchers and the Brazilian meteorological service (INPE), as well as remote sensing products of the North American and European space agencies NASA and ESA.Our results show that (1) there was a strong interannual variation in deposition of Ca [4.4-29 kg ha-1 a-1], Mg [1.6-12], and K [9.8-30]) between 1998 and 2003. High deposition changed the Ca and Mg budgets of the catchments from loss to retention, suggesting that the additionally available Ca and Mg was used by the ecosystem. Increased base metal deposition was related to dust outbursts of the Sahara and an Amazonian precipitation pattern with trans-regional dry spells allowing for dust transport to the Andes. The increased base metal deposition coincided with a strong La Niña event in 1999/2000. There were also significantly elevated H+, N, and Mn depositions during the annual biomass burning period in the Amazon basin. Elevated H+ deposition during the biomass burning period caused elevated base metal loss from the canopy and the organic horizon and deteriorated already low base metal supply of the vegetation. Nitrogen was only retained during biomass burning but not during non-fire conditions when deposition was much smaller. Therefore biomass burning-related aerosol emissions in Amazonia seem large enough to substantially increase element

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deposition at the western rim of Amazonia. Particularly the related increase of acid deposition impoverishes already base-metal scarce ecosystems. As biomass burning is most intense during El Niño situations, a shortened ENSO cycle because of global warming likely enhances the acid deposition at our study forest.Element budgets of Andean tropical montane rain forest proved to be markedly affected by long-range transport of Saharan dust and biomass burning-related aerosols. Thus, increased acid and nutrient deposition and forced by global climate change probably drive the tropical montane forest to another state with unknown consequences for its functions and biological diversity.

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Session 34: Impacts of climatic change in the tropics today and tomorrow - PosterP34-03

Modelling the effectiveness of protected areas for conserving species on Thailand

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An understanding the effectiveness of protected areas (PAs) is currently lacking for many tropical regions. This project is examining the current potential distributions of species, and the effectiveness of PAs to conserve biodiversity now and in the future as climate warm. I have focused on butterflies in Thailand and have used Maxent software to model species distribution in relation to climate (precipitation and temperature variables). Potential distributions of species in the future were also modelled under A2 and B2 SRES scenarios under when Thailand is predicted to get warmer (~2-3C) and wetter (1-13%). Reserve design software (Zonation) was used to rank the importance of PAs based on the potential distribution of species and the extent of forest cover. Output from model suggests that PAs preserve many important highly-ranked areas, but that many other important areas are not currently protected and deserve increase protection.

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Carbon implications of fires in Andean Cloud Montane Forest

Roman-Cuesta, RM., Asbjorsen, H., Salinas, Aragao, L., Zimmermann, M., N., Silman, M., Malhi, Y.,Günter, S., Knoke, T., Stimm, B., Mosandl, R., and C. Carmona-Moreno.

Fire in Tropical Montane Cloud Forests (TMCFs) is not as rare as once believed. In the Andes, humid TMCFs sit immediately below highly flammable, high altitude dry grasslands (the puna) that have suffered from recurrent anthropogenic pressures for millennia. Affected by climatic and human pressures, this treeline is a zone of climatic tension where massive on-going and predicted high elevation warming is likely to enhance fire presence and impacts. TMCFs contain large stocks of carbon, with total soil carbon frequently more than doubling the above ground biomass. Carbon losses through fire in TMCFs are a potentially large unaccounted for source of CO2 to the atmosphere. Main questions addressed in this paper include: 1) what are the above and below ground carbon stock losses by fire in TMCFs in the Andes? and 2) what is the regional contribution of biomass burning emissions of TMCFs in the Andes in relationship to Amazonian net emissions?. We evaluated carbon stocks in mature burned TMCFs versus their control plots in five sites (>2800m) at the Manu National Park, in the Southern Peruvian Andes. We extrapolated these carbon stocks and fluxes to the entire high tropical Andes (>2000m) by means of remote sensing. Soils contributed the most to biomass emissions, with fire significantly diminishing the organic soil layers (Wilcoxon matched pairs, $p \leq 0.1$). Contrastingly, the average live standing tree carbon stocks in the burned plots decreased a non-significant 37% compared to the control, mainly leaded by vigorous resprouting. However, carbon stocks of standing dead tree were significantly higher in burned plots than in the controls, with a mean three-fold increase. Fallen dead wood and coarse woody debris (CWD) also increased significantly in the burned plots. Our regional estimates of net carbon emissions for burned TMCFs in the Andes, for the 90's, represent up to 11% (8% mean) of Amazonian LULC change net emissions. If we consider the total area of TMCFs, the ratio of our estimated net TMCFs carbon emissions, for the 90's, almost doubles the Amazonian one (0.6 versus 0.38).

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Andean plant migration in response to climate change: fast enough?

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The east Andean slope harbors Earth's highest biodiversity and also faces large and unprecedentedly rapid climate changes. Climate scenarios predict a 4-5 ºC temperature increase by 2100 in SW Amazonia and the adjacent Andes, requiring plants to migrate ~800m altitudinally to remain in equilibrium with temperature. Here we use data from an inventory of fourteen 1-ha forest plots in Manu National Park, Peru, spanning an elevational gradient from 900m to 3400m , and also collections data for plants, to ask (1) what are the predicted changes in population sizes and extinction risk of Andean plants, and (2) can we detect changes in community composition and species migrations within the current study? We find that if plants can migrate to remain in equilibrium with climate extinction risk is low, and many high elevation populations will increase in size. If climate outpaces plants dramatic decreases in population sizes occur above 1-2C, with a 4C warming leaving ~2/3 of plant species with <50% of their original population sizes, and ~30% of species critically low. Incorporating scenarios of land-use, particularly anthropogenic tree line, changes the extinction predictions qualitatively and is a major threat to the persistence of high elevation species. We find that species within the plots are migrating upwards, but that rates of actual species migration indicate that species are not in equilibrium with climate. We close with a discussion of other factors limiting migration, including plant-animal interactions and substrate effects. Whatever the cause(s) the slow migration of trees indicates a limited ability to respond to increased temperatures which may lead to elevated extinction risks under future climate change.

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Management impacts on forest carbon balance

D.P. Bebber, R. Capretz, N. Khan, G. Lombardo, I. Murthy, T. Riutta

Forest carbon stocks and fluxes are amongst the least well-defined elements of the global carbon cycle, and great uncertainty remains in predicting the effect of climate change on forest dynamics. Human activities at varying scales and intensities also influence forest carbon directly, and through interactions with climate. In some cases, the management-climate interaction is well known, for example through increased fire susceptibility when tropical forests are logged. Elsewhere, these interactions are poorly understood, but are likely to be important in improving modelling of climate change, and in valuing forest carbon. To improve understanding of management-climate interactions, a network of permanent sample plots has been established in five sites around the world – in the UK, USA, Brazil, India and China. The sites are near larger CTFS plots to facilitate comparisons. At each site, 1-ha plots have been placed in forest stands with differing management regimes and histories. Within each plot, all trees >5cm dbh are tagged, mapped, identified to species, and diameter is recorded. A subset of trees have dendrometer bands attached, to record seasonal change in growth. Dead wood and litterfall samples are taken. Microclimate is recorded using automatic sensors. Serial measurements will allow correlation of forest dynamics with weather.

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Session 34: Impacts of climatic change in the tropics today and tomorrow - PosterP34-07

The global warming and its possible consequences to the distribution and decline for the brazilian amphibians

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Amphibians are a bioindicator group since they are sensitivity to environmental alterations, a consequence of the high skin permeability. Considering Brazil, the country with the highest number of amphibians species in the world, we expect two general forces impact the distribution and species survival. The first would result from the elevation of the sea level with the sea invasion in lowland coastal areas and islands. The second would be the changes in the climatic conditions particularly of the ombrophilous forest in mountainous areas. The elevation of the atmospheric temperatures raises the clouds to higher altitudes, altering the distribution or eliminating the ombrophilous forests in the mountain ranges. Since several amphibian species are endemic to these forests, they will be at risk or will be completely eliminated. By considering that in the year 2100 the CO2 concentration will be two times that of the pre-industrial era, it is reasonable to suppose that local extinctions will occur for species with ample distribution and total extinctions will occur for endemic species with restrict distribution. Here we use bioclimatic models to foresee some possible consequences of the climate warming on the distribution and survival of anuran amphibians restricted to ombrophilous mountainous Brazilian Atlantic forests.

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Session 34: Impacts of climatic change in the tropics today and tomorrow - PosterP34-08

High elevation ants from the Ecuadorian Andes

M. Leponce, N. Wauters, J. Jacquemin, T. Delsinne & Y. Roisin

As baseline information to evaluate the possible consequences of climatic change on ants in tropical montane forests we were interested in determining : (1) whether the high altitude fauna corresponds either to a depauperate fauna of lower elevation species or to taxa adapted to high elevations ; (2) the upper elevation limit of ant distribution. We will present here preliminary results of recent inventories conducted at various altitudes in Podocarpus National Park, Ecuador, where ants were found up to 3000m a.s.l.

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Session 34: Impacts of climatic change in the tropics today and tomorrow - PosterP34-09

Response of Croton floribundus and Piptadenia gonoacantha to ozone exposure: Evaluation of pionner plant applied in reforest of the urban fragment of tropical forest , Mata Atlantica, South America

S. R. de Souza, M. T. Grombone-Guaratini A. A. Nascimento & M. M. P. Aidar

Native tropical species have been planted in region derived from deforest, where the ozone level might be high. Our goal was to assess the effect of ozone on biological responses of species Croton floribundus and Piptadenia gonoacantha, in which have different successional growth stage.Young plants of each species were exposed to 50 ppb of ozone and filtered air for 7 days individually and combined.The AA level and biomass were lower in Piptadenia exposed to ozone individually. In combined situation, there were no significant difference between ozone and control treatment The ozone level decreased in exposure of Croton to ozone individually and combined. Our result supports the hypothesis that pioneers plants might also be able to protect the plants of lower successional stages against ozone by emitting high level of reactive volatiles.

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Session 34: Impacts of climatic change in the tropics today and tomorrow - PosterP34-10

Differences in body mass and body surface between two different altitudes in the southeast of Brazil

M.C.B. Toledo & J.S.M. Santos

Bergmann's (1847) rule predicts that in warm-blooded animals, races from warm regions are smaller than races from cold regions. In colder and warmer areas, the temperature regulation requires increases in metabolism according to the need for heat production or loss. The objective of this study was to compare the Zonotrichia capensis individuals in two different altitudes. The specimens were captured in Campos do Jordão, located at 1700 m asl, with mean annual temperature of 18°C, and in Ubatuba at 17m asl, with mean annual temperature of 26°C (1°C decrease every 140 m of altitude). We measured 12 specimens in each site using a mist net. These specimens were weighed (mass), and total length, tail length and bill length (surfaces), were measured. The results showed that measurements were significantly different between the locations regarding total length ($F= 6.14$; $p<0.05$) and wing length ($F= 13.18$; $p<0.01$). Therefore, the specimens in Campos do Jordão (1700 m) showed longer surfaces. Tail and bill did not present significant differences. Body masses declined significantly in individuals that live in cold climate ($F= 5.38$; $p<0.05$). The relationship between mass and surface allows the identification of two distinct groups. Identifying these differences is very important to study and monitor climate changes in tropical mountains.

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Session 34: Impacts of climatic change in the tropics today and tomorrow - PosterP34-11

Application of an atmospheric model in ecosystem research – a sensitivity study

K. Trachte, R. Rollenbeck, T. Nauss & J. Bendix

The Andes of Ecuador are one of the 'hottest' hotspots of vascular plant biodiversity and responds very sensitiv to any changings 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. One of the important factors for the ecosystem is the hydrological cycle. Informations about precipitation events were obtained with a local area rain radar (LAWR) and automatic climate stations over the last years. In order to analyze features and processes of this ecosystem a coupled atmosphere-soil-vegetation model has been implemented. The poster will present first results of a sensitivity study of the atmospheric compound of the modelling framework, which will be discussed in the context of the environmental conditions of the target area.

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Session 34: Impacts of climatic change in the tropics today and tomorrow - PosterP34-12

Influence of terrain heterogeneity on trace gases fluxes from tropical montane forest soils

Katrin Wolf, Edzo Veldkamp, Heinz Flessa

Tropical montane regions reveal great spatial heterogeneity in terrain and soil properties which is reflected amongst others in the high diversity of vegetation. Using chamber techniques, we measured trace gas fluxes of N2O, NO and CH4 at different landscape positions along an altitudinal gradient (1000 m, 2000 m and 3000 m elevation). We selected six replicated plots at three landscape positions (upslope, midslope and downslope). At all altitudes annual N2O and NO emissions were very low. They ranged from 0.13 kg N ha-1yr-1 at 1000 m, to 0.04 kg N ha-1yr-1 at 3000 m for N2O and from 0.02 kg N ha-1 yr-1 at 1000 m, to even lower values at 2000 and 3000 m for NO. Methane uptake rates at 1000 m were about four times higher than at 3000 m and almost doubled the rates at 2000 m. Gas fluxes of the three landscape positions also clearly deviated. N2O emissions from soils of downslope sites more than doubled the fluxes of the upslope sites at 2000 m. At 3000 m annual means of N2O fluxes were negative for upslope sites, while mid and upslope soils emitted N2O. We will explain the observed differences with the major processes that control trace gas fluxes: soil nutrient status, soil water budget and the organic layer as gas diffusion barrier.

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Session 35: Free Topics – Bats - Talk T35-01

Why is male philopatry adaptive in the greater sac-winged bat (Saccopteryx bilineata)?

M. Nagy, M. Knörnschild, C.C. Voigt & F. Mayer

Male philopatry is exceedingly rare among mammals and the majority of known cases are found among primates including our own species. In some cases, as in our study species the greater sac-winged bat, male philopatry correlates with the rather unusual mammalian male mating strategy of resource defence, where the familiarity with the natal area is supposed to be advantageous in territory acquisition for young males. Recent evidence indicates that male sac-winged bats in a colony actively exclude non-familiar males, which can be identified via learned isolation calls that include a group signature and suggests a possible role of cooperation. Our results show that average male tenure is longer in colonies with a larger number of resident males and that tenure is important in determining lifetime reproductive success. Reproduction predominantly occurred on a colony level, though males are not able to monopolize females in their harems, why it should be more profitable to tolerate philopatry of own kin and at least loose fertilizations to relatives. Therefore colonies of the sac-winged bat might act as cooperative alliances where males gain direct fitness by associating with adjacent harems and male philopatry is favoured since monopolization of harem females is not feasible.

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Session 35: Free Topics – Bats - Talk T35-02

Influence of neotropical bats on germination parameters of free-standing and strangler figs (Ficus sp., Moraceae)

K.Heer & E.K.V. Kalko

Seed dispersal plays crucial roles in vegetation dynamics and forest regeneration. The majority of seeds in tropical habitats are dispersed by fruit-eating animals. Frugivores can influence germination success of seeds through transportation, handling and ingestion. We experimentally tested the contribution of the common fruit-eating bat, Artibeus jamaicensis (Phyllostomidae, Chiroptera) on percentage and rate of seed germination of figs (Ficus, Moraceae). We studied three species of free-standing figs (Pharmacosycea) and three species of strangler figs (Urostigma) on Barro Colorado Island, Panama, from March to May 2008. Seeds removed from fruit pulp either manually or by ingestion germinated in > 92 % of all cases, while seeds that were not removed from fruit pulp were quickly destroyed by fast growing fungi. Consequently, seeds germination is strongly favoured by ingestion of A. jamaicensis. Additionally, we found that seeds of free-standing figs germinated faster and over a shorter period of time than seeds of strangler figs. Furthermore, the two subgenera differed in development of roots and cotyledons of seedlings and seed coating. Probably, these differences are adaptative with respect to suitability of microsites for establishment such as a tree fall gap for free-standing figs or a host tree for stranglers.

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Session 35: Free Topics – Bats - Talk **T35-03**

Colonization, dispersal and extinction: the hard life of bat phoretic flower mites

E.B. Sperr & M. Tschapka

Species living in spatial and temporal unstable habitats face severe challenges and need extremely efficient dispersal mechanisms. Highest challenges face organisms that depend exclusively on such unpredictable, short-lived habitats and are unable to cover larger distances on their own. The interaction between the flower mite Spadiseius calyptrogynae and the palm Calyptrogyne ghiesbreghtiana illustrates such an extreme case. The inflorescences with a 9 day lifespan serve the mites as exclusive habitat. Survival of the mite population depends on efficient dispersal via phoretic transportation on flower visitors and rapid colonization of fresh inflorescences. We studied patch occupancy, colonization, migration and extinction in this plant-animal system at the La Selva Biological Station in Costa Rica. Inflorescences were available year round and at least 50% were inhabited by the mites. Population size of S. calyptrogynae peaked in the middle-aged inflorescences. Most mites succeeded to disperse while extinction rate was low. Five different flower visitors were observed to transport S. calyptrogynae, and frugivorous bats had, with up to 361 mites per individual, the highest transport capacity. All mite instars traveled phoretically, but motivation for dispersal increased with habitat age and instar. This extraordinary system provides insight into the complexity of metapopulation dynamics within animal-plant interactions.

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Session 35: Free Topics – Bats - Talk **T35-04**

Density Response to Habitat at Different Scales: A Case Study in The Tent-Roosting Bat Uroderma bilobatum

M. Sagot, R.D. Stevens & B. Rodriguez-H

Heterogeneous landscapes are usually divided into patches; some are suitable for animals and some are not. In a cost-free environment in which animals specialize on high-quality patches, individuals can select habitats containing advantageous resources and they do so at different scales. In a coarse-grained fashion, individuals select habitats with characteristics that maximize their fitness, such as particular vegetation or proximity to water. In a fine-grained fashion, they select habitat subsets with resources like food and roosts. Most explanatory theories proposed to explain abundance patterns usually do so at one scale, generating ambiguous results. To better understand patterns of habitat selection, we should examine different scales. To determine density response to habitat by U. bilobatum, we estimated microhabitat variation within small plots nested within different macrohabitats. We measured microhabitat variables for all plants with bat refuges and then randomly selected the same number of plants without refuges and estimate the same measurements. Data were analyzed using a variation partitioning analysis to disentangle the variance explained by macro and microhabitat. Disentangling density response to habitat at different scales will improve understanding of spatial and temporal dynamics of these populations as well as habitat effects on group cohesion.

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Session 35: Free Topics – Bats - Talk **T35-05**

Nectar resources of chiroptherophilic flowers and their influence on "Leptonycteris yerbabuenae" abundance in a tropical dry forest

N. RODRÍGUEZ-PEÑA, K. E. STONER, M. HENRY, J. AYALA-BERDON, C. M. FLORES-ORTIZ+, AND J. E. SCHONDUBE*

Pollinators choose from a range of nectar resource plants based on flowering phenology of the species, density and spatial distribution of individuals, number of flowers, and the quantity and quality of nectar. Here, we identified tradeoffs between energy content of nectar rewards and nectar production patterns, determine which attributes of nectar resources best correlate with year-round variations of the lesser long-nosed bat L. yerbabuenae. A total of 703 flowers distributed in 12 species and 6 families were investigated. Chiroptherophilic flowers showed nectar volumes at anthesis from 10 to 1040 ml. Concentration values from 3 % to 33% (wt/wt). Using Baker´s terminology, the 12 Chiroptherophilic species fall into the four distinct groups. A gradient of energy allocation strategy pattern was found segregating species producing concentrated nectar over a short period of time from those producing diluted nectar over longer periods of time. L. yerbabuenae abundance was best correlated with energy density.

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Session 35: Free Topics – Bats - Poster P35-01

Vocal learning in a bat

M. KnörnschildM. NagyO. von Helversen

The greater sac-winged bat, Saccopteryx bilineata, exhibits a complex vocal repertoire that is developed through infant babbling and vocal learning, i.e. the modification of innate vocalizations through social influences and the acquisition of new vocalizations through vocal imitation. During the ontogeny of the species' vocal repertoire, pups produce renditions of all known adult vocalization types and mix them into bouts that resemble the infant babbling behaviour of humans. Babbling occurs in pups of both sexes, even though only adult males but not females utter all different vocalization types produced in infancy. Evidence for vocal learning can be found in two different vocalization types, isolation calls and territorial songs. Isolation calls of pups not only exhibit an individual signature but also a social group signature that is modified based on vocal input from group members. The group signature becomes more prominent during ontogeny and functions as an acoustical password that facilitates the recognition of group members. In contrast to isolation calls, territorial songs are not innate but learned during ontogeny through vocal imitation. The territorial songs of the pups' respective harem male function as acoustic prototypes for the pups' renditions independent of the relatedness between harem males and pups.

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Session 35: Free Topics – Bats - Poster P35-02

Finding the needle in a hay stack: prey capture performance of the Common Big-Eared Bat Micronycteris microtis

I. Geipel & E.K.V. Kalko

Bats are particularly species-rich in tropical ecosystems. Local species assemblages are composed of functional groups that share similar habitats, diets and foraging modes. Bats that take food from surfaces (gleaning) have evolved several feeding strategies. Gleaners use different cues for food detection based on different sensory systems, such as odours (fruit- and flower-visiting bats), prey-generated sounds like rustling noises of bush crickets (passive mode in animalivorous bats), or echolocation signals (active mode). It has been debated whether echolocation alone gives sufficient information for successful detection of motionless prey since gleaning bats are confronted with the problem that weak echoes returning from stationary food objects might be masked by strong echoes produced by the background (clutter). Behavioural experiments under IR-illumination demonstrate convincingly that the gleaning, animalivorous bat Micronycteris microtis (Phyllostomidae) is able to detect, classify, and localize silent, motionless dragonflies (Odonata) buried in clutter with echolocation alone. Exposure of the bat to a variety of experimental setups (dragonfly body without wings, four or two wings without body, aluminium and paper dragonfly dummies) suggests that M. microtis mainly uses a combination of echo-acoustic cues originating from the typical cross shape of the dragonflies' body and the surface structure of its wings for prey detection.

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Session 35: Free Topics – Bats - Poster P35-03

An assessment of the suitability of bats for long-term monitoring within the framework of Conservation International's Tropical Ecology, Assessment and Monitoring (TEAM) Initiative

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Bats are ecologically important mammals in tropical ecosystems, yet their populations face numerous environmental threats such as global climate change and increasing habitat loss associated with human activities. Given the growing need to monitor tropical bat populations, we assessed the feasibility of incorporating bats as a target group for long-term monitoring as part of the Tropical Ecology, Assessment and Monitoring (TEAM) initiative. We evaluated the potential for TEAM to reliably estimate species richness at TEAM sites and to detect trends in relative species abundance over time. We found that species detectability is highly heterogeneous in surveys of tropical bats. Detectability estimates were sensitive to a range of external factors, highlighting the need to account for variation in detectability when comparing species richness estimates over time. Due to generally high species-specific detection probabilities, Neotropical aerial insectivorous bats proved to be well-suited for monitoring using acoustic sampling techniques. Conversely, for species with low detectability it will be essential to correct count data obtained in monitoring surveys for detection error. Even though most species analyzed exhibited pronounced temporal variation in abundance, power simulations revealed that population trends could be detected with adequate statistical power for a wide range of species within the anticipated timeframe of TEAM monitoring.

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Session 35: Free Topics – Bats - Poster P35-04

Eavesdropping on public information in a species-rich assemblage of neotropical bats

K. Uebernickel & E. K. V. Kalko

Information transfer via eavesdropping on public information within and between species receives increased attention. Using bats as a model system we compared differences in activity pattern of bats (passes) in the field with playback experiments and tested reactions of selected bat species towards search signals and feeding buzzes of conspecifics and other, sympatric species with similar ecologies.Our study included six species from three families: four aerial insectivores (Myotis nigricans (Vespertilionidae); Saccopteryx bilineata, Saccopteryx leptura, and Centronycteris centralis (Emballunoridae) and two trawling bats Noctilio leporinus and Noctilio albiventris, Noctilionidae). N. leporinus and to a lesser degree also N. albiventris reacted towards final buzzes and search calls of conspecifics by temporarily increasing the number of passes during and shortly after the playbacks. This was in contrast to the aerial insectivores that did not reveal statistically significant changes in activity.Our results suggest that some bat species in the species rich assemblage interact across species boundaries via eavesdropping. The intensity of the species-specific reaction towards public information was linked to the species ecology, in particular to similarities in habitat structures, as well as distribution and density of prey.

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Session 35: Free Topics – Bats - Poster P35-05

A choice between looking for predators, competitors or mates: Australian grey-headed flying-foxes can flexibly adjust vigilance effort

S.M. Klose, E.K.V. Kalko

Group-living in colonies of social vertebrates often encompasses considerable structural change in both space and time. It is little understood how these changes within animal aggregations affect vigilance behavior. Our hypothesis was that spatial as well as temporal variation in social organization may influence socially and environmentally targeted vigilance effort. We investigated the vigilance of individuals in a colony of threatened wild-living grey-headed flying-foxes (Pteropus poliocephalus) in Australia. Color-marking of individuals at different stages of the reproductive cycle and the year and at different locations within the colony allowed to examine the effects of temporal and spatial factors on social and environmental vigilance. We found that vigilance was related social structure of the colony. Bats at the periphery of the colony directed more vigilance towards the environment. Animals roosting at intermediate distances from the colony's edge showed highest social vigilance. Reproductive state was also important, with social vigilance increasing toward the mating season, particularly in males. Our findings show that variation in social structure can have differential effects on social and environmental vigilance. Higher vigilance effort at the periphery may be significant also from a conservation perspective against a backdrop of continuous decline of both flying-fox numbers and colony sizes.

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Session 35: Free Topics – Bats - Poster P35-06

Bats in the city: effects of urbanization on species richness, composition and activity of Neotropical aerial insectivores

K. Jung, E. K. V. Kalko

Human population continues to increase throughout the world, leading to major habitat changes. This endangers the survival of many wildlife species and poses a particularly serious threat on the species-rich tropics.We investigated the effects of human-induced habitat modifications on species composition and activity of aerial insectivorous bats, an ecologically important but seriously understudied group of vertebrates, using acoustic monitoring along a pronounced anthropogenic gradient in Panamá ranging from mature forest to a densely populated metropolitan area.In two years of field work, we recorded 44.744 bat passes over the microphone and identified a total of 25 aerial insectivorous bat species. Species richness and evenness decreased while dominance of single species increased from mature forest towards the metropolitan area.Species differed in adaptability to urban habitats and grouped into three classes: urban avoiders, urban adapters and urban exploiters. We provide crucial baseline data for the adaptability of aerial insectivorous bats towards urbanization in the Neotropics and point towards a rather high degree of behavioural plasticity in several species. This constitutes important elements for the development of effective conservation strategies. Finally, we argue species or groups of species can be taken as valuable indicators for the degree of anthropogenic disturbance.

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Session 35: Free Topics – Bats - Poster P35-07

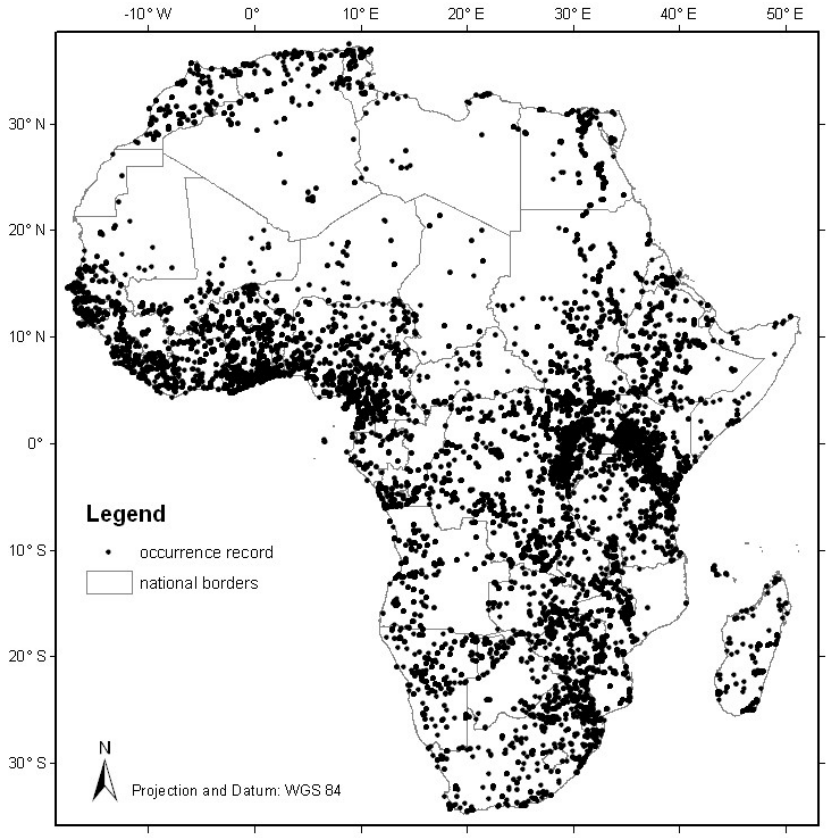
AfriBats – a new knowledge platform for biodiversity research on African Chiroptera

K.M.B. Herkt, G. Barnikel, E.K.V. Kalko, J. Fahr

Which environmental factors drive diversity among African bat species? Where are centres of endemism and diversity hotspots? Where do they coincide with intensive human land-use? How might climate change affect these patterns? To address such questions and to support the development of effective and efficient conservation strategies for African bats using e.g. species distribution models, species occurrence data are essential. While these are becoming increasingly available through data portals such as GBIF, data quality is frequently unknown or compromised, especially with respect to taxonomy, species identification, and georeferencing. We therefore developed AfriBats as a knowledge platform that integrates data and information from three principal sources: 1) natural history collections (NHC), 2) published literature, and 3) field capture data. Synthesizing these partly disparate and incongruent data sources requires extensive expert knowledge, but allows unparalleled cross-checks and plausibility tests. AfriBats currently holds ~ 136,000 occurrence records. About 30,000 of these were gleaned from ~ 2000 publications, 94,000 specimen data received from 31 European and North American NHCs, and 12,000 capture data were obtained through field surveys. This contribution discusses critical issues such as spatial and temporal collecting bias, georeferencing of localities, and challenges regarding an updated and consistent taxonomy.

Session 35: Free Topics – Bats - Poster P35-07

Figure 1: Plot of all georeferenced localities contained in AfriBats suggesting considerable spatial variation in sampling density.



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Session 35: Free Topics – Bats - Poster P35-08

Exploring the consequences of detecting only a subset of the full species pool in tropical bat monitoring surveys for capturing among-site patterns in species richness and composition

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Surveys of species-rich tropical animal assemblages are generally faced with a trade-off between comprehensiveness of a survey and sample size. An important question then is, if one is interested in characterizing site-to-site variation in species richness and composition and monitoring changes in these attributes over time, what would be the consequences of surveying only a subsample of species from the entire species pool for capturing among-site patterns in species richness and composition? For 20 tropical bat assemblages, we assessed the magnitude of correlations for bat species richness and species composition, respectively, between each complete data set that included all species sampled vs. species subsets with different numbers of species deleted at random or according to their rarity in the respective assemblage. Our analyses suggest that information lost when the rarest species in an assemblage remain undetected would be negligible and that the species subset sampled can serve as a good surrogate for the full suite of species actually present. However, to be able to make reliable inferences regarding among-site variation in species richness and composition, monitoring surveys need to invest sufficiently high sampling effort to ensure that at least those species with relative abundances > 0.1% are detected.

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Session 35: Free Topics – Bats - Poster P35-09

Trypanosome diversity in A.jamaicensis and habitat fragmentation

V.M. Cottontail, N. Wellinghausen & E.K.V. Kalko

The aim of our study was to detect the trypanosome prevalence in Artibeus jamaicensis in order to determine and compare trypanosome species distribution in bats from islands (fragmented habitat) vs. mainland (unfragmented forest) in Panama. We used a nested PCR amplifying a SSU RNA gene fragment and sequencing, and found that 32.4 % of all bats were infected with trypanosomes. Analysis of the base sequence showed that there were 7 different types of trypanosomes, some belonging to the Trypanosoma cruzi complex, one T. rangeli and three, presumably specific, as of now undescribed trypanosomes. Bats captured in fragmented habitats had a significantly higher prevalence of trypanosome infection and also multiple infections than on the mainland. There also was a distinctly different trypanosome distribution on the islands, where trypanosomes of the T. cruzi complex were more common. We concluded that the characteristics of fragmented habitats, e.g. vegetation cover, influence the species composition not only of the host, but also of the parasite.

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Session 36: Free Topics - Phylogenetic / Phylogeography - TalkT36-01

Can Pleistocene refuge theory explain within-species patterns of genetic diversity in African lowland rainforest trees?

M. Heuertz, V. Savolainen, K.B. Budde, K. Daïnou, J. Duminil, G.K. Koffi & O.J. Hardy

The main factors governing the geographical distribution of biodiversity in Central Africa were suggested to be adaptations to ecological gradients and stochastic processes related to historical climate. The latter are exemplified in Pleistocene refuge theory, which holds that regions which nowadays harbour high numbers of endemic species correspond to so-called forest refuges, where rainforest persisted through periods of adverse climatic conditions. We here surveyed geographical patterns of genetic diversity based on chloroplast DNA sequences in fifteen rainforest tree species (12 samples/species). Chloroplast DNA is largely neutral to selection and reflects therefore the demographic history of species, ignoring adaptations. We investigated to what extent isolation in Pleistocene refuges could explain current geographical patterns of within-species genetic diversity and whether such patterns were shared between species. Genetic data for multiple species allowed evaluating the impact of species life history traits and ecological requirements on divergence patterns. High-resolution maps of genetic diversity in five species allowed a preliminary testing of Pleistocene refuge theory at the within-species level, i.e. whether regions of high species endemism also hold high levels of endemic alleles. Our results are essential to understand the origin of biodiversity patterns in Central Africa, a biogeographically important region.

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Session 36: Free Topics - Phylogenetic / Phylogeography - TalkT36-02

Reconstructing West African rainforest refugia via forest frogs

A. Hillers, M. Veith, S.B.J. Menken & M.-O. Rödel

The existence of forest refugia during past glacial climates is one of several theories explaining tropical species' diversification and distribution. West African rainforest refugia were thought to be consistent with centers of high species richness and endemism, but neither distribution patterns of different taxonomic groups nor palynological data consistently indicated numbers, locations, and sizes of refugia. Facing future climatic changes and the many threats to West African forests (logging, habitat conversion, mining), detailed knowledge about the locations of refugia is needed for an optimal priority setting in protecting remaining forests and associated biota. We used phylogenetic and phylogeographic analyses for partial mitochondrial 16S rRNA and cytochrome b sequences of forest frogs to detect West African rainforest refugia. Information from Bayesian molecular dating revealed that interspecific splits predate Plio- and Pleistocene glacial times, while intraspecific lineages of various species evolved during this period. Genetic variation patterns differed between species. Nucleotide diversity, (spatial) analysis of molecular variance, effective population sizes, mismatch distribution, and nested clade phylogeographic analysis revealed that three previously assumed refugia were part of larger refuge zones. We furthermore identified four additional refuge areas. Independent evolutionary lineages of single frog species hint at local refugia within the larger refuge zones.

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Session 36: Free Topics - Phylogenetic / Phylogeography - TalkT36-03

Pre-Pleistocene population structure of widespread tropical forest trees

C. W. Dick

Tropical rain forests support a remarkable taxonomic diversity of trees in comparison to temperate and boreal forests. Debates on the origin of tropical tree diversity and its resilience to global warming have focused on age of contemporary taxa. In order to determine age structure of populations of Neotropical tree species, we estimated divergence times for 12 lowland tree species with disjunct cross-Andean populations. The results support Pliocene-Miocene origins for nine of the 12 sets of populations. These Tertiary age populations, which may be found in hundreds of other rain forest species with similar biogeographic histories, represent evolutionary lineages that have endured ice age cooling and climates even warmer than predicted for the late 21st century.

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Session 36: Free Topics - Phylogenetic / Phylogeography - TalkT36-04

Recruitment dynamics across multiple life stages in the tropical tree Prunus africana

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Spatially heterogeneous dispersal patterns created by animal pollinators and seed dispersers have pivotal impact on demographic and genetic processes in recruitment dynamics of trees. Seed dispersal is especially important for recruitment, allowing offspring to escape from high mortality near mother plants (Janzen-Connell hypothesis). Beside a relevance for demographic processes, pollination and seed dispersal are main vectors of gene flow in plants and strongly influence genetic structuring. As various influences alter initial patterns created by dispersers at the seed stage, it is essential to assess how these patterns change during further recruitment. In our study, we investigated demographic and genetic processes across several recruitment stages of Prunus africana, a tropical tree pollinated and dispersed by animals. We assessed pollen and seed dispersal patterns across four different life stages using microsatellite markers. First, we studied spatial patterns of pollen and seed dispersal and investigated changes in patterns throughout consecutive recruitment. Second we looked more closely at potential Janzen-Connell effects across four life stages. Finally, we assessed how the dispersal patterns we found translated into genetic structuring of P. africana. Our study aims at a comprehensive understanding of how pollination and seed dispersal by animals affect recruitment processes of a tropical tree.

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Session 36: Free Topics - Phylogenetic / Phylogeography - TalkT36-05

Seed rain, gene flow and fine-scale genetic structure of a bird-dispersed dioecious under-canopy fig tree:Ficus cyrtophylla

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F. cyrtophylla is an under-canopy dioecious bird-dispersed fig tree species. To understand how seed dispersers and fig wasp pollinators shape the gene flow and local genetic structure, we set up seed traps inside of natural forest and meanwhile provide a complete locating of all individual plants in an area of 400 × 400 m2. For the adult trees, we extended the sampling to two neighboring populations that both were 1-2 km apart. Samples from seeds, seedlings, saplings and adult trees were collected and the simple sequence repeat microsatellite (SSRs) markers were adopted for the maternity and paternity analysis and analysis for fine scale genetic structure. We are going to present the results for addressing the following questions: 1)How does seed rain non-randomly distributed due to the behavior of frugivorous birds, 2) How does the fine scale genetic structure change along with the development of recruitment of seedlings to adult trees, and, 3) How do the dispersers and fig wasps shape the gene flow both within population and across populations.

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Session 36: Free Topics - Phylogenetic / Phylogeography - PosterP36-01

Genetic structure of Symphonia globulifera at different geographical scales

K.B. Budde, S.C. González-Martínez, C.W. Dick, O.J. Hardy, M. Heuertz

Understanding the spatial genetic structure of tree species is crucial to develop suitable conservation strategies. Especially for tropical tree species, little is known about the genetic structure at different geographical scales.Symphonia globulifera (Clusiaceae) is a widespread and very old rainforest tree species (pollen fossil records date back to ~ 45 Ma BP). Today it is found in Madagascar, tropical Africa and America and the West Indies. Its flowers are insect and bird-pollinated and the fruits are dispersed by birds and different mammals. The genus radiated on Madagascar from where it spread to Africa and subsequently to America. The species was exposed to multiple climatic oscillations during this inconceivably long time period producing various vicariance events. In particular the last glacial and interglacial epochs might have left signatures in the genetic constitution of this species.So far few studies have addressed the spatial distribution of the genetic variation in S. globulifera and all were restricted to Central and South America. We here investigate the genetic structure within and among populations of S. globulifera in Atlantic Equatorial Africa utilizing microsatellite markers. Furthermore our findings are supplemented by data of chloroplast DNA sequences that enable us to elucidate the biogeographic history of the species in Africa.

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Session 36: Free Topics - Phylogenetic / Phylogeography - PosterP36-02

Species delimitation and phylogeography of a complex of African tropical tree species.

Jérôme Duminil, Myriam Heuertz, Nils Bourland, Jean-Louis Doucet et Olivier Hardy.

Past climatic changes have largely influenced the demographic history of species. In tropical Africa, the last glacial periods have been marked by dry conditions allowing forest species to survive only in favourable environments (forest refuges). At the return of high levels of humidity, species ranges expanded reaching their current distribution. The impact of these past climatic changes on the demographic dynamics of tropical forest trees can be investigated using the current ecological, genetic and distribution characteristics of tropical species. In this context, we used the two timber tree sister species, Erythrophleum ivorense / E. suaveolens (Caesalpiniaceae) in Central Africa as a model system. Our integrated approach is based on the synergetic study of the spatial distribution of chloroplast DNA (cpDNA) polymorphisms and on the characterization of the ecological heterogeneity throughout the distribution area of the study model. A first point was to address species delimitation within the complex. Morphological identification is generally not possible in the field due to the absence of clearly discriminating morphological markers. We here adopted a blind sampling approach and a posterior assignation of individuals to each species. Our results suggest that the two species would rarely be found in sympatry, one species being distributed along the coast where rainfall is highest, and the other being more continentally-distributed. The within-species distribution of genetic diversity and their contrasted ecological requirements provide information on the history of each species. This study constitutes an initial step for future comparisons of phylogeographic patterns in tropical tree species with the aim of resolving their past history.

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Session 36: Free Topics - Phylogenetic / Phylogeography - PosterP36-03

Seed Shedding Phenology and Germination Characteristics of a Drought-Prone Vegetation in Southeastern Brazil

M.I.Braz & E.A. de Mattos

Seed germination is determined by the environmental conditions of a habitat and by the geographical origin of species pool. During the Quaternary, Brazilian Atlantic Rainforest species expanded their distribution into the restingas. However, periods of water shortage are frequent in the sandy substrate of the restinga. We aimed to investigate whether the germination characteristics of restinga species are more related to their biogeographical origin or to water shortage on sandy substrates. We characterized the seed shedding of a restinga community and conducted experiments to determine the water requirements for seed germination and the short-term seed dehydration sensitivity. There were species shedding seeds throughout the year. When subjected to moderate water deficit, seed germination decreased and germination time increased in six out of ten species. Most species showed high seed moisture content at seed shedding. Seeds took 3 to 17 days to dehydrate when subjected to RH less than 77%. Only two species had seeds sensitive to short-term dehydration. Thus, rather than a specific set of germination characteristics related to humid or dry habitats, we gathered evidence to show that the germination characteristics of restinga species represent a multiplicity of responses that may be found in both kinds of habitat.

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Session 36: Free Topics - Phylogenetic / Phylogeography - PosterP36-04

Demographic Fine-scale Genetic Structure of Protium spruceanum (Burseraceae), a Dioecious-dominant Neotropical Tree, on Brazilian Atlantic Population

F.A.VIEIRA &. D. CARVALHO

The analysis of fine-scale genetic structure (FSGS) provides information about the mechanisms responsible for the observed patterns. We present a study case of the relation among fragmentation, FSGS and age structure in an insect-pollinated and secondary bird-dispersed tree. Using allozyme loci, the spatial and temporal patterns of genetic structure within a 40 m x 60 m area in Atlantic forest were investigated the distribution of genetic diversity. Four categories of plants (N = 345) from seedlings to adults according to diameter classes were analyzed. The results showed a high average population level of gene diversity (He = 0.438), but genetic diversity parameters did not change among cohorts. The spatial distribution pattern analysis showed significant levels of aggregation at small and medium diameter-class and random distribution at the high diameter-class. There was a high link between demographic and genetic spatial structures at small distances (less than 10 m). We inferred that limited seed dispersal and subsequent random loss of individuals from the family patches are responsible for the observed changes in FSGS across different demographic classes. Moreover, this study shows how genetic diversity can be maintained due to natural plant recruitment post-fragmentation, a positive aspect for in situ conservation.

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Session 36: Free Topics - Phylogenetic / Phylogeography - PosterP36-05

The evolution of ecological traits in the important neotropical tree family Chrysobalanaceae

J. Chamagne, K.G. Dexter, C. Baraloto & J. Châve

The distribution and abundance of species depends on ecologically important traits that reflect their adaptation to climatic or other abiotic regimes and modulate their interaction with other species. To determine the extent to which phylogenetic heritage may influence patterns in the distribution of tropical tree species, we examine the evolution of ecologically important traits in the diverse neotropical tree family Chrysobalanaceae. Specifically, we assess the evolutionary lability of 12 traits such as specific leaf area, sapwood density, and maximum height. We find, in general, that most evolutionary traits are evolutionarily labile and do not display significant phylogenetic signal. We next investigate the distribution of Chrysobalanaceae species in French Guiana along a significant climatic gradient and find that closely related species can differ greatly in their distribution pattern along this gradient. Together our results indicate that phylogenetic heritage does not seem to limit the distribution of Chrysobalanaceae species.

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Session 36: Free Topics - Phylogenetic / Phylogeography - PosterP36-06

The reproductive success and genetic structure of Carica papaya in a fragmented rainforest in Mexico

M. Chávez-Pesqueira & J. Núñez-Farfán

The potential alteration of interactions between plants, pollinators and seed dispersers, along with the reduction in density of plants brought about by habitat fragmentation, may alter their reproductive success and favour the local extinction of tropical species. Our study aims to assess the effect of forest fragmentation in the reproductive success and genetic structure of Carica papaya, a representative species of Los Tuxtlas rainforest, in Mexico. We examine the effects of habitat fragmentation on seed production and germination percentage in both habitats (continuous and fragmented). Using genetic variation at six microsatellite loci we evaluated the genetic structure of continuous and fragmented populations, as well as the outcrossing rate, by screening progenies derived from trees from both habitats, to determine the effect of forest fragmentation in the mating system and dispersion capacity. Preliminary results show a reduction in seed number in plants inhabiting forest fragments, as well as an altered quality of seeds, reducing their germination capacity, and suggesting inbreeding depression. We expect a reduction in genetic variation and an increase of inbred progeny in fragmented populations, due to isolation. Evaluating the ecological and evolutionary responses of plants of different life histories to habitat fragmentation is important for conservation efforts.

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Session 36: Free Topics - Phylogenetic / Phylogeography - PosterP36-07

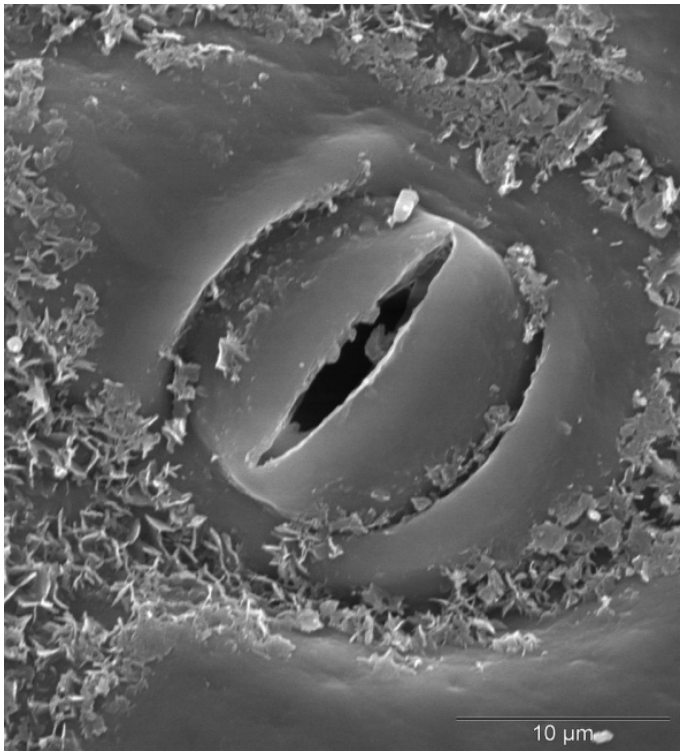
Exceptional diversification in leaf surface characteristics of the C4 Hawaiian Chamaesyce radiation: detailed analysis for 26 native taxa across environments

M.J. Sporck, L. Sack

The Hawaiian Chamaesyce are a group of C4 dicots that radiated from one colonizing species into 29 taxa. This group is present on all main islands and range in form, from creeping woody sub-shrubs to trees, with taxa adapted to diverse habitats, from wet forest to dry forest to the coast. Typically stomata are distributed only on the abaxial (lower) surface of the leaf (hypostomaty), or on both the abaxial and adaxial (upper) surfaces (amphistomaty). The distribution of stomata only on the adaxial surface (hyperstomaty) is rare, previously documented in some aquatic plants, herbs, sedges, and grasses. For 26 native Chamaesyce taxa we determined stomatal characteristics using scanning electron microscopy of leaf surfaces. For each taxon we quantified stomatal numbers, dimensions and distribution; we tested for correlation of these traits with the source population elevation, mean annual rainfall, temperature, and vapor pressure deficit, and with leaf size and thickness. We found an unexpectedly large diversity in stomatal characteristics, including hypostomaty, amphistomaty and, hyperstomaty. Apparently, Hawaii's isolated location and strong climatic gradients have driven stomatal diversification for Chamaesyce beyond any previously characterized lineage. We explore possible hypotheses for the evolutionary factors involved, and the functional significance of this diversity.

Session 36: Free Topics - Phylogenetic / Phylogeography - PosterP36-07

Figure 1: Stomate on the abaxial surface of C. celestroides var. kaenana.



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Session 36: Free Topics - Phylogenetic / Phylogeography - PosterP36-08

Reproductive patterns in Myrteae (Myrtaceae): an ecological and phylogenetic perspective

V.G. Staggemeier, J.A.F. Diniz-Filho & L.P.C. Morellato

Myrteae (Myrtaceae) species are a dominant component of neotropical forests. The large variation of reproductive patterns expressed across the great number of species makes this group a good model to study general trends and evolutionary patterns in angiosperms phenology. We evaluated the importance of biotic and phylogenetic factors in addition to abiotic factors on the phenological response of 34 Myrteae species in Southeastern Brazilian Atlantic rainforest. Facilitation and competition hypothesis were tested by randomization technique. The proportion of species phenological variation attributed exclusively to phylogeny, to ecology (climatic factors), or to both factors combined was evaluated using phylogenetic eigenvectors regressions. During the 30-months study Myrteae species showed strong flowering seasonality, most species flowering in months with longer photoperiod (Dec-Jan). Aggregated blossom increases the flowers conspicuousness and may be advantageous for plants and animals via facilitative interactions. Random fruiting pattern, with at least three species offering fruits each month, indicated little restrictive climatic conditions to fruit development. Closer related species tended to reproduce when the climatic conditions were more similar. The high shared influence of ecology and phylogeny in Myrteae phenology pointed the existence of a phylogenetically structured reproductive niche. We demonstrated that there is phylogenetic structure in plants reproduction, even when species reproduce throughout the whole year.

Session 36: Free Topics - Phylogenetic / Phylogeography - PosterP36-08

Figure 1: Variation percentage of Myrteae phenological response strictly attributed to phylogeny (a), shared between ecology and phylogeny (b), strictly attributed to ecology (c), and unexplained variability proportion (d).

Phenophases		Individual fractions			
		Strictly Phylogeny	Shared	Strictly Ecology	Unexplained
		[a]	[b]	[c]	[d]
PEAK	Flower bud	4.67	63.14	28.60	3.60
	Flower	-1.48	53.58	32.45	15.45
	Immature fruit	4.55	37.75	45.76	11.94
	Mature fruit	-0.11	34.71	60.85	4.55

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Session 36: Free Topics - Phylogenetic / Phylogeography - PosterP36-09

Assessment of genetic structure within andamong populations of Chukrasia tabularis A.H.L. Jussieu (Meliaceae), a commercial timber tree and conservation strategies

Tran Thi Hoa, Nguyen Ngoc Cuong, Le Dinh Kha, K Pinyopusarerk, A. Kalinganire, L.Triest and K. Jarkko

Assessment of genetic structure within andamong populations of Chukrasia tabularis A.H.L. Jussieu (Meliaceae), a commercial timber tree Tran Thi Hoa1, Nguyen Ngoc Cuong2, Tran Van Vuong2, Le Dinh Kha2, K Pinyopusarerk3, A. Kalinganire3, L.Triest4 and K. Jarkko51. Institute of Agricultural Genetics (AGI), Hanoi, Vietnam2.Research Center for Forest Tree Improvement (RCFTI)/Vietnam Institute of Forest Science (VIFS), Hanoi, Vietnam3. CSIRO Forestry and Forest Products, PO Box E4008, Kingson. ACT 2604, Australia4. Plant Science and Nature Management, Free University of Brussels, Pleinlaan 2, B-1050 Brussels, Belgium5. International Plant Genetic Resources Institute (IPGRI/Bioversity InternationalRegional Office for Asia, the Pacific and OceaniaPO Box 236, UPM Post Office, Serdang43400 Selangor D.E., MalaysiaAbstractWe analysed genetic variation within and between populations of the economic important timber tree, Chukrasia tabularis in order to extract biological information useful in the context of conservation management of Asia countries genetic resources of hardwood species. Chukrasia tabularis is a species that distributed mainly in South and Southeast Asia. Our survey of isoenzyme was conducted on material gathered from international provenance trials over 8 countries for 25 populations.A total of 1250 seedlings were typed at 6 isoenzyme loci.Analysis of within-population inbreeding suggests no-indication of inbreeding or in a few cases, of genetic selection following the given environmental conditions. Difference among population expected only about 8.7% of total genetic diversity.Keywords:Chukrasia tabularis, genetic structure, inbreeding, isoenzyme, southeast Asia

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Session 37: Free Topics – Forest - Talk T37-01

Comparison of different pathways of succession in the tropical dry evergreen forest on the Coromandel coast of south India: Evaluating reforestation.

V.Kinhal & N.Parthasarathy

Differing patterns of reforestation are observed under different regimes of restoration practices dictated by diverse land-use and management. Directed succession seen in a chronosequence of 2, 6, 12 & 30 years old afforestation sites with soil and water conservation supplemented by enrichment planting to restore the tropical dry evergreen forest was compared to spontaneous succession in a chronosequence of grazing lands aged 2, 4, 10 & 50 years. The significant vegetative inter-species and overall community interactions are all positive in both pathways. But continuous disturbance (grazing pressure) slows the rate of succession. After 30 years directed sites are more similar (16%) and species rich (123) than spontaneous sites 5% & 109 species respectively.Resilience measured for vegetation ≥ 1 cm dbh reveals that density is seven times, basal area is five times, cover is 29 times and height is 1.5 times more in oldest sites of directed than in spontaneous succession, but number of primary forest species regenerating is similar in both cases. The secondary forest from directed succession has higher basal area and density compared to a forest fragment, but is expensive, while spontaneous succession which shows only 30% recovery nonetheless has 64% of its species providing usufruct benefits.

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Session 37: Free Topics – Forest - Talk T37-02

Could the gregarious bamboo flowering modify the regeneration process of an Atlantic Forest fragment?

M. T. Grombone-Guaratini1, L. F. Alves 1,2 and P. G. Carvalho1

The Brazilian Atlantic Forest is rich in native bamboo species. After anthropogenic and natural disturbances, some woody bamboos may turn into dominant species. Bamboo dominance can decreases tree recruitment and growth modifying forest structure and composition. The synchronized dieback of monocarpic bamboos generally changes the dynamic of these forests. The present study was carried out in a tropical forest fragment in Southeastern Brazil. Our goal was to assess the effect of a native bamboo species on forest structure and regeneration in bamboo-dominated (BD) and control (C) sites during two years. A manipulative experiment comprising of bamboo removal was also performed. We recorded a pulse of new seedlings and an increase in diameter and height growth of established seedlings after the onset of bamboo death in August 2007. Similarly, we found high recruitment rates and low mortality rates after bamboo removal. Our results supports the hypothesis that bamboo dieback changes the forest dynamics.

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Session 37: Free Topics – Forest - Talk T37-03

Water relations of indigenous trees in a tropical mountain forest in Ethiopia

S. Strobl, A. Abate, F. Fritzsche, M. Fetene & E. Beck

Podocarpus falcatus and Croton macrostachyus trees share the same sites in a tropical mountain forest in Ethiopia. Podocarpus is evergreen while Croton is (facultative) deciduous shedding its leaves usually in the course of the dry season.Sap flow measurements revealed 95 l/d for Croton with full foliage and between 6 to 17 l/d at the end of the dry season, respectively. Differences were small in Podocarpus (22 l/d in the dry, 16 l/d in the rainy season). Leaf transpiration rates of Croton were more than twofold higher than those of Podocarpus. In Podocarpus kinetics of daily sap flow showed a significant later onset than leaf transpiration but not in Croton.Comparison of the root systems showed that fine root biomass is much higher for Podocarpus (1.34 kg/m³ compared to 0.32 kg/m³ for Croton). Most of the fine roots occur in the upper 30 cm of the soil. However, in the dry season, Podocarpus developed a second set of roots in about 1 m depth. Comparing the 18O-signature of the soil water at various soil depths and of water collected from the twigs, the soil horizons from which the trees collected the bulk of their daily water consumption could be identified.

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Session 37: Free Topics – Forest - Talk T37-04

Herbivores suppress seedling growth of a dominant canopy-emergent tree in a Central African forest

J.M. Norghauer & D.M. Newbery

Although insect herbivores are abundant in tropical forests their impact on survival and growth of young trees is poorly known. Here, we report preliminary results from a large-scale, ongoing field experiment where 'Econet-B' mesh netting protected seedlings of Microberlinia bisulcata and Tetraberlinia bifoliolata from herbivores in canopy gaps and paired understory locations across an 82.5 ha plot in Korup National Park, Cameroon. After c. 8 months, Microberlinia seedling survival was significantly lower in the controls than exclosures, irrespective of light environment, whereas it was not for Tetraberlinia. After c. 14 months, Tetraberlinia height increment and change in total leaves was similar between controls and exclosures, but slightly more leaves were produced in exclosures. For Microberlinia, however, seedling growth was 50–60% greater when protected from herbivores, especially in gaps. As expected, growth was significantly enhanced for both species in gaps compared to understory. Levels of leaf damage to Microberlinia were twice as high in controls than exclosures, but similar for Tetraberlinia. Overall, under increasing %PPFD, the protected Microberlinia seedlings grew nearly twice as fast as seedlings exposed to herbivores. These results suggest herbivores contribute to the poor regeneration of Microberlinia in this forest, which in turn may favor Tetraberlinia's recruitment.

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Session 37: Free Topics – Forest - Talk T37-05

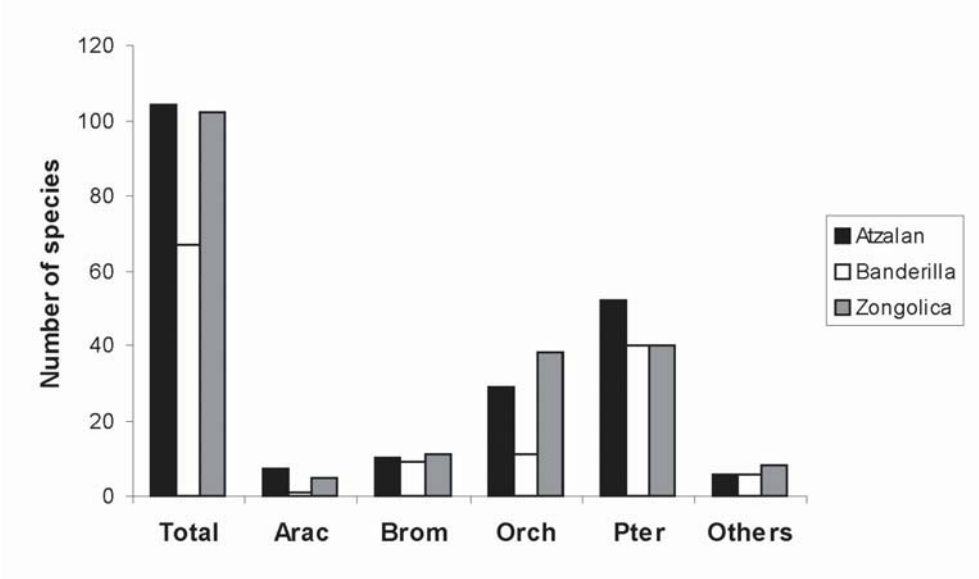
Impact of anthropogenic disturbance on diversity of five selected plant groups in cloud forest fragments of central Veracruz, Mexico.

T. Krömer, J. Viccon Esquivel, H. Flores Mendez & A. Acebey

Tropical humid forests are among the most species-rich plant communities on earth, however, our understanding of their diversity remains fragmentary in spite of the alarming rate of destruction of these forests. To study the impact of anthropogenic disturbance on this diversity, we compared species richness and floristic composition of five selected plant groups (aroids, bromeliads, orchids, ferns, and other epiphytes) in three fragmented cloud forest sites between 1000-1500 m in central Veracruz, Mexico. Whereas diversity in the Atzalan and Zongolica sites was very high (about 100 species each), diversity at Banderilla only showed 65% of this value. The lower richness at the latter site is mainly due to the scarcity of aroids and orchids, and is probably caused by human influence. While the forest fragments of Atzalan and Zongolica are located in rural areas of difficult access, that of Banderilla is near an urban area and utilized since decades as a source of firewood, and is thus highly transformed. Another factor of importance seems to be illegal harvesting at Banderilla, resulting in reduced abundance and restricted sites for species survival. Despite the legal protection of epiphytes in Mexico, illegal epiphyte trafficking is common in the markets of central Veracruz.

Session 37: Free Topics – Forest - Talk **T37-05**

Figure 1: Number of species of five selected plant groups (Arac: Araceae; Brom: Bromeliaceae; Orch: Orchidaceae; Pter: Pteridophyta; Others: additional epiphytic species) in three cloud forest sites in central Veracruz, Mexico.



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Session 37: Free Topics – Forest - Talk T37-06

Distribution and abundance of tree species in secondary forests: linking local, landscape, and regional scales in a Panamanian forest

M. van Breugel, Hall, J., R. Condit, D. Craven

Secondary forests are perceived to be dominated by a very small subset of the total regional species pool. While several studies support this observation, they generally include few sites. Further few studies have explicitly examined if plot-level abundance and dominance are related to frequency of occurrence across the secondary forests of a rural landscape, i.e. if local-scale and landscape-scale descriptors of commonness are related. Extensive work in the forests of the Panama Canal Watershed (PCW) offers a unique opportunity to study tree distribution on multiple scales across a range of forest types. We explore patterns of dominance, abundance and frequency of tree species across fifty young secondary forest (YSF) plots in a 20 km2 rural area and relate these patterns to regional distribution patterns, using data from inventories of >120 mature and older secondary forests sites across the 5500 km2 PCW. We found over 350 species in the YSF. While in each plot a limited number of species dominated, dominating species differed between plots. Contrary to expectation it took over 50 species to come to 75% of total stem density. Relationships between frequency and abundance patterns across multiple scales are complicated with important interspecific variation.

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Session 37: Free Topics – Forest - Talk T37-07

Phenology of woody species in permanent plots of the Yungas mountain forest, La Paz - Bolivia

A.E.Q. Apaza, S. Beck & M. Sauvain

In the Yungas mountain forest totally 158 woody species were sampled in 6 permanent plots, 49 species did not show any reproductive phenological event during the monthly survey between October 2002 until December 2004. From the 109 reproductive species we describe of 24 species phenological characteristics. The results of foliage activity (around 100%) showed that this is an evergreen.forest. The reproductive phenology indicated flowering and fruiting species as well in dry season as in the wet season. The phenological events were mainly annual. Some species had higher synchronic events and others (p.e. Miconia and arboreus ferns), tended to a continuous behaviour. The duration of the phenological events for 14 species reached a mean of 4,2 months for flower buds, 3,8 months for flowering and 6 months for fruiting. Concerning each plot flowering and fruiting were observed in all months, even though, some plots presented more activity in dry or wet season. A secondary forest plot at 2365 m showed more definite events with flowering mainly in dry season and fruiting in wet season. In contrast, in a more conserved area and at less altitude (1580 m), more species flowered in the middle of the wet season and fruited in the dry season.

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Session 37: Free Topics – Forest - Talk T37-08

Community Dynamics of a Secondary Tropical Dry Forest: successional pathways and variability

E. Lebrija-Trejos, E. A. Pérez-García, J. A. Meave, L. Poorter & F. Bongers

Pathways and mechanisms of succession are system and site specific, but most tropical forest-succession models are based on wet tropics and on temperate forests succession. We analyzed secondary successional dynamics over 4 years in 17 plots covering >65 years of abandonment after agriculture in tropical dry forest (TDF) in Oaxaca, Mexico. Results showed clear transitions between two tree-dominated phases, one of pioneers and one of mature-forest species. Individual-plot vegetation development followed chronosequence-based predicted pathways: basal area, crown cover and species diversity increased with time. Tree density, however, did not. Pioneers peaked in basal area at ca. 20 years; mature-forest species became dominant 20 years later. Pioneer recruitment stopped after 10 years and mortality continued, while mature forest species recruited continuously and mortality increased gradually. Pioneers did not wither because of increasing mature-forest species dominance but because pioneers facilitated their own replacement: they aged and declined well before mature-forest plants dominated or reached maximum development rates. Development in our TDF is less complex than in most wet forests. We conclude that upon fairly homogeneous historical and environmental conditions, an orderly series of delimited changes takes place during secondary succession and that a common set of deterministic forces strongly drive this development.

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Session 37: Free Topics – Forest - Talk T37-09

Succession dynamics on landslide sites in a tropical mountain forest in southern Ecuador

Dislich, C. & Huth, A.

Shallow landslides are a main source of natural disturbance in tropical mountain forests. We study the vegetation dynamics of such forests in southern Ecuador, with the aim to understand regeneration processes following landslides. The study site is a predominantly undisturbed forest reserve located on the eastern slopes of the Andes. With over 280 tree species, this ecosystem is characterized as "megadiverse". To analyse its dynamics, we employ the process-based, individual-oriented simulation model FORMIND. The model is built in the tradition of forest gap models, to investigate long term impacts of disturbances in tropical rain forests. Within the model, species are grouped into plant functional types according to physiological species traits. We parameterised the model for the ridge forest (1900-2100 m asl), and found that the model is successfully reproducing the abundance of functional types and forest structure for the grown forest. However, the normal succession in the model proceeds quite rapidly, while in reality succession may be slowed by lower recruitment and/or by decreased growth rate following landslides. These results suggest a need to strengthen empirical knowledge of how trees respond to the changed environmental conditions following landslides.

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Session 37: Free Topics – Forest - Talk T37-10

Fog in the tropical lowland cloud forest of French Guiana – A frequent phenomenon with impact on microclimate and epiphytes

A. Obregon, J. Bendix, C. Gehrig & S.R. Gradstein

The occurrence of fog is a common event in the valleys of central French Guiana, but to date, an in-depth study of this phenomenon is lacking. Thus, a three years interdisciplinary project focuses on the research of the meteorological processes leading to fog formation and the consequences for the epiphytic vegetation. In August 2007, an automatic weather station was installed on a 45m canopy tower and climate measurements were conducted at different elevation and levels within canopy trees. The data show that fog occurs on more than 90% of days, with a maximum in the morning between 6 and 7 LT in the river valleys. This frequency is typical for tropical montane cloud forests but rather unusual in the tropical lowland. The average daily fog duration ranges between 4 h in dry season and 6 h in rainy season. Fog formation seems to depend mainly on humidity and radiation balance. Further, nocturnal cold air drainage plays a role in the formation of fog. We hypothesize that the frequent occurrence of valley fog induces different microclimatic conditions at hill and valley sites and hence higher epiphyte diversity, biomass and abundance in the valley forest.

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Session 37: Free Topics – Forest - Poster P37-01

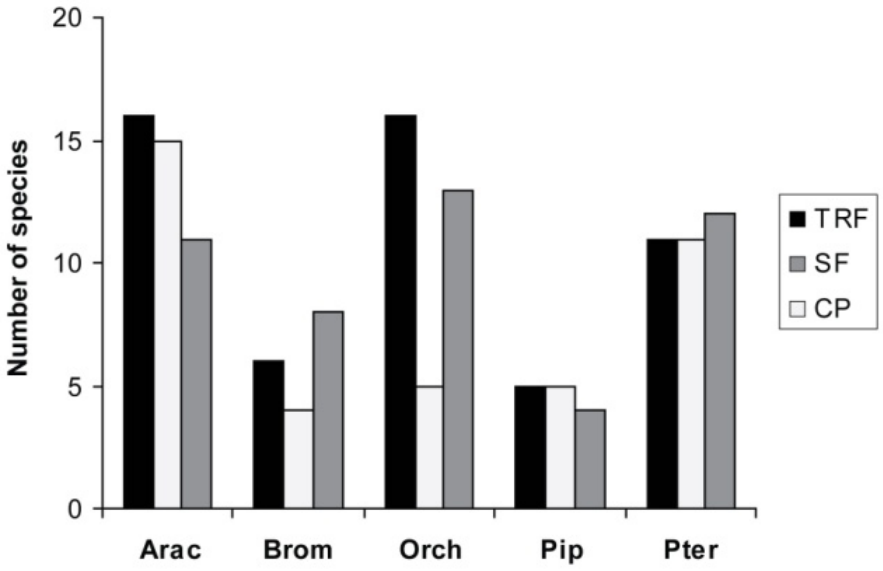
The role of secondary forests and citrus plantations in the conservation of vascular epiphyte diversity in Los Tuxtlas, Veracruz, Mexico.

T. Krömer, A. Pérez Peña & A. Acebey

The diversity of vascular epiphytes is one of the most striking characteristics of tropical humid forests. Unfortunately, these forests are still disappearing rapidly, as a result of increasing human pressures. To study the impact of anthropogenic disturbance on vascular epiphyte diversity, we compared their species richness and floristic composition in old-growth tropical rain forest (TRF), adjacent 20 yr old secondary forest (SF), and 30-40 yr old citrus plantations (CP) in southeastern Veracruz, Mexico. We recorded 81 species of vascular epiphytes, of which 58 were found in TRF, 42 in SF, and 51 in CP. Orchids contributed most to epiphyte richness, followed by ferns, aroids, and bromeliads. SF and CP had 28% resp. 12% fewer species than neighbouring TRF. Orchids were most strongly affected by anthropogenic disturbance showing a decrease of 68% in SF and of 19% in CP. In contrast, species richness of aroids, piperoids and ferns was similar in all three vegetation types. The study shows that SF and CP are important in the conservation of vascular epiphyte diversity. However, not all taxa can colonize both types of disturbed vegetation and, in particular, many species of orchids would disappear by complete transformation of the rain forest.

Session 37: Free Topics – Forest - Poster P37-01

Figure 1: Number of species of vascular epiphyte groups (Arac: Araceae; Brom: Bromeliaceae; Orch: Orchidaceae; Pip: Piperaceae; Pter: Pteridophyta) in three vegetation types (TRF: tropical rain forest; SF: secondary forest; CP: citrus plantations) in southeastern Veracruz, Mexico.



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Session 37: Free Topics – Forest - Poster P37-02

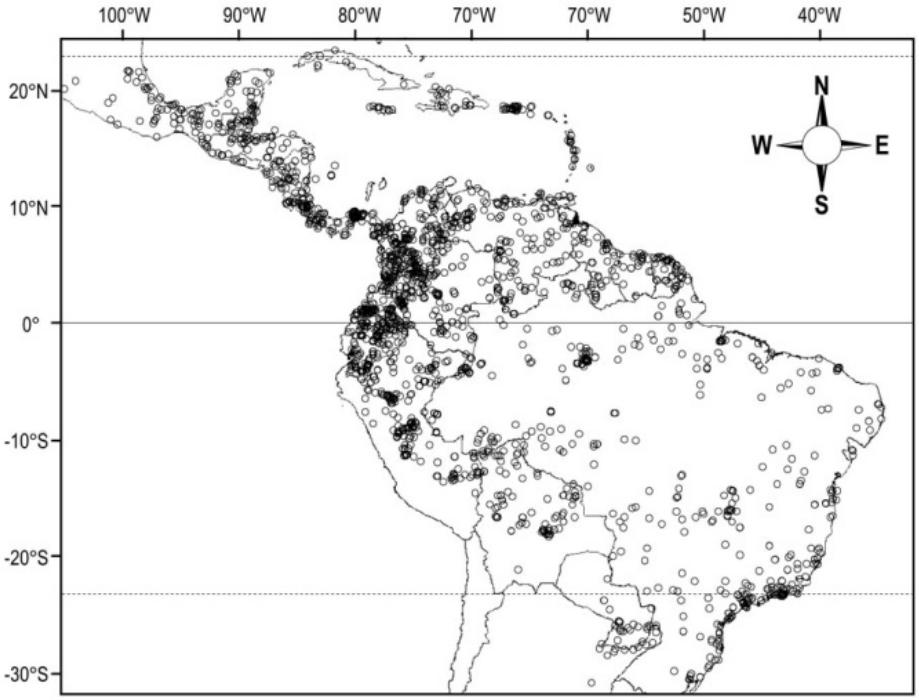
Continental-scale patterns of cecropia phenology: Evidence from herbarium specimens

P.-C. Zalamea, P. Heuret, F. Munoz, C.E.T. Paine, C. Sarmiento, D. Sabatier & P.R. Stevenson.

The documentation of global patterns in phenology and the identification of their proximate causes are crucial aspects of understanding how climate change affects ecosystem function. Pioneer plants are very important in successional processes. Along with a revision of the current knowledge on Cecropia phenology, we aimed, i) to describe the flowering patterns of the genus based on herbarium data, and ii) to identify the climatic variables with the highest potential to trigger flowering events. Flowering phenology was recorded from 35 species, which were represented by 3382 specimens. We used Fourier spectral analysis to determine the frequency of flowering, and circular vector algebra to calculate mean flowering dates for annual species. Circular correlations determined potential associations between phenological patterns and abiotic variables. 18, 1, and 7 species had annual, subannual, and continuous flowering phenologies respectively, while for the remainder it was not possible to determine a flowering pattern. For annual flowering species, we identified regions that group species with similar mean flowering dates, and regions that are composed by species with different mean flowering dates. At a genus level, precipitation and temperatures are highly correlated with flowering periodicity. Herbarium flowering phenologies provide a powerful tool to future research in phenology.

Session 37: Free Topics – Forest - Poster **P37-02**

Figure 1: Cecropia herbarium data throughout the neotropical region.



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Session 37: Free Topics – Forest - Poster P37-03

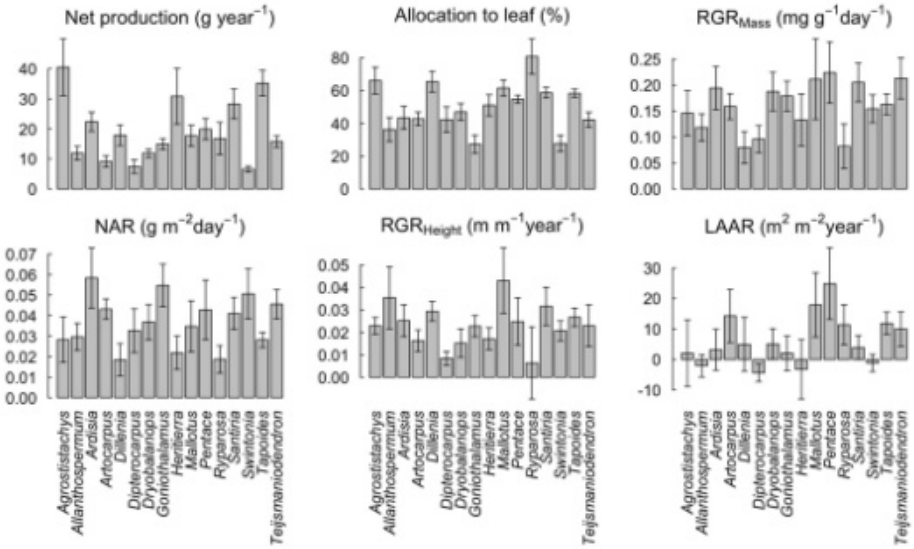
Growth properties of 16 non-pioneer rain forest tree species differing in sapling architecture

M. Aiba & T. Nakashizuka

Sapling architecture may be an important determinant of performance traits, such as light interception and height growth, but few studies have examined the direct relationship between sapling architecture and growth properties. To study this relationship, we analysed the growth properties in saplings of 16 Bornean tree species that differ in architecture.Annual net production significantly differed amongst species and was positively correlated with total above-ground dry mass, total leaf area and crown area. In contrast, the net assimilation rate was weakly but negatively correlated with these architectural traits. The net assimilation rate was virtually independent of leaf size and specific leaf area. Relationships between sapling architecture and relative growth rate in mass were weak.The relative growth rate in height did not significantly differ amongst species, although their total dry mass, a proxy for extension cost, varied four-fold across species. This is because the proportional increase in net production with total dry mass cancelled out the higher extension cost. All architectural traits, including leaf size and specific leaf area, failed to predict height growth rate.Overall, relationships between architecture and function in tropical tree saplings seem unexpectedly weak at least under shaded conditions.

Session 37: Free Topics – Forest - Poster **P37-03**

Figure 1: Juvenile growth properties of 16 tropical tree species.



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Session 37: Free Topics – Forest - Poster P37-04

Collapse of a keystone resource in a maturing forest

L. Albrecht & E.K.V. Kalko

Figs (Ficus sp.) are considered as keystone resources for frugivores in many tropical forests mainly because of their abundance and year-round fruit availability. On the 15.6 m2 Barro Colorado Island in Panama, Ficus is with more than 1,200 recorded individuals of 17 species a very abundant genus of woody plants. Of those, two free-standing fig species, F. insipida and F. yoponensis, comprise about three quarter of the whole community (about 800 trees). However, free-standing figs are pioneer species and usually reach their peak in tall secondary forest. A 30-year study on fig dynamics on Barro Colorado Island (BCI), a field station of the Smithsonian Tropical Research Institute (STRI) reveals a dramatic decline in free-standing figs with almost no trees left in the mature forest. Based on the figs' biology we assume that this decline represents a normal stage of forest succession, further accelerated by severe droughts like in El Niño years.

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Session 37: Free Topics – Forest - Poster P37-05

Epiphytic biomass and canopy microclimate in lowland cloud forest and lowland rain forest of French Guiana

C. Gehrig, A. Obregon, J. Bendix & S. R. Gradstein

Studies on bryophyte diversity in lowland forests of northern South America have shown the existence of a new type of cloud forest, the “Tropical Lowland Cloud Forest” (TLCF). TLCF occurs in river valleys below 400 m with high air humidity and radiation fog, and is very rich in epiphytes. We analyzed the coverage and biomass of epiphytic cryptogams, ferns and flowering plants in six standard height zones on 48 canopy trees in TLCF and lowland rain forest (TLRF) of Central French Guiana. In each study site, air temperature and relative air humidity were measured 290 days between September 2007 and June 2008 using data-loggers installed in the crowns of 20 canopy trees. TLCF trees were more densely covered with epiphytes and held higher amounts of epiphytic biomass than TLRF trees. Microclimate data showed significant differences between TLCF and TLRF. We propose that the greater abundance of epiphytes in TLCF is due to altered forest microclimate conditions, in particular higher air humidity.

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Session 37: Free Topics – Forest - Poster P37-06

Epiphyllous bryophyte diversity in lowland rain forest and lowland cloud forest of French Guiana: first results

M. Hoffstätter, C. Gehrig, A. Obregon, J. Bendix & S. R. Gradstein

Tropical Lowland Cloud Forest (TLCF) has recently been described as a new forest type. In contrast to tropical lowland rain forest (TLRF), TLCF frequently experiences radiation fog in the mornings, which alters forest microclimate and supposedly leads to a greater richness of epiphytes. So far, TLCF has been found in moist river valleys in French Guiana at altitudes between below 400 m, but it probably has a much wider distribution. We analyzed species diversity of epiphyllous liverworts and mosses in the understory of forty 10 x 10 m plots in TLCF and TLRF of central French Guiana. First results show strong differences between the two forest types. In TLCF, epiphylls are much more abundant and divers than in TLRF, and individual species tend to occur more frequently. Palm leaves seem to carry more species than other leaf types. Regardless of leaf type, light gaps promote a higher diversity of epiphylls than shaded sampling plots. Some of the species recorded are new to French Guiana.

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Session 37: Free Topics – Forest - Poster P37-07

Spectral Properties of Selected Plants from a Tropical Mountain Ecosystem - Traits for Plant Functional Types

Dietrich Göttlicher, Janina Albert, Jörg Bendix, Thomas Nauss and Rütger Rollenbeck

Reflection and transmission of sunlight from different leafs is measured with a spectroscope within the range of 305 to 1705 nm. To enable the possibility to compare the results individually and calculate further statistical key figures, a standard procedure is used. The measured leaf area is set to one for all species.
The species were collected in the study area of the "Estacion Cientifica Rio San Francisco" in southern Ecuador in the framework of the German research unit "Biodiversity and Sustainable Management of a Megadiverse Mountain Ecosystem in South Ecuador". The plants cover different vegetation units from different types of tropical mountain forest to paramo vegetation, disturbed sites and crop plants.
Objective of the appraisal is to determine if the differences in the vegetation spectral properties significantly delineate functional vegetation groups. If so the reflection and transmission of the leafs can be used as traits for plant functional types (PFT).
Finally, these measurements are used as new input values for the plant functional types of the soil-vegetation-atmosphere transfer scheme which is used to analyse the energy and water fluxes due to changes in vegetation cover or in climatic variables.

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Session 37: Free Topics – Forest - Poster P37-08

Prevention of burning: the first step for mountain forest restoration

D. Lippok, S. Beck, K. Wesche & I. Hensen

In parts of the eastern Cordillera (“Yungas”) of Bolivia, mountain forests have been converted into mountain savannas (“pajonales”) by the influence of man-made fires. There is great interest in restoring the destroyed mountain forests because of the crucial role they play in the hydrological cycle and in preventing soil erosion. The aim of our study, therefore, was to achieve a better understanding of the successional processes which occur following fire.The floristic composition and species abundance of a chronosequence of three differently aged savanna sites (1 , 2 & 15 years) were studied and compared with results from a secondary forest (>50 years). For floristic classification, a detrended correspondence analysis (DCA) was performed. As expected, the main gradient of the DCA diagram was represented by the age of the sites. With increasing age, height and coverage of the shrub layer increased; as did the amount of woody plants. A high species turnover was observed, and of the 3 sites, the floristic composition of the 15 year old site showed the closest similarity to that of the secondary forest. Our data reveal that the protection of the savanna sites from periodical burning results in a rapid increase in several woody plant species that form part of the native mountain forest community. Therefore, any forest restoration measures for the region should primarily focus on the prevention of burning.

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Session 37: Free Topics – Forest - Poster P37-09

Epiphytic filmy ferns as indicators of Tropical Lowland Cloud Forest

J. Marquardt, C. Gehrig, A. Obregon, J. Bendix & S. R. Gradstein

Recent studies on bryophyte diversity in lowland forests of northern South America have shown the existence of a new type of cloud forest, the Tropical Lowland Cloud Forest" (TLCF). TLCF is very rich in epiphytes and occurs in river valleys below 400 m, where radiation fog in the mornings provides high air humidity. We explored the characteristics of TLCF in a lowland area (200-400 m) near Saül, central French Guiana, using Hymenophyllaceae (filmy ferns) as indicator taxa. Diversity and vertical distribution of epiphytic filmy ferns were analyzed on 20 trees in four 1-ha plots, two plots in humid valley forest (TLCF) and two in dryer rain forest (TLRF) on nearby slopes. Species richness was significantly different in the two forest types. Moreover, of about half of the species found only occurred in TLCF, whereas all species of TLRF were present in TLCF. Comparison of the height zones indicates an upward shift of the vertical ranges of some rain forest species towards the canopy of TLCF. We attribute the detected patterns to higher air humidity in TLCF.

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Session 37: Free Topics – Forest - Poster P37-10

Biomass allocation and vital rates in seedlings of eight cloud forest tree species in response to variable light in shade house conditions

A. Saldaña-Acosta, J.A. Meave & L.R. Sánchez-Velásquez

Patterns of above- and below-ground biomass allocation in seedlings of eight cloud forest tree species of western Mexico were evaluated under varying controlled light conditions, in order to analyse the relationships between vital rates (growth, survival) and four morphological traits (SLA, stems, leaves and roots). For six species all traits differed between light levels. SLA was largest for five species in the darkest conditions (e.g. Fraxinus uhdei, Quercus salicifolia and Magnolia iltisana); only Juglans major had a large SLA at the highest light level (377.47 cm2 g-1). Relative growth rates (RGR) of the former five species significantly differed between light levels, and for three species they were correlated with SLA. In general, all species grew better in the highest light levels. Allocation to stem, leaves and roots were strongly correlated with the RGR of five species. Survival varied significantly between treatments only in the case of Simplococarpon purpusii, and this vital rate was correlated with all morphological traits. Peto and Peto's test showed a significantly larger survival of its seedlings in the highest light level. Our results show a wide range of resource allocation patterns in seedlings and emphasise the role of morphological traits in this variation.

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Session 37: Free Topics – Forest - Poster P37-11

Distribution of neotropical palm species along an altitudinal gradient: implications for their conservation.

M.A. Pérez- Farrera, R. Martínez-Camilo, N. Martínez-Meléndez, S. López & c. Tejeda-Cruz

We studied the palm community in an altitudinal gradient on a mountain forest in southern Mexico. This forest has two slopes that had variations both in their abruptness and humidity conditions: a) the Atlantic slope is drier and has a gentler slope, and the Pacific slope, which is more humid and abrupt. Ten palm species were recorded (eight Chamaedorea spp and two Geonoma spp) along the two mountain slopes. Eight species were found in the Atlantic slope , while ten species were recorded in the Pacific. We found a non-linear relationship between altitude and species richness with a maximum number of species at the mid range in the Pacific slope, but not in the Atlantic slope. When low altitude species associated to high human disturbance were excluded, we found a negative relationship between altitude and species richness for both slopes. In general, species dominant at higher altitude grow in colonies; in contrast, solitary species become dominant at lower altitudes. One-way Anova showed that average altitude is significantly different within all species. Our results suggest that lower altitude species are more susceptible to human impacts; therefore conservation efforts should be directed to solitary species at lower altitude.

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Session 37: Free Topics – Forest - Poster P37-12

Temporal stability analysis of throughfall in tropical montane forests

H. Todt, H. Dalitz, R. Gliniars, M. Oesker & W. Musila

Throughfall is the part of precipitation that passes through the crown of trees and falls onto the ground. According to our hypothesis, throughfall is a main factor determining water and nutrient transfer from the canopy to soil. Thus it is an important abiotic factor in creating niches in which different tree seedlings germinate and establish. The aim of this poster is to describe a method of calculating the temporally persistence of existing heterogenic patterns of throughfall. For this purpose only water amounts are shown exemplarily. But other chemical parameters (pH, electrical conductivity, concentration of ions) were measures as well.Throughfall was collected on daily basis during a 6-year field campaign (2002-2008) in Kakamega Forest, Western Kenya. An comparative measuring campaign was conducted during April 2009 in Budongo Forest, Uganda. The results show that some locations have a more temporally stable water input than others, resulting in different water regimes for those locations. According to our hypothesis this would translate into different temporally stable ecological niches.Locations of high temporal stable water input can be used as monitoring sites for defined purposes: locations that receive permanently the least amount of throughfall can be used as monitoring sites against drying out.

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Session 37: Free Topics – Forest - Poster P37-13

On the use of leaf wetness sensors for estimating dewfall in a tropical lowland cloud forest

P. Vonhoene, A. Obregon, J. Bendix, C. Gehrig, S.R. Gradstein, A. Pardow & M. Lakatos

Leaf wetness sensors emulate the surface of a leaf and are primarily used to detect periods of leaf wetness caused by rain, dew or fog by measuring electrical resistance. We used several leaf wetness sensors (model 237, Campbell Scientific) to estimate dewfall in a valley of tropical lowland cloud forest in central French Guiana, which is frequently affected by fog, and on a nearby slope with drier tropical rain forest. For many epiphytes, dew may serve as an additional water source. Average dew duration is significantly longer at the valley site compared to the hill site. Generally, dew duration is longest in the rainy season. Further, dew amount was calculated with additional parameters using an approximative approach. Times of calculated dewfall are in good accordance with dew periods derived by the leaf wetness sensor but correlation between calculated dew amount and electrical resistances of the sensor is only weak. However, leaf wetness sensors can be used effectively in combination with other sensors to distinguish between rainfall, fog drip and dew deposition.

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Session 37: Free Topics – Forest - Poster P37-14

Reduced epiphyte diversity on isolated remnant trees – a consequence of dieback of resident flora or reduced recruitment?

F.A. Werner & S.R. Gradstein

Constituting the smallest possible forest fragment, isolated trees are model systems for the study of processes related to forest fragmentation. In the present study we test whether reduced abundance and species richness of vascular epiphytes on trunks of isolated trees in moist montane Ecuador are related to 1) increased mortality of resident epiphytes, 2) reduced recruitment compared to intact forest.Mortality of well-established, post-seedling life stages of individually marked epiphytes was greatly increased after 3 years following the isolation of their host trees in a clearing (72% vs. 11% on control trees in forest), with highest losses among hygrophytic taxa. Rates of epiphyte seedling establishment on isolated trees were reduced by 90% relative to forest levels. Seedling assemblages on trunks of forest trees were diverse and characterized by hygrophytic understory ferns, those on isolated trees were poor and dominated by few xerotolerant canopy taxa. Colonisation probability on isolated trees was significantly higher on trees closer to forest, suggesting an influence of dispersal constraints.Our results show that both increased mortality of resident epiphytes and lowered recruitment shape epiphyte assemblages on isolated trees. We conclude that microclimatic changes are key predictor for the composition of epiphyte communities of disturbed habitats.

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Session 37: Free Topics – Forest - Poster P37-15

Leaf Photosynthetic Traits of Tree Species in the Tropical Mountain Rainforest of South Ecuador

B. Wittich, V. Horna & Ch. Leuschner

Measurements of leaf gas exchange were made along an elevational gradient in the tropical mountain forest of South Ecuador. We aimed to characterize the photosynthetic leaf traits of the tree species at three different elevations. Measurements were made on 13-15 trees at 1000, 2000 and 3000 m a.s.l. For each tree, we measured light and CO2 response curves at the mean ambient temperature. We analyzed the photosynthetic response to photosynthetic photon flux density based on a rectangular hyperbolic response and we used the biochemical model of Farquhar et al. (1980) for the response to CO2 variation.Mean foliar respiration varied from 0.36 ± 0.07 µmol CO2 m-2 s-1 at the highest elevation to 0.79 ± 0.05 µmol CO2 m-2 s-1 at 1000 m elevation. Mean apparent maximal photosynthetic rate at ambient CO2 concentration was highest at 2000 m (9.23 ± 0.41 µmol CO2 m-2 s-1) and reached only 7.11 ± 0.48 µmol CO2 m-2 s-1 at 1000 m and 4.4 ± 0.51 µmol CO2 m-2 s-1 at 3000 m elevation.Differences in photosynthetic traits with elevation seemed to be mainly related to the variation in ambient temperature. Further evaluation of photosynthesis response at varying temperature, will help to determine the level of vegetation plasticity to climatic variation.

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Session 37: Free Topics – Forest - Poster P37-16

Research trails affect the abundance of a tropical bromeliad

L.L.B. Wörner, R. Bialozyt, B. Ziegenhagen & E.W. Heymann

Vascular epiphytes are important and sensitive components of tropical forests, whose diversity has been shown to be affected by large-scale forest devastation. In the present study, the effect of research infrastructure given as a grid of small pathways was analysed in the area of the DPZ Research Station Estación Biologica Quebrada Blanco in the Peruvian rainforest.The abundance of Guzmania vittata has been investigated next to the existing pathways as well as in the primary forest. Plant monitoring was accompanied by measuring relative light intensities with simple methods using luxmeters and a digital camera. Fisher´s exact test revealed a significant effect of the small-scale disturbances since G. vittata occurred in higher densities (more host trees colonized) next to the pathways than within the primary forest. It was not possible to correlate the abundance of the bromeliad and light availability. We conclude that already small-scale disturbances by research infrastructure had an influence on the study species which may in consequence have inferences for interacting other species as well. Causes for the increased abundance of G. vittata at disturbed micro-sites may include the facilitation of anemochorous dispersal through altered micro-climate (wind current) and/or the availability of favourable conditions for establishment and growth.

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Session 37: Free Topics – Forest - Poster P37-17

Río Changuinola, Panama: The locality with the highest alpha-diversity of vascular epiphytes in the tropical lowlands

S. Laube, G. Mendieta-Leiva, L. Nauheimer, W. Wanek, H. Kreft, G. Zotz

The taxonomic composition of the vascular epiphyte flora at the Rìo Changuinola, Panama, and its biogeographical relationships were examined and complemented with an analysis of physiological parameters related to plant water and nutrient relations. In an area of c. 1,000 ha we found a total of 476 species. This marks a new diversity record among lowland rainforest sites. The floristic similarity with other Neotropical lowland sites decreased with distance and relative position towards the Andes. The proportion of species with the water-saving crassulacean acid metabolism (CAM) was low compared to other studies and many of these species showed a rather weak expression of this photosynthetic pathway. Also noteworthy, 15% of the species in the study area were previously not found a such low elevation. This suggests high local water availability which in turn is allows the maintenance of such high species diversity.

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Session 37: Free Topics – Forest - Poster P37-18

Stem girth variation of tropical tree species at Danum, Malaysia, in response to water availability.

M. Lingenfelder & D.M. Newbery

The lowland dipterocarp-forest at Danum (Malaysian Borneo) is perturbed by droughts that affect tree species' growth, mortality and recruitment. While species seem adapted to this perturbation regime of the past magnitude, possible future increase in the frequency and intensity of droughts related to global climatic change may threaten the structural stability of these forests in South-East Asia. Little is known, however, even of the immediate, short-term responses of tropical trees to drought stress. Over the past 2.5 yrs, we have monitored the size of tree stems with conventional (n = 100) and electronic (n = 20) dendrometer bands and also recorded soil water availability at high temporal resolution (2 weeks and 30 min, respectively) This enabled us to directly assess the responses of six key tree species in the over- and under-storey at Danum. Overall, trees showed diurnal stem expansion and shrinkage, and these changes in size were closely related to soil water status. However, over several months, responses varied across species and appear influenced by initial tree size and/or social status. These preliminary results (analysis ongoing) suggest a strong immediate dependency of tree growth on water availability and the data is expected to reveal species-specific responses to drought.

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Session 37: Free Topics – Forest - Poster P37-19

Advantage and conservation status of vascular plants in East African rain forests

K. Rembold, I. Theisen, E. Fischer

The conservation status and advantage of vascular plants are studied in situ in two East African rain forests: Budongo Forest in Uganda and Kakamega Forest in Kenya. In both forests vegetation mapping was already carried out in each six different disturbed forest types. All together the mapped area amounts 2,4ha and includes 118 families and 657 species of vascular plants. Additionally to their frequency in our study areas and their worldwide distribution all plant species are verified concerning their ecological importance for animals and their use for humans. This approach shall assure that e.g. important keystone species get the same attention than rare plant species. The availability and composition of epiphytic plant species is under particular consideration as due to their demanding habitat requirements they are supposed to be suited as bioindicators for the different forest types and disturbance. Based on this data and in close cooperation with the Botanical Garden of Maseno (Kenya) we establish an ex-situ conservation collection of the endangered plant species of both forests.

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Session 38: Free Topics - Vertebrates - Talk T38-01

How do primate communities vary among sites in an intact Neotropical forested landscape?

S. Palminteri, G.V. Powell, C.A. Peres, C.A. Kirkby, W. Endo, & D.W. Yu

Primates are relatively well studied, yet few studies compare primate community structure across spatially distinct sites. We examined primate community composition with respect to environmental and human use variables at two spatial scales in southeastern Peru. This region's intact mature floodplain and nonflooded forests have one of the highest likelihoods for long-term conservation along the Andes-Amazon ecological interface and support one of the world's highest diversity of primates. We determined species abundance on 36 sets of transects at five sites representing approximately 22,200 km2. Hunting and elevation explained almost half the variation in overall primate abundance, while habitat type, river barrier, and management regime explained an unexpectedly small portion of overall abundance. Individual species abundances were, however, affected by different combinations of these predictor variables, with hunting more important in predicting larger species' abundance and habitat type and river barrier more important for smaller species. Much of the substantial variation in species abundance across our study area remained unexplained by our predictor variables and appeared to reflect geographic location, a premise supported by community analysis. These results complement the detailed ecological and behavioural knowledge assembled on individual primate species at single sites.

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Session 38: Free Topics - Vertebrates - Talk T38-02

Food abundance impacts activity patterns in the Central-American agouti

L. Suselbeek, B.T. Hirsch, R.W. Kays & P.A. Jansen

Foraging theory says that animal behaviour reflects a trade-off between acquiring resources and avoiding predation. Prey species typically rest in safe havens (e.g. burrows) and then risk predation when they actively forage. This theoretical framework predicts that animals change the balance between foraging and predator avoidance in response to temporal variation in predation risk, food abundance or both. We studied how temporal activity patterns varied with resource abundance, in the Central American agouti on Barro Colorado Island, Panama. Between October 2008 and March 2009, agoutis were captured and radio-collared in areas that widely varied in the abundance of three major food resources – two palm species and a canopy tree species – from very low to very high. Activity data was collected using an Automated Radio Telemetry System consisting of 7 towers that automatically scanned radio transmitter frequencies at fixed time intervals (5 min). Activity was quantified based on changes in their radio-signal. We found that total daily activity of agoutis increased significantly when resources become scarce. We conclude that agoutis extend their foraging bouts into more risky periods when food becomes scarce, thereby shifting the hunger-fear balance and increasing their risk of predation.

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Session 38: Free Topics - Vertebrates - Talk T38-03

A community-wide stable isotope analysis reveals dense trophic species packing in a Malagasy primate community

M. Dammhahn & P.M. Kappeler

Understanding the processes determining the composition of animal communities is a central issue in ecology. The dry deciduous forests of western Madagascar are inhabited by one of the world's most species-rich and dense primate communities. Partly because detailed data on the ecology of many species is preliminary, the mechanisms structuring and maintaining these communities are still poorly understood. We therefore aimed to explore the trophic community structure of 8 co-occurring primate species in Kirindy forest. Based on stable nitrogen and carbon isotope data from hair samples, we calculated species' "niche-spaces" and a community-wide measure of trophic structure, recently proposed by Layman et al. (2007, Ecology 88:42). Our data revealed feeding niche separation between some mainly folivorous and frugivorous species but high inter-specific overlap among closely related omnivorous species. Thus, feeding niche differentiation can only partly explain the structure of this species-rich primate community. Stable isotope mixing models revealed that larger primate species are the main prey of the fossa, the top predator in this community. Hence, predator-mediated coexistence is unlikely to explain the co-occurrence of small omnivorous species. Instead, dense trophic species packing of omnivores might be facilitated by heterogeneous distribution on a small spatial scale.

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Session 38: Free Topics - Vertebrates - Talk T38-04

Amphibian hotspots in West Africa revisited – do patterns change with finer resolution?

J. Penner, A. Hillers, K.M.B. Herkt, J. Fahr, M.-O. Rödel

One third of the world's known amphibians is listed as threatened. Robust and precise distribution data are required for the design and implementation of efficient conservation plans. For most tropical regions, these are only available at coarse resolutions based on expert opinion, e.g. the Global Amphibian Assessment. Employing the MaxEnt-algorithm, we modelled the distributions of 179 amphibian species in West Africa with a spatial resolution of 1 km². Our analysis of the relative importance of 18 environmental variables revealed precipitation and land cover as significant ecological drivers for most of the modelled distributions. Hotspots of diversity and endemism were identified in SW Ghana and in the transboundary region between Liberia, Ivory Coast and Guinea. The increased resolution allowed a refined delineation of previously highlighted areas irreplaceable for the conservation of amphibians. Subsequently, we used the modelled distribution ranges in a gap analysis to test the effectiveness of the current network of protected areas. We further compared the refined hotspots maps to historical refugia suggested by an independent genetic analysis. We conclude that biodiversity patterns change substantially with spatial scale, with far-reaching implications for the design of efficient conservation strategies.

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Session 38: Free Topics - Vertebrates - Talk T38-05

Habitat use and diet of capybara (Hydrochoerus hydrochaeris: Rodentia, Hydrochaeridae)in the floodplain savannas of the Orinoco, Colombia

L.F. Vega, P. Stevenson & K.M. Wantzen

Seasonal floodplain wetlands of the neotropical savanna biomes are threatened by drainage and other impacts on the floodpulse. Sustainable management of the floodpulse-adapted biota appears to be the most reasonable use type to maintain the natural characteristics of these important wetlands. This study reports feeding preferences and habitat use by capybara (Hydrochoerus hydrochaeris: Rodentia, Hydrochaeridae) in the floodplain savannas of the Orinoco, Colombia, as a subsidy for management concepts and conservation planning. The Orinoquian flooded savanna is composed by a matrix of herbaceous vegetation dominated by guaratara (Axonopus purpusii), víbora (Imperata contracta) or rabo de vaca (Andropogon bicornis) and riparian forests. The main habitat requirements of capybara are water bodies, dry places to rest, forests and grazing areas. Population densities of capybaras varied significantly between sites of different plant associations and hunting pressure. A total of 52 species of plants was eaten. The selectivity for individual plant species was significantly related to habitat type. The grasses guaratara, rabo de vaca and Panicum sp. 2, covered most of its diet (rainy season: 52,9%; dry season: 55,3%. An integrative management concept, based on an ecological classification of the wetlands (see poster) is urgently needed to preserve the Orinoquian flooded savannas in Colombia.

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Session 38: Free Topics - Vertebrates - PosterP38-01

The possible role of Steroidogenic Factor 1 in the mechanism of sex determination in green turtle, Chelonia mydas

A. Barlian, D. Vebiyanti & S. Bahri

Green turtle, Chelonia mydas, is one of endangered turtles that live in Indonesian ocean. In Chelonia mydas sex is determined by egg's incubation temperature, therefore global temperature is very important for determining the sex ratio and consequently the survival of this species. However, in Temperature-dependent sex determination (TSD) animal such as green turtle, seems to share the common genes with mammal in the mechanism of sex determination. The results with green turtle showed that Sf1 (Steroidogenic Factor 1) is expressed in differential manner during thermosensitive period (TSP). Sf1 has been expressed before the onset of TSP, even before the formation of gonads and the pattern of Sf1 expression is different between gonads incubated in female producing temperature and male producing temperature. Sf1 is also still present in green turtle gonadal cell culture showing that cell culture of this endangered species will become a valuable model for studying the mechanism of sex determination in the future, especially for endangered species such as green turtle. Unraveling the mechanism of sex determination in TSD animals will be very crucial in evolution and sex determination process in general and perhaps the conservation of this endangered species in the future.

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Session 38: Free Topics - Vertebrates - PosterP38-02

Ecology of a newly discovered population of the critically endangered greater bamboo lemur, prolemur simus, in central Madagascar: Linking local communities and conservation.

R. Dolch, J.L. Fiely

The Greater Bamboo Lemur (Prolemur simus) is among the world's most endangered primates and the rarest lemur species of Madagascar. Distributed widely over the island in historic times, this bamboo specialist has been reduced to several isolated populations occurring in the SE of Madagascar. We here present the discovery of a new and distinct population in Central Madagascar that has been monitored since July 2007, integrating local villagers and para-scientists. With 6 lemurs radio-collared, more than 400 GPS coordinates taken reveal animal movements over a 12 months period whose analysis permits testing hypotheses about group dynamics, home range size and seasonal activities. Additional data on feeding behavior and bamboo density will equally be used for a concerted species action plan leading to getting protection status for Prolemur simus habitat, currently under threat from mining. Research presented has been generously supported by Conservation International, the Margot Marsh Biodiversity Foundation, and the Primate Action Fund.

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Session 38: Free Topics - Vertebrates - PosterP38-03

Are figs a keystone resource for mammals because of their high calcium content?

L. Albrecht & E.K.V. Kalko

Figs (Ficus sp.) are often considered as keystone resources in tropical forests because of their phenology and high sugar content, both of which make figs a valuable food resource for many frugivorous animals. Recent studies from Asia and Africa revealed that calcium contents in figs can be several times higher than in other zoochorous fruits in a given area. It has therefore been suggested that figs may be a particularly important keystone resource for mammals, as calcium is the most important and often limited mineral during pregnancy and lactation. We analyzed the calcium concentrations of the most abundant Ficus species and other fruits eaten by the common fruit bat Artibeus jamaicensis in a tropical lowland forest on Barro Colorado Island, Panama. Our results show that calcium content of neotropical figs is generally several times higher (3.5 – 18.1 mg/g dry weight pulp) than in other fruits (0.5 – 3.8 mg/g). We present preliminary data on different minerals in primarily bat-dispersed figs and give a brief overview on first results obtained by feeding experiments and faecal analysis on potential differences in assimilation rates of minerals in relation to reproduction in A. jamaicensis and discuss the broader implications of this research into other areas.

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Session 38: Free Topics - Vertebrates - PosterP38-04

Composition and Diversity of Ramphastos Toucan Foraging Flocks at La Selva, Costa Rica

R.E. Callahan & M.A. Patten

We evaluated the temporal and spatial relationships between Ramphastos toucan foraging flock composition and fruit availability at La Selva Biological Station, Costa Rica. We hypothesized that fruit density affects species composition of frugivorous flocks and that flock composition and diversity would fluctuate as fruit abundance changed in the tree crown. Foraging observations of the Chestnut-mandibled Toucan (R. swainsonii) and Keel-billed Toucan (R. sulfuratus) were recorded from 4-29 July 2008 and 5-17 January 2009 (N=320); observations included determining species and abundance of other frugivores foraging in the focal tree. Fruit abundance data from focal trees were recorded to illustrate changes within a single tree over the study period. Toucans were observed in 18 focal trees during the 2008 study period and 11 during the 2009 study period. We found that fruiting phenology of individual trees and interspecies interactions of tropical frugivores determine composition of foraging flocks in this dynamic system.

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Session 38: Free Topics - Vertebrates - PosterP38-05

Using GPS-tracking to elucidate animal ranging patterns where radio-tracking is not feasible: The example of an enigmatic Malagasy carnivore

M.-L. Lührs & P.M. Kappeler

The ranging behaviour of a species is crucial for the study of social organisation as well as for the planning of conservation strategies in fragmented habitats. Information about home range size and movement of a species is usually obtained via radio-tracking. Radio-tracking is, however, of limited feasibility when animals are far-ranging and occurring in areas which are difficult to access. In our study of the social organisation of the fossa (Cryptoprocta ferox), Madagascar's largest extant carnivore, we use GPS-tracking to investigate the species' ranging behaviour, which was estimated 12 years ago based on radio-tracking in an area of limited access. In 2008, we equipped 1 male and 1 female with GPS-collars, which logged the position of the individuals at 20-min-intervals over a period of 2 months. The home range areas obtained by this technique turned out to be of double (for the female) and triple (for the male) size than former estimates based on radio-tracking. GPS-tracking has revealed a ranging pattern, which was impossible to detect via radio-tracking. Given the small size of modern GPS-devices, GPS-tracking is expected soon to replace radio-tracking and will be an important means for conservation.

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Session 38: Free Topics - Vertebrates - PosterP38-06

Effect of habitat structure, resources and anthropogenic disturbance on vertebrate's frugivore assemblage in a mountain tropical rain forest (Hainan Island, China)

S.Scotto di Vettimo & W.Liang

The tropical mountain rain forest is one of the rarest and most threatened ecosystems in China. Lowland tropical forest having almost entirely disappeared, it appears as a refuge and contributes highly to the country's biodiversity. In Hainan Island the remaining forest cover is only 4% resulting from a heavy deforestation up to the 90's. The Bawangling National Nature Reserve was created in 1980 in order to protect the rare and endangered Hainan gibbon. The objective of the study is to assess the relations between habitat variables (forest structure, floristic composition, fruiting tree diversity and abundance) and the assemblage of frugivorous vertebrates. We compared two sites corresponding to two tropical rain forest types at an altitude comprised between 800 and 1200 m along an anthropogenic disturbance gradient. We sampled 80 plots of 500m² representing a total surface of 4 ha for vegetation structure. Densities, diversity and species richness of mammals and birds were estimated by line transect distance sampling method. The abundance and density of fauna was negatively affected by human direct (hunting) and indirect (logging) impact. Factors such as vegetation structure and level of anthropogenic disturbance were discussed to determine a possible conservation strategy.

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Session 38: Free Topics - Vertebrates - PosterP38-07

Birds assemblages for ecological indication in a neotropical mountain forest

C.Tejeda-Cruz & A.E. García-Ramírez

Indicator species are organisms whose characteristics may be used as a criterion for evaluating attributes too difficult, expensive or inconvenient to measure for environmental conditions of interest. Understanding ecological effects of anthropogenic stresses on natural ecosystems is essential for conservation planning. Given the speed at which these anthropogenic changes are taking place, reliable methods to select species and species assemblages to monitor environmental and ecological change are urgently needed. We adapted the Indicator Value method to find indicator bird species assemblages that best represent the degree of conservation of a tropical mountain forest system in southern Mexico. Furthermore, we analyzed two data sets (1996 and 2005), to evaluate the robustness of bird species assemblages in differential time frame and observer experience. We found two bird species assemblages (three species each) that better indicate good conditions for two primary forest types in our area (cloud forest and montane rainforest). Species in the assemblages were robust, both to changes over time and observer experience. We propose that these assemblages should be targeted for long term monitoring within those habitats where they are specific. Our method could also be used elsewhere for a systematic selection of indicator species.

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Session 39: Free Topics - Ants - Talk T39-01

The waste dumps of leaf-cutting ants and their utilization in ecological research.

H. Herz

Leaf-cutting ants (genera Atta and Acromyrmex) are ecologically and economically the most important herbivores in the Neotropics. Large colonies collect hundreds of kilograms of biomass annually to culture a mutualistic fungus in their nest for their own nutrition. However, more than a third of this biomass the fungus does not break down and the ants dump this material as refuse in internal chambers or on external mounds. The Panamanian Atta colombica has an external refuse mound and I will present data on how this intriguing system can be used for ecological research: The refuse dumping activity reflects the size of a colony and can be employed for estimating its herbivory in the ecosystem. Since the refuse stems directly from the fungal culture inside the nest, externally dumped refuse can be used to non-invasively screen the health of a colony in respect of specific parasites that occur as pests in these large farming insect societies. Furthermore, the refuse still has a high nutrient content therefore representing an important factor in nutrient dynamics of tropical forests. It also attracts a highly diverse and specific arthropod community providing an opportunity to study these mounds as a model system for community ecology and theory of island biogeography.

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Session 39: Free Topics - Ants - Talk T39-02

What still can be found in tropical soils – the case of Martialis heureka, the most primitive living ant!

C. Rabeling & M. Verhaagh

A new species of blind, subterranean, predatory ant discovered in the Amazon rainforest is likely a descendant of the early ants to evolve. We named the new ant Martialis heureka, which translates roughly to “ant from Mars, we found it”, because the ant has a combination of morphological characteristics never recorded before. The approx. three millimeters long, pale ant has no eyes and long, slender mandibles. It dwells apparently in the soil and seems to be a specialized predator of some kind of other small soil animal. The ant belongs to its own new genus, Martialis, and subfamily, Martialinae, one of now 21 subfamilies in living ants. This is the first time since 1923 that a new subfamily of ants with living species has been discovered. Analysis of DNA from a leg of the only known specimen confirmed its phylogenetic position at the very base of the ant evolutionary tree. The discovery hints at a wealth of unknown species, possibly of great evolutionary importance, still hidden in the environmentally stable tropical soils of the remaining rainforests.

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Session 39: Free Topics - Ants - Talk T39-03

Tropical parabiotic ants: an unusual partnership

F. Menzel, T. Schmitt & N. Blüthgen

Aggression between ant colonies is ubiquitous. However, ants of the genera Crematogaster and Camponotus often tolerate each other, and certain species of these genera even live together in the same nest (parabioses). In the tropical rainforest of Borneo, parabiotic associations between Crematogaster modiglianii and Camponotus rufifemur are common. It is still unknown whether these associations are mutualistic, commensalistic, or parasitic. We therefore studied the ecological advantages derived from the associations, as well as the chemical and behavioral mechanisms underlying the high interspecific tolerance. Ants use their cuticular hydrocarbons as nestmate recognition cues. Both parabiotic species possess unusually long cuticular hydrocarbons, which are less volatile than shorter ones. Thus, they may cause the unusually high interspecific tolerance between the two species. Moreover, Crematogaster produces a set of hereto unknown cuticular substances, which significantly reduce aggression in Camponotus. Our results further indicate that both species profit from the association. Camponotus follows Crematogaster pheromone trails and thereby benefits from Crematogaster's ability to find food resources. Crematogaster, in turn, profits from nest defense by Camponotus. However, Camponotus was never found without its partner, while Crematogaster can nests non-parabiotically. Thus, Camponotus seems to be more dependent on Crematogaster than vice versa.

Session 39: Free Topics - Ants - Talk **T39-03**

Figure 1: The parabiotic ants Crematogaster modiglianii and Camponotus rufifemur.

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Session 39: Free Topics - Ants - Talk T39-04

Ecology and maintenance of a novel tripartite mutualistic association

C. Leroy, P.J. Malé, A. Quilichini, M.X. Ruiz-González, A. Dejean & J. Orivel

Inter-specific, mutualistic interactions involving ants are widespread in tropical ecosystems and play a key role in shaping biodiversity. Most studies on obligate and highly specific, protective mutualisms concentrated on bipartite associations and only a few systems involving more than two species received attention. We focus here on a novel tripartite association involving an ant-plant, its specific associated ant and a fungus manipulated by these ants. The morpho-anatomical structure of the leaf-domatia differed considerably from the lamina; these specialized structures are colonized by ants very early in the plant's ontogeny. As in any protective ant-plant interaction, the ants defend their host from herbivores and thus favour its vegetative growth. They have however a negative effect on its reproductive success, most probably due to limited space affecting colony size and reproduction. Nevertheless, the impact of such a conflict of interest needs to be re-examined in light of the presence of the third, specific and obligate fungal partner. An exploration of its potential roles in the interaction demonstrated that it could play a crucial role in the maintenance of this association. Moreover, such results lead us to believe that the beneficial outcomes of this tripartite interaction could be more nutritional than protective.

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Session 39: Free Topics - Ants - Talk T39-05

Competition for shared mutualist ants may influence plant performance

A.E. Fleming-Davies

Plants often engage in ant-defense mutualisms, in which the plants provide extrafloral nectar (EFN) to attract the ants, and the ants remove potential herbivores. If the benefit to the plant varies with the number of mutualist ants, and visits by ants decrease in the presence of neighbor plants, then competition for mutualists will occur. I manipulated ant presence on the EFN-bearing neotropical treelet species Colubrina spinosa (Rhamnaceae) to ask if EFN plants compete for mutualist ants. Work was conducted at La Selva Biological Station, Costa Rica. Results suggest C. spinosa plants may compete intraspecifically for ant mutualists. When ants were excluded from C. spinosa saplings growing near a conspecific neighbor, the number of ants on the neighbor plant increased over 2 months (n=80 pairs).In turn, the benefit C. spinosa plants receive from mutualist ants appears to depend on the frequency of visits and number of ants present. I used ant exclusion and artificial nectar addition to induce a wide range of ant presence on 300 C. spinosa saplings over 2 years. Controlling for their size, plants with more ants exhibited increased growth and survival. Therefore, the presence of a neighboring plant could lower plant performance by decreasing ant visits, thus introducing a new source of density dependence. EFN plants are abundant in tropical forests, and interactions among them could be an important influence on the diversity and distribution of tropical plants.

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Session 39: Free Topics - Ants - Poster P39-01

Is extrafloral nectar production induced by herbivores or ants in a tropical facultative ant-plant system?

R.J. BixenmannP.D. ColeyT.A. Kursar

Many plants use induced defenses to reduce the costs of antiherbivore defense. These plants invest energy in growth when herbivores are absent but shunt energy to defense when herbivores are present. In contrast, constitutive defenses are expressed continuously regardless of herbivore presence. Induction has been widely documented in temperate plants but has not been reported from tropical plants. Most tropical plants have higher, more constant herbivore pressure than temperate plants. In this situation, it is hypothesized that constitutive defenses rather than induced defense would be favored. Using natural herbivores of 4 species of Inga saplings on Barro Colorado Island, Panama, herbivore presence was crossed with ant presence to determine their effects on extrafloral nectar production. Analysis of nectar samples revealed that Inga species do not induce nectar production in response to herbivores. This result is not due to an inability of the plants to respond as the plants in this study increased nectar production in response to light and ant presence. Contrary to the dogma in temperate ecosystem plants, these results demonstrate that tropical plants do not induce one type of defense and suggest that the most adaptive defense strategies are different for the two ecosystems.

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Session 39: Free Topics - Ants - Poster P39-02

Influence of aridity and soil on the distribution and diversity of ant assemblages and dominant plant species in the Paraguayan dry Chaco

T. Delsinne, Y. Roisin, J. Herbauts & M. Leponce

Ants like plants are sessile organisms and are tractable for conservation purposes. We were interested in studying the influence of aridity and soil on the α and β-diversities of ant assemblages and in comparing the response of dominant plants to these factors.Ants and plants were sampled along a 400km-long aridity gradient (350-1000mm mean annual rainfall) in Chacoan xeromorphic forests. Along elementary 200m-long transects, ants were collected by pitfall traps and the abundance of 45 characteristic tree and shrub species was recorded. In complement physicochemical properties of the soil were measured.Overall, 197 ant species were collected. Ant α-diversity was neither related to aridity nor to edaphic properties. By contrast, the ant composition was more related to soil than to rainfall conditions. Three faunal complexes were observed: one in the most arid and sandy locality, another one in the most humid locality at the border of the wet Chaco, and a third one found in localities with a large range of precipitations and soils. Plants responded even more finely to these factors. Our results suggest that, in the Paraguayan dry Chaco, dominant plants appear as a good umbrella group for site selection aimed at species conservation.

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Session 39: Free Topics - Ants - Poster P39-03

Ants mediate foliar structure and phytotelm invertebrate diversity in an ant-garden bromeliad

C. Leroy, B. Corbara, A. Dejean & R. Céréghino

Aechmea mertensii (Bromeliaceae) is both a phytotelm and an ant-garden (AG) epiphyte. We used the Self-Organizing Map algorithm to analyse the influence of its associated ant species (either Pachycondyla goeldii or Camponotus femoratus) in French Guiana on the structural characteristics of the plants, and on the diversity of the invertebrate communities that inhabit the tanks. P. goeldii and C. femoratus colonize exposed and partially-shaded areas, respectively. Exposed bromeliads (P. goeldii AGs) are smaller and avoid direct light incidence by adopting an amphora-shape, whereas the ones in the shade (C. femoratus AGs) are larger and forage for light by developing a wider canopy. By coexisting on a local scale, the ants indirectly generate a gradient of available resources (space and food) for the aquatic invertebrates through the phenotypic variability of the bromeliad. The diversity of the invertebrate communities increases with greater volumes of water and fine detritus in the tanks. The highest invertebrate diversity and leaf δ15N values were found in C. femoratus-associated bromeliads. Our results exemplify a complex ant-plant interaction that subsequently affects the biodiversity of a broader range of organisms that are themselves likely to influence nutrient assimilation by A. mertensii leaves in a kind of plant-invertebrate-plant feedback loop.

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Session 39: Free Topics - Ants - Poster P39-04

Acoustic variability in the stridulatory signals of two Pachycondyla ants (Hymenoptera: Formicidae)

E. CROS, R.S. FERREIRA, F.RYBAK & D.FRESNEAU.

Stridulation is a widespread phenomenon in ants. It occurs during several behaviours such as alarm, recruitment, nest immigration, or as an essential part of the courtship behavior of some species. Although stridulation plays a very important role in ants, it is probably still the least understood communication channel and detailed studies on the acoustic characteristics of these signals are scarce. In this perspective, we studied the temporal and frequency parameters of stridulations in males, gynes and workers in two Neotropical ponerine species, P.apicalis and P.verenae, in order to verify the caste and species specificity of these signals. In these species, stridulations have audible and ultrasound components and they present globally homogenous structures. They are composed of bursts of numerous pulses, usually emitted in series. The acoustic analysis demonstrated that the signal produced differs between all three castes of P.verenae. In P.apicalis acoustic variations exist only between males and workers. Furthermore, the stridulatory signals of both female castes diverge between the studied species. * Supported by the Programme AlBan, the European Union Programme of High Level Scholarships for Latin America, scholarship n° E06D101212BR.

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Session 39: Free Topics - Ants - Poster P39-05

Leaf-cutting ant herbivory reduces plant reproductive success

V. S. Barbosa, R. Wirth & I. R. Leal

Foliar herbivory induces plants to allocate photosynthetic products to compensate for vegetative tissue loss. However, this process may come at the expense of reproductive structures. Here we hypothesized that plants harvested by leaf-cutting ants (LCA) – one of the most voracious folivore of neotropical forests – exhibit lower production of reproductive structures, and thus inferior reproductive success in comparison to undamaged plants. We evaluated the reproductive output of seven shrub/tree species frequently used by LCA (Lacistema robustum – Lacistemataceae; Leandra rufescens, Miconia nervosa – Melastomataceae; Psychotria deflexa, Psychotria platypoda, Psychotria racemosa – Rubiaceae; Vismia guianensis – Clusiaceae) in an area of the Brazilian Atlantic forest. During two consecutive years (2006-2008) we monitored different parameters of reproductive success of harvested and unharvested individuals. The results indicated that LCA negatively affect plant reproduction as harvested individuals of different species presented one or more of the following responses: (1) reduced number of flowers per inflorescence; (2) lower ratios of flower/bud, fruit/flower, and seed/fruit; and (3) smaller and lighter seeds. Our findings add a hitherto undescribed mechanism to the manifold impacts LCAs exert on their food plants.

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Session 39: Free Topics - Ants - Poster P39-06

Temperature preferences suggest niche pattern in Bornean leaf litter ants

D. Mezger & M. Pfeiffer

Tropical rain forests constitute the ecosystem with the highest diversity of ant species. In the ongoing dispute about the reasons for this extraordinary species richness niche models are one of the suggested paradigms. Temperature is a classical niche factor for ants as it influences ant metabolism and ant brood development. We studied ant species' temperature preferences in the lowland rainforest in Gunung Mulu National Park, Sarawak, Malaysia in a temperature organ experiment involving 41 species of six subfamilies. For each species we analysed temperature preferences of up to 16 entire ant colonies that cared for brood.Ants preferred temperatures from 16.0°C to 30.7°C for their brood. The ten most common species showed significant differences in their temperature preferences. Some genera, like Pheidole, showed a clearly separation of species among the temperature gradient. Ants from more exposed nest sites preferred higher temperatures than those nesting directly in the soil. We found significant correlations between preferred brood temperature and the temperature in the natural surrounding of the nest, or the degree of plant cover in this area. Our results support the hypotheses that temperature is an important factor for niche differentiation of ants in tropical rain forests.

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Session 39: Free Topics - Ants - Poster P39-07

Vine characteristics and foraging in tropical ants

C. Silveri, S.P. Yanoviak

For central point foragers such as ants, costs increase with increasing travel distance. Thus, it is advantageous for ants to establish foraging trails that provide efficient access to distant resources. Vines are a conspicuous structural component of tropical forests and commonly serve as foraging corridors for ants. Here we examined how two basic physical properties of vines affect foraging patterns in tropical ants: a) vine size (diameter) vs. forager size (body length) across a range of ant species; and b) substrate roughness and foraging velocity in the arboreal species Crematogaster carinata. Our prediction that large ants would be excluded from small vines was not supported; the largest ants (Paraponera clavata and Pachycondyla spp.) occurred on almost the entire range of sampled vine diameters (1-180 mm). Substrate roughness did not significantly affect foraging velocities of C. carinata at roughness magnitudes < 1 mm (ca. 33% of the ants' body length), but average velocities were significantly slower on coarse substrates (particle size ca. 1 mm). Our results suggest that ants are opportunistic with respect to vine use while foraging under natural conditions. However, substrate roughness (e.g., different types of bark) influences foraging speed, which may have broader implications for interspecific interactions and access to patchy resources.

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Session 39: Free Topics - Ants - Poster P39-08

Chemical recognition in an ant-plant mutualistic interaction

E. Cosio

The neotropical ant Pseudomyrmex triplarinus carries out an obligate and complex symbiotic association with Triplaris americana trees. The ants occupy trunk and branch domatia which they coinhabit with coccids and nematodes that serve as a food source. Pseudomyrmex triplarinus reacts aggressively to all foreign, non-Triplaris, beings or objects. This behavior of the mutualistic ant dweller seems to be partially responsible for the success the tree has in disturbed forest areas or forest clearings where it can establish itself readily. Our work focuses on the chemical and behavioral basis of the ant/host tree recognition process. Ant host-selectivity was quantified by monitoring ant pruning behavior towards other plant species around Triplaris trees and further by the rate of removal of leaves pinned onto the trunk. In either experiment, the ants readily identified non-Triplaris species and pruned them. In order to investigate the chemical nature of the ant recognition, filter strips were impregnated with cuticular extracts of Triplaris species vs. untreated controls and attached to Triplaris americana tree trunks which hosted ants. Filter strips treated with leaf wax extracts received significantly less attention than control strips. There was a good correlation between ant visits and damage to the filter strips. The experiments suggest that P. triplarinus recognizes surface chemicals of their host tree, more than the texture of the carrier material. Thus the cuticular surface chemistry of T. americana leaves was investigated by GC-MS analysis using two different extraction methods that yield extracts of the epicuticular layer vs. lower cuticular components. Subfractionation is underway to test via in-vivo experiments the effectiveness of particular components of the Triplaris americana leaf surface cuticular chemistry towards ant recognition.

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Session 40: Free Topics - Plant-Insect Interactions - TalkT40-01

Linking interspecific variation in vertebrate seed predation, insect seed predation, and pathogen attack to fruit traits in tropical woody plants

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Interspecific variation in predispersal seed survival is related to variation in plant life history traits, including fruit defenses. We quantify how interspecific variation of fruit traits influences predispersal seed mortality due to vertebrates, insects, and fungal pathogens in a natural enemy removal experiment (i.e. vertebrate exclosures, insecticide, and fungicide, respectively) using canopy cranes in Central Panama. We examine morphological and chemical (i.e. toxicity) fruit defenses throughout development among nine canopy species. To investigate interspecific variation in seed survival due to fruit traits, summary statistics of defense traits are included as covariates in an analysis of seed survival in response to removal treatments.We find that morphological and chemical defenses vary widely among species, between immature and mature stages, and within fruit. Trait data for immature fruit help explain patterns of seed survival among species in response to natural enemy removal treatments. Identification of consistent relationships between relatively easily measured fruit traits and the impacts of natural enemies would greatly facilitate generalization to unstudied species and help identify those species at greatest risk under environmental change. This is particularly important in tropical forests, where high species diversity makes it logistically difficult to perform manipulative experiments on every plant species.

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Session 40: Free Topics - Plant-Insect Interactions - TalkT40-02

Caterpillar communities on selected shrubs in the Andes of southern Ecuador – first results

F. Bodner, G. Brehm, P. Strutzenberger & K. Fiedler

The moth fauna of the „Reserva Biológica San Francisco“, in the montane forest zone of southern Ecuador, has previously been studied intensely, identifying this region as a global diversity hotspot of the Lepidoptera. To gain better insight into the role these organisms play in their ecosystem and the mechanisms behind their enormous diversity, we have started to investigate their larval stages. In particular, we focus on community structure at the scale of individual host plants. Here, we present first results on caterpillar communities on 16 selected shrub species (Asteraceae; 3 spp., Piperaceae: 13 Piper spp.). Shrubs (altogether 198 shrubs, range: 6-23 replicate individuals per plant species) were sampled by beating in six-week-cycles during two extensive field campaigns, to gather data on community composition, herbivore density, seasonality and host plant specificity. Caterpillar counts were dominated by gregarious Actinote diceus (Nymphalidae; >60% of individuals). With gregarious species downweighted, communities consisted mainly of Geometridae (63%), followed by Noctuidae (12%). Caterpillar density showed only limited temporal variation, but differed strongly between shrub species. Caterpillar species that are not truly herbivorous (i.e. feeding on lichen, epiphylls, or dead leaves) make up for a surprisingly large fraction of up to 80% on some shrub species.

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Session 40: Free Topics - Plant-Insect Interactions - TalkT40-03

A tale of three islands, two plants and their pollinators: Understanding geographic variation in plant-pollinator interactions and pollinator-mediated genetic structure in two Eastern Caribbean Heliconia (Heliconiaceae)

V. Gowda and W. J. Kress

Among tropical plant-animal systems, plants in the genus Heliconia (predominantly Neotropical; ~200 species) are known for the adaptive interactions with their hummingbird pollinators (Trochilidae). Among the Eastern Caribbean Islands two native species of heliconias (H. bihai and H. caribaea) and 3-8 native hummingbird species have been recorded. The Caribbean heliconias represent a unique sexually specialized plant-pollinator interaction where territorial male Purple-throated Carib hummingbirds (Eulampis jugularis; here after PTC) are specialized pollinators of H. caribaea while traplining female PTCs are specialized on H. bihai.

In this study, we first explore the spatial variations in adaptive interactions between heliconias and hummingbirds by investigating plant-pollinator interactions (visitation frequencies, flowering phenologies and floral characters) on three Eastern Caribbean Islands (St. Kitts, Dominica and St. Vincent). We next quantify using microsatellite markers the role of hummingbird pollinators in engineering the genetic population structure of the two heliconias on each island. We show that heliconia-hummingbird interactions are variable among islands ranging from highly specialized to generalized interactions. Our results on population genetic structure show that territorial male hummingbirds promote inbreeding among H. caribaea populations while traplining female PTCs promote outcrossing within H. bihai.

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Session 40: Free Topics - Plant-Insect Interactions - TalkT40-04

Reproductive isolation by floral scent in three sympatric euglossine-pollinated Araceae species

H. Hentrich & G. Gottsberger

Male euglossine bees are known to collect fragrances at the “perfume flowers” of many Neotropical plant species. Previous studies showed that fragrance composition is decisive for the specific attraction of the bees and for the pollination and reproductive isolation of the plants. However, most of these studies focused on orchids, almost ignoring another family in which numerous euglossine-visited species are found – the Araceae. We studied the pollination biology of three euglossine-visited aroids, Anthurium sagittatum, A. thrinax, and Spathiphyllum humboldtii in the Natural Reserve Nouragues, French Guiana. The plants occurred sympatrically at the site, growing along small creeks and flowered simultaneously. Our study showed that each plant species emitted a floral fragrance bouquet with specific major compounds and was pollinated by a species-specific spectrum of euglossine-pollinators. We suggest that the emission of different floral fragrance bouquets of the three sympatric plant species leads to the clear separation of the main pollinating euglossine species, providing a directed and efficient pollen flow. Since the simple floral (inflorescence) morphology of the studied plants does not support any morphological mechanisms to exclude visitors, as in euglossine-pollinated perfume orchids, floral scent might be of major importance for the reproductive isolation and the sympatric occurrence of these plants.

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Session 40: Free Topics - Plant-Insect Interactions - TalkT40-05

Resin collection in a tropical stingless bee community

S.D. Leonhardt, T. Schmitt, N. Blüthgen

The eusocial stingless bees (Apidae: Meliponini) are important pollinators in tropical ecosystems. Besides collecting pollen and nectar they also collect large amounts of plant resins. Bees use resin for nest construction, nest maintenance, and nest defense; but how these factors influence the resin collecting activity in bee colonies has received little attention. It is also unknown whether bees are specialized on certain resin sources. We found that colonies of two stingless bee species (Tetragonilla collina and Tetragonula melanocephala) in Borneo strongly increase the intensity of resin collection when their colony is attacked by ants, indicating that defense against predators is an important factor in resin use of stingless bees. By contrast, artificial nest damage poorly influenced resin intake. All bee species collected resin from several tree species, particularly from trees of the dipterocarp family. Analysis of network-level specialization suggests that bee species are highly generalized in their resin collecting behavior. Consequently, resin tree diversity may be important for stingless bees in order to provide resin of complementary physiological and chemical properties. However, it remains to be investigated whether the diversity of resins collected is of true importance to the bees or just reflects an opportunistic choice of resin sources.

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Session 41: Free Topics - TalkT41-01

Can non-viable seed enhance fitness? The Sacrificial sibling hypothesis

J. Ghazoul and A. Satake

Many tree species produce far more fruit than eventually mature, with a large proportion of developing fruit being aborted mid way through the development process. Whether this is a maternally controlled late-acting self-incompatibility mechanism, or an expression of inbreeding depression, is difficult to determine. In either case, however, selection is expected to favour early abortion of inbred or incompatible zygotes to minimise loss of resources. In many species this does not occur, suggesting the possibility of adaptive reasons for retaining selfed or inbred seed that are aborted at relatively late developmental stages. We propose that such seed serve an important function in diluting the impact of pre-dispersal seed predators by acting as seed predator sink and thereby increasing the survival probabilities of outcrossed and fully viable seed. We suggest that selfed seed retained and developed through the periods of seed predator attack are effectively offered and sacrificed for the benefit of outcrossed seed.

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Session 41: Free Topics - TalkT41-02

Termite beta-diversity in French Guiana rainforests: high turnover of soil feeders

T. Bourguignon, M. Leponce & Y. Roisin

Termites are major decomposers of organic matter in tropical ecosystems, where they constitute a large part of the animal biomass. This makes them particularly suitable as an indicator group to evaluate the human impact on tropical forest ecosystems: differences in termite assemblage composition between disturbed and primary forests have been repeatedly documented. However, the intrinsic faunal variation among natural ecosystems is largely unknown. Here, we examine the difference in termite species composition and abundance of seven primary French Guiana forests, with particular attention on feeding ecology. Overall, 849 occurrences representing 96 species were recorded. Some species were abundantly distributed among all types of forest whereas others were only found in a single site. This last category mainly concerns soil feeders which generally appear much more site-specific than wood feeders. We put forward that this higher specificity to particular types of forest explains the higher sensitivity of soil feeders to modifications of the environment and makes them particularly suitable as indicators of human disturbance.

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Session 41: Free Topics - TalkT41-03

Multi-scale pattern analyses of a mound building termite species in central Namibia

C. Grohmann, J. Oldeland, D. Stoyan and K.E. Linsenmair

Termites are known as ecosystem engineers since they play a major role in decomposition, nutrient cycling and soil water infiltration. For mound building species, their impact on ecosystem functioning depends on their distribution in space. The distribution patterns in turn vary with the scale regarded and depends on the size of the termite mounds.Our objective was to analyse the patterns of termite mounds, especially to look for factors influencing the establishment of young colonies.The study took place in central Namibia, at the BIOTA observatory Toggekry. Position, size and status (inhabited vs. uninhabited) of all termite mounds build by Macrotermes michaelseni (Sjöstedt, 1914) were documented. For data analyses we used the pair correlation function and further second order statistics.Small inhabited mounds showed a random pattern with a tendency towards clustering, while large mounds were significantly regular distributed. Small inhabited mounds occurred closer to large inhabited mounds and closer to recently died large mounds than expected by random labelling.All results show strong intraspecific competition ruling the mound (termite colony) distribution. The conclusions are discussed focussing on consequences for population growth and ecosystem functioning.

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Session 41: Free Topics - TalkT41-04

Biodiversity islands in the savanna - Botanical characterisation and zonation of termite mounds

I. Kirchmair, M. Schmidt, K. Hahn-Hadjali, G. Zizka

Termite mounds are abundant microhabitats in tropical ecosystems and an important source of landscape heterogenity in Sub-Sahelian West Africa. Flora as well as density, structure and zonation of plant cover on termite mounds in northern Benin were studied and compared to the adjacent savanna vegetation. Altogether 57 abandoned termite mounds of comparable size and similarly effected by erosion located in different types of savanna vegetation and in cotton fields (inside and outside of the W National Park) were investigated.. The mounts are azonal habitats differing by being more densely vegetated and by a flora comprising also species not found in the surrounding savanna. Plant functional types like succulents and climbers as well as representattivews of some systematic groups (e.g. Capparaceae) are much more abundant on the mounds. A distinctive zonation of plant cover on the mounds was observed with some characteristic species including succulents mainly restricted to the upper parts and an increasing proportion of typical savanna plants towards the base of the mound The flora and vegetation on termite mounds proved to be rather homogenous, although those located in cotton fields differed from the others in higher abundance of grasses (Poaceae) and lower species richness.

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Session 41: Free Topics - TalkT41-05

Stable isotope ratios reveal niche differentiation among neotropical soil-feeding termites

T. Bourguignon, J. Šobotník, G. Lepoint, J.-M. Martin & Y. Roisin

Termites are among the most important decomposers in tropical rainforests. They are especially abundant and species-diverse in soils. As there is little evidence for spatial or temporal separation between species, we hypothesized that the high diversity of termites in soil ecosystems could be explained by resource partitioning. Using delta-13C and delta-15N isotopic ratios, we tested whether neotropical soil-dwelling termites separate along a gradient of food source decomposition in French Guiana rainforests. Significant differences in delta-15N were found between species, notably within the soldierless Anoplotermes group of species. Species-average delta-15N values for both sites were highly correlated. Our results demonstrate that sympatric soil-feeding termites exploit distinct food sources spread along a humification gradient, and therefore suggest that food niche differentiation can therefore account for the high species richness and diversity of these termites in neotropical rainforests.

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Session 41: Free Topics - Talk **T41-06**

Invasive weed Parthenium hysterophorus - a threat to the protection and conservation of native plant communities

D.R. Batish

Invasive alien weeds pose a serious threat to the diversity and dynamics of native plant communities. Upon invasion they severely affect the ecology of the invaded areas and pose a great threat to ecosystem integrity. Parthenium hysterophorus is a noxious invasive weed from Tropical America that has severely invaded in various tropical parts of the world including India. The weed spreads very fast and possesses a high reproductive potential. Because of its rapid spread, the weed replaces the native flora, particularly grasses and herbs. Consequently, their density, abundance and dominance are significantly reduced leading to fodder scarcity. A study was conducted to explore the impact of this invasive weed on the species diversity, richness and evenness of the native species. A drastic reduction in the density and diversity of native vegetation was observed. Besides, the value of ecological indices like Shannon's Index, Simpsons's Index and Evenness Index were altered in the P. hysterophorus invaded areas indicating greater homogeneity due to exploitation of available niches by a few opportunistic species. Such areas thus need to be protected so as to conserve the native flora. The paper discusses efforts being made to conserve and protect native flora by managing P. hysterophorus

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Session 41: Free Topics - Talk **T41-07**

Recruitment reveals forest expanding into savanna of central Brazil after 35 years without fire

E.L. Geiger, G.D. Vale, S.G. Gotsch, W.A. Hoffmann, A.C. Franco

In Neotropical savannas, fire limits forest expansion but where fire is absent, forest commonly expands into savanna. Forest expansion has been documented with little regard to the importance of speciesidentity and size distribution. Here we examined community composition of tree (>5 cm diameter), sapling (>1 m tall), and seedlings (<1 m tall) in 36 plots established in forest, transition, and savannahabitats in the Cerrado biome approximately 35 km south of Brasília, Brazil (15 º 55' S and 47 º 53' W). Densities of trees, saplings, and seedlings were similar across habitats. Non-metric multidimensional scaling (NMDS) revealed sapling and seedling communities in the forest were similar to adult composition, with little evidence of savanna tree species successfully establishing in the forest environment. In boundary and savanna plots, however, many more forest species were present in the juvenile strata than in the tree layer. Relatively few species accounted for the vast majority of these forest juveniles in savanna. Results suggest that early stages of forest expansion into savanna is dependent on a relatively small subset of the species present in transitional forests, though these species do not belong to genera typically considered to be Neotropical forest pioneers

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Session 41: Free Topics - Talk **T41-08**

Natural succession of abandoned pastures in the Andes of South Ecuador

X. Palomeque, R. Arias, S. Günter, B. Stimm, N. Aguirre, M. Weber

Reforestation of abandoned pastures in the neotropical montane rain forest region of South Ecuador faces several ecological barriers, for example root competition by introduced grasses, or light competition of bracken fern. We tested the hypothesis that the three stages "pastures, bracken fern" and "shrub stage" - represent a real time series of succesional development in the ecosystem of tropical montane rain forest in South Ecuador. We monitored changes of diversity from 2003 to 2007 and the effects of mechanical treatment of competing ground vegetation on the floristic composition and diversity of tree species.Surprisingly, bracken fern was the most dynamic site, despite very low light intensities. The shrub stage in contrast showed the lowest dynamic followed by the early succession stage of recently abandoned pasture. Though mechanical management improved tree abundance at all stages, it did not increase species richness and floristic composition. Scaling of species and sites revealed that shrub and bracken stage are much more similar in its floristic composition that the pasture. We conclude that management measures are not adequate to change succesional pathways and thus other strategies such a reforestation may be better suitable to improve the production potential of abandoned pastures.

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Session 41: Free Topics - Talk **T41-09**

Influence of soil conditions on plant diversity and functional traits in savanna woodlands: grass savanna islands on lateritic crusts (bowé) in and adjacent to the W National Park, Burkina Faso

A. Zwarg, T. Janßen, M. Schmidt, K. Hahn-Hadjali, G. Zizka

Grass savannas on lateritic crusts (bowé) are typical landscape elements in West Africa. Bowé are covered by shallow soils that are periodically waterlogged or extremely dry which restrains the development of a woody layer. As savannas on bowé cannot be cultivated, rare plant species like carnivores (Lentibulariaceae, Droseraceae) can often be found there. Although bowé are widespread in West Africa, only little information is available on habitat conditions and vegetation cover of these structures.Plant diversity and soil conditions on and adjacent to lateritic crusts were assessed in a survey of 19 sites in and around the W National Park in south eastern Burkina Faso. Soils on lateritic crusts are shallow, acidic and their nutrient availability is comparatively low. The observed flora comprises 130 species mainly belonging to the families Combretaceae, Cyperaceae, Leguminosae and Poaceae with a high share of therophytes and C4 species. Hence, extreme edaphic and hydrological conditions on bowé lead to the formation of grass savannas characterized by a specific flora distinct from their surroundings and representing island ecosystems in the savanna woodland of the West African Sudan Zone.

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Session 41: Free Topics - TalkT41-10

Diversity and population dynamics of woody plant species in a semi-arid savanna in Northern Benin

K. Jurisch, R. Wittig & K. Hahn-Hadjali

The utilisation of timber and non-timber forest products for a wide range of applications has a central position in everyday life in West Africa. People collect indigenous species around their settlements mainly on fallows or in areas which are not well suited for agriculture. These habitats are decreasing as the landscape is continuously transformed due to the cultivation of crops, especially cotton. This economic dependence also results in increasing stocking rates as cattle are grazed on the same above-mentioned sites. The consequence is overexploitation of resources in harvesting sites causing changes in population structures of trees and shrubs. Thus, we investigated the diversity and dynamics of woody plants to estimate their potential to survive under the given circumstances. We explored this in permanent plots, which are monitored twice a year. Biometric parameters like diameter and height are collected both for juvenile and mature woody plants. As grazing, soil conditions and fire are assumed to be the main factors impacting on regeneration of woody species in savannas soil samples are taken and grazing observations are carried out to quantify their influence on regeneration. We present first data on the growth and mortality on permanent plots and on size-class-distribution for mature trees.

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Session 41: Free Topics - PosterP41-01

Stomatal conductance and leaf traits of trees in multi-species reforestation stands on Leyte island, the Philippines

R.S.Come & D. Hölscher

AbstractStomatal conductance for water vapour and leaf traits were studied in trees of a reforestation scheme emphasizing the use of native trees in mixed stands (rainforestation). Our objectives were to determine the maximal leaf stomatal conductance (gsmax) and to search for characteristic patterns on the relationship between this parameter and leaf traits. Sites were located on Leyte island, the Philippines, where 16 broad-leaved tree species were studied with five individuals per species. Among the co-occuring trees, species-specific gsmax of fully sun-lit leaves differed by a factor of five. A highly significant correlation was found between gsmax and crown projection area (CPA), leaf size and length-width ratio with correlation coefficients (r) higher than 0.40 at $p<0.001$; and stable carbon isotope ratios (δ13C) with $r=0.57$ at $p=0.02$. A multiple linear regression with leaf size and CPA explained 64% of variability in gsmax for the studied species (significant at $p<0.01$). The results suggest that the above-mentioned parameters can be good predictors to this important physiological parameter and a considerable variation in leaf water conductance exists in trees in the studied reforestation stand, which may contribute to their functional diversity.

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Session 41: Free Topics - PosterP41-02

Silicon Influence on Resistance Induction to the Whitefly Bemisia tabaci Biotype B (Genn.) (Hemiptera: Aleyrodidae) and on Vegetative Development in Two Soybean Glycine max (L.) Merrill Cultivars

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The potential for resistant whitefly populations to develop as a consequence of intensive use of chemical insecticides has stimulated studies on integrated pest management tactics, for example, the induction of host-plant resistance. Recent studies have shown that silicon can increase plant resistance against insects. The objectives of this work were the evaluation of resistance induction to the whitefly B. tabaci biotype B and the vegetative development of soybean plants, by silicon application. Free-choice and no-choice tests of oviposition preference had been carried on two soybean cultivars, IAC-19 (moderately resistant to insects) and MONSOY-8001 (susceptible). The number of eggs and nymphs of 3rd and/or 4th, phenolic compounds, lignin and non-proteic nitrogen production and dry weight of aerial parts and roots of the plants had been evaluated. Silicon did not affect whitefly oviposition preference; however, it caused greater mortality of nymphs. Moreover, silicon had decreased the production of phenolic compounds, did not affected lignin production, although when associated to cultivar IAC-19 it had increased the production of non-proteic nitrogen in soybean plants. Silicon did not affect the vegetative development of soybean plants and associated to cultivar IAC-19 it had increased the level of resistance to whitefly. In this way, the use of silicon in association to the cultivar IAC-19 can reduce significantly the populations of this whitefly, bringing positive reflexes to soybean crops and to the environment.

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Session 41: Free Topics - PosterP41-03

Different floral scent chemotypes within a population of Gongora quinquenervis (Orchidaceae) show distinct associations with pollinators – a case of sympatric speciation?

H. Hentrich, A. Jürgens & G. Gottsberger

The pollination biology of a large population (>100 ind.) of the “perfume orchid” Gongora quinquenervis was studied in a tropical secondary forest at the Central Pacific coast of Costa Rica. We found a high variation in the flower morphology, flower color, and floral fragrance composition between different plant individuals. Fragrance analyses and visitor observations revealed the existence of two distinct plant groups within the population. One group was pollinated by male Euglossa azureoviridis and E. variabilis, and its fragrance contained estragole and chavicol. The other group was pollinated by E. deceptrix, E. erythrochlora, and E. variabilis and the scent of these individuals lacked estragole and chavicol. It was not possible to distinguish plants of the two groups by their floral morphology or color alone. Our data suggest that the different scent chemotypes within the population form distinct associations with different pollinator species. It is likely that the different scent chemotypes form two isolated clusters with separate pollen- and gene-flow that may result in sympatric speciation. However, we suspect that some introgression might occur because all individuals share one pollinator, Euglossa variabilis.

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Figure 1: Flowers of different Gongora quinquenervis individuals.

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Session 41: Free Topics - PosterP41-04

High pollinator specificity and xenogamy in the pollination of the myco-heterotrophic species Voyria clavata (Gentianaceae)

H. Hentrich & G. Gottsberger

Voyria (Gentianaceae) is a small genus of myco-heterotrophic plants, which has its center of distribution in the Guianas. Most species possess large, fragrant, and brightly colored flowers, which produce nectar. Nevertheless, up to now no pollinators were known for these species. The only profound study on the reproductive biology of the genus was made on alcohol-preserved material of Voyria rosea, suggesting that the plants are strictly autogamous since pollen germinated within the anthers and pollen tubes penetrated the style. This pattern was also observed in other myco-heterotrophic genera and families, giving the impression that autogamy is an obligatory adaptation to the myco-heterotrophic life form.We studied the reproductive biology of Voyria clavata in the Natural Reserve Nouragues, French Guiana. Flowering plants were scarce at the site and usually separated for several hundreds of meters. The flowers were large, tubular, yellow-white colored, produced nectar, and emitted a pleasant floral scent. The floral characteristics and our visitor observations indicate that V. clavata is xenogamous and has adapted to a small species group of euglossine bee pollinators. The study suggests that xenogamy is strongly correlated to a close plant-pollinator relationship in this species.

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Figure 1: Flowering Voyria clavata in Nouragues, French Guiana.

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Session 41: Free Topics - PosterP41-05

Insights into the nature and mechanism of interference of tropical invasive weed Ageratum conyzoides

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Ageratum conzyoides L. (family Asteraceae) is an invasive weed from tropical America that has now invaded in pastures, plantations, forests and arable land of Southeast Asia. It has formed huge monospecific strands in the infested areas and severely affected the natural communities. We planned a series of experiments to elucidate it nature and mechanism of its interference that helps in infestation in the alien environments. We observed that the weed releases certain metabolites into the rhizospheric region making it toxic for the growth of other plant species. These metabolites not only affected the growth of other species but significantly altered soil chemistry and affected availability of soil nutrients. The present paper discusses the role of secondary metabolites and root-mediated interactions of A. conyzoides in the alien environment and their role in heavy infestation in invaded areas.

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Session 41: Free Topics - PosterP41-06

Taxonomy and distribution of Carapa (Meliaceae), a new source for biological insecticide in West Africa

D. Kenfack, M. Gueye & P.M. Forget

Carapa comprises small to large trees distributed throughout tropical forests in Africa and America. Species of this genus are becoming increasingly socio-economically important especially in West Africa where they are used as timber, medicine and more recently as biological insecticide in the cultivation of biological cotton. The high demand of Carapa species is likely to expose them to overexploitation. We carried out a taxonomy study of the genus in West Africa based on herbarium specimens and field surveys in Senegal and Mali, to determine the number of species in this region, study their natural habitat and evaluate their densities and regeneration in the field. Unlike previous studies that recognized only one species of Carapa in West Africa, our results indicate that there are three species, two of which are sympatric in Senegal. For all three species water relations, rather than physical substrate appear to be important in determining their distribution. All have patchy distribution mainly along streams and marshy areas. The distribution of diameter size classes showed that they regenerate in areas where the seeds are no exploited. The three species of Carapa may exhibit different biological insecticidal properties for the cultivation of the organic Cotton in West Africa.

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Session 41: Free Topics - PosterP41-07

The Tropical Investigation Centre (CITRO) of the University of Veracruz at Xalapa, Mexico

A. Gómez-Pompa, E. Rodríguez-Luna & T. Krömer

The Centro de Investigaciones Tropicales (CITRO) is an academic institution of the Universidad Veracruzana created in 2003, in collaboration with the University of California, Riverside.
Located in the city of Xalapa, state of Veracruz, Mexico, CITRO's mission is to contribute to the sustainable development of the marginalized tropical zones of Veracruz and Mexico through applied research and extension, and the dissemination of scientific and technological information. In this way, its activities are oriented to impact favorably the environmental, economic, and social conditions of this region; besides promoting strategies to fight against deforestation and loss of biodiversity. An example of this work is the Flora of Veracruz-Project, whose main objective is to enhance the floristic knowledge of the region for its conservation and rescue.
Conscious that the problems of underdevelopment are complex and integrated, with repercussions in social, economic, and political aspects of the community, as well as in the environment of the region, CITRO has achieved to attract specialists of diverse disciplines, who work to surpass the methodological, semantic and communication barriers, that separate them, being centered in finding efficient and deeper levels of cooperation.

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Session 41: Free Topics - PosterP41-08

Using Data from Museum Specimens to Build a Preliminary Conservation Assessment of Species

G.A. Krupnick & W.J. Kress

The Global Strategy for Plant Conservation calls for a preliminary assessment of the conservation status of all known plant species by the year 2010. To date insufficient progress has been made on meeting this target. New efforts are needed to develop a preliminary list beyond using the full IUCN criteria in plant assessments. Here we present an algorithm that provides a preliminary assessment of the conservation status of plant species using spatial, temporal, and abundance data from herbarium records. We use specimen data for species of two economically important, over-harvested plant families (the Cactaceae and the Orchidaceae) as examples of the application of the algorithm. Preliminary results indicate that up to three-quarters of the species are potentially threatened with extinction, but further evaluations using additional data are necessary (e.g., herbarium material, field work and taxonomic expert assessment). Conversely, approximately a third of the species is clearly not threatened and will not require any additional evaluations for full assessment. This methodology provides a rapid means of determining preliminary conservation assessment of a large number of species in a short period of time and greatly decreases the number of species requiring full and labor intensive assessments.

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Session 41: Free Topics - PosterP41-09

Habitat use and coexistence in an assemblage of Neotropical wandering spiders

W. Lapinski & PD Dr. M. Tschapka

Coexistence of similar species is thought to be based on differences that allow partitioning of limited resources and thus decrease competition between those species. The mechanisms structuring assemblages of generalist arthropods such as wandering spiders are still poorly understood. An assemblage of eight sympatric large wandering spider species from the Ctenidae and Trechaleidae families was studied in a lowland rainforest of Costa Rica. The species were partially segregated by habitat type, differed in their microhabitat preferences and in their ability to adhere to a steep smooth plexiglass surface. Based on these differences the species may be assigned to three subguilds: 1) semi-aquatic, 2) forest ground dwelling and 3) vegetation dwelling species. The studied assemblage showed essential similarities to a wandering spider assemblage at a central Amazonian rainforest site, which suggests that similar selection pressures have lead to similar habits. Similarly structured wandering spider assemblages may therefore be expected in different geographical regions under similar climatic conditions.

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Session 41: Free Topics - PosterP41-10

Virtual Pollination Ecology: Cognition-mediated Co-evolution

V. Nachev & Y. Winter

Using conventional methods it is extremely difficult to test hypotheses and even to make predictions about the strength and outcome of pollinator exerted selection in plant-pollinator systems. These co-evolutionary relationships are highly complex: plants with different nectar production characteristics compete with each other for pollinator visits and pollinators compete for nectar. Furthermore, the decision-making mechanisms that pollinators, especially mammals such as nectar-feeding bats, employ in order to choose between different nectar sources are still poorly understood.These hurdles can be overcome by the novel research method virtual pollination ecology, in which the evolution of virtual plants is guided by the cognitive choices of real pollinators. We apply this method using artificial flowers with user-controllable nectar production characteristics and Neotropical nectar-feeding bats as model animals.We propose a possible mechanism for the hypothesized shift from the ancestral condition of more concentrated scarce nectars to the more dilute, copious nectars typical for modern bat-pollinated plants. We suggest that this evolutionary transition can be explained by the cognitive mechanisms underlying pollinator decision making.

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Session 41: Free Topics - PosterP41-11

Soil type preference and leaf functional traits in the genus Inga (Fabaceae)

D.T. Palow & K. Kitajima

Several recent studies have shown association of leaf functional traits with habitat specialization across a wide range of tropical tree species. In this study, we focused on a speciose genus, Inga (Fabaceae), at La Selva Biological Station, Costa Rica, where soils are categorized as relatively infertile volcanic soil and rich alluvial soil. We assessed soil type preferences of Inga species by surveying transects that encompass all major soil types. We then quantified differences in leaf traits of the species of which we encountered at least ten individuals. Seven out of nine species showed soil type preference, with >80% of individuals encountered on only one of the two major soil types. Only one species appears to be a generalist with regards to soil types, but a specialist to early successional sites. Leaf size varies both within and between soil types. Some co-occurring species have leaves of similar size while others do not. Diversification of leaf functional traits within a group of closely related species may be directly linked to their ecological significance such as habitat specialization and co-existence of closely related species.

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Session 41: Free Topics - PosterP41-12

Functional trait shift through species exclusion

J.C. Riemann, J. Nopper, M. Mohneke, M.-O. Rödel

The effects of amphibian declines on ecosystems are little understood. In West African savanna ponds tadpoles play a crucial role in ecosystem functioning. They are highly abundant and can be regarded as key elements of ponds' food webs. Currently several West African frog species are harvested for food in an unsustainable manner, tadpole numbers thus likely are decreasing. To predict the consequences of these losses, a better understanding of the tadpoles' ecological role is needed. We tested if the exclusion of particular tadpole species lead to shifts in the functional traits of other frog larvae. Therefore artificial tadpole communities with varying species composition were set up. Tadpoles of all species were then tested individually for their isotope signature. We recorded distinct differences in isotope signatures between species. Moreover intra-specific isotope signatures varied according to the respective tadpole assemblages, thus showing that food web functioning changes, depending on the presence or absence of particular tadpole species.

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Session 41: Free Topics - PosterP41-13

Relationship among soil seed bank, seed rain, and vegetation in the tropical savannas of Central Brazil (Cerrado)

A.Salazar, G.Goldstein,A.C Franco and F.Miralles-Wilhelm

Soil seed banks play a crucial role in determining plant community composition. They provide a mechanism for population persistence through the supply of propagules for recruitment after disturbance. Little is known about the dynamics of the soil seed bank in the tropical savannas of Central Brazil (Cerrado) and their relationship with seed rain, seedling bank and vegetation. At the IBGE reserve, Brasilia, we studied the composition of germinable soil seed bank, seedling bank, seed rain, and vegetation in three savanna types that differ in canopy cover and are located along shallow topographic gradients (approx 30 m). We used non-metric multi-dimensional scaling ordinations to examine community patterns. The soil seed bank in all studied sites was mostly composed by herbaceous species and few woody species. Woody species did not form persistent seed banks because of their very short seed longevity. Richness and density of the soil bank tended to be higher in closed savannas than in open savannas. Vegetation and seed rain were moderately similar to each other (52%) suggesting that seed rain is mostly produced by local trees. Soil seed bank and seedling bank were slightly similar (< 10%) to the vegetation and to the seed rain indicating low recruitment from the soil seed bank. Differential recruitment across savanna types contributes to maintain Cerrado vegetation structure.

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Session 41: Free Topics - PosterP41-14

Flora of the Arly National Park, Burkina Faso

O. Ouédraogo, M. Schmidt, A. Thiombiano, K. Hahn-Hadjali, S. Guinko, G. Zizka

The Arly National Park is in the center of the WAP complex, the largest continuous system of protected areas in West Africa. Although well known for its large mammal populations, its flora has largely been unexplored until recently. The species composition is typical for savannah areas with a high share of grasses and legumes and very similar to the neighbouring Pama reserve and W National Park. The 495 vascular plant species belong to 280 genera and 86 families. The ten most species rich families are Poaceae (88 species), followed by Fabaceae s.str. (67), Cyperaceae (27), Rubiaceae (22), Combretaceae (19), Caesalpiniaceae (14), Euphorbiaceae (14), Mimosaceae (14), Acanthaceae (13) and Convolvulaceae (13). The life form composition is dominated by phanerophytes (40%) and therophytes (33%), followed by chamaephytes (10%), hemicryptophytes (9%), geophytes (5%), hydrophytes (2%) and helophytes (1%).

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Session 41: Free Topics - PosterP41-15

Mangroves isolated from the sea: Special mangrove habitats on the Caribbean coast of Colombia

M.L.Schnetter

Mangroves are often called tidal forests because most of them grow within a zone of tidal influence. On the eastern part of the Caribbean coast of Colombia such suitable mangrove habitats are rare, due to the low differences in tidal water level, and the arid climate. Nevertheless, in this region mangroves are found in many sites. Most of them grow in flat areas separated from the sea by a sandy barrier, without or scarce tidal influence. Instead of water level changes induced by tides, these mangrove habitats are characterized by seasonal changes of water level and salinity. Two conditions are indispensable to permit mangrove growth in such areas: 1. Because evaporation exceeds precipitation, a fresh water supply additionally to rainfall is necessary to dissolve the salt accumulated in the upper strata of the soil during the dry season. 2. A permanent or seasonal opening in the barrier must permit water to run off to the sea, and by this make the exportation of the dissolved salt possible. Extension of these mangrove forests and their species composition depend on the topographic conditions and the presence of water during the dry season.

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Session 41: Free Topics - PosterP41-16

Impact of invasive woody perennial Lantana camara in the foothills of Shivalik Himalayas: implications for conservation of plant biodiversity

H.P. Singh

The Himalayas are one of the biodiversity hotspots of the world known for their rich biodiversity. However, during the last 15-20 year there has been a drastic change in the structure and composition of the vegetation, particularly due to invasion by the exotic invasive species. The Shivalik ranges in the foothills of Himalayas are one such fragile ecosystem that has been invaded by invasive woody perennial Lantana camara. Invasion by Lantana has, in fact, replaced the native herbs and shrubs under the natural forest, plantations and in grasslands, thereby resulting in a shift in vegetation regime of the area. Its invasion has resulted in denudation of the hill tops at the expanse of native shrubs and trees. Due to the presence of pungent biologically active principles (lantadenes and volatile terpenes), the cattle do not feed upon the weed. It has further deteriorated the socio-economic status of the Gaddi tribes of the region who depend greatly on the native herbs and grasses for their livestock. The present paper attempts to discuss the impact of invasion by Lantana on the ecology of Shivalik Himalayas and some strategies to conserve the local biodiversity vis-à-vis the socio-economic aspects of the local communities.

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Session 41: Free Topics - PosterP41-17

How does habitat fragmentation affects the plant-pollinator interaction and the reproductive success of Dieffenbachia seguine in a rain forest of Mexico?

M.P. Suárez-Montes & J. Núñez-Farfán

In fragmented habitats, the plant-pollinator interaction could be modified if pollinators abundance is reduced affecting the process of pollination in fragments. The restriction of gene flow may reduce genetic diversity and cause inbreeding that, in the long-term, could alter the stability of the fragmented populations. The aim of our study was to examine if forest fragmentation affects the interaction between Dieffenbachia seguine (Araceae) with its beetle pollinators (Cyclocephala), as well as plants reproductive success. This study was carried out in the tropical forest “Los Tuxtlas” in Mexico. Our results show that the persistence of D. seguine could be threatened indirectly by the effects on the abundance and diversity of the beetle, which we found was lower in the fragmented populations of D. seguine. Experimental pollen supplementations to inflorescences increased fruit production in both habitats, indicating the existence of pollen limitation. Natural fruit set was higher in the continuous forest, suggesting that habitat fragmentation also affects the reproductive success of D. seguine. This study confirms that habitat fragmentation causes a negative effect on pollination and a subsequent decline on D. seguine sexual reproduction.

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Session 41: Free Topics - PosterP41-18

Standardization of Traditional Local Knowledge of Indonesian Food Fermentation

P. Adiawati, T.S. Syamsudin and D. I. Astuti

Traditional knowledge in conservation and utilization of biological resources has long been known by local traditional Indonesian. Public awareness of these traditional knowledge is recently decline and even feared extinct. The aim of these research is to conserve the use of traditional technique of food preservation and fermentation. Eight kind of fermented food (tempoyak = fermented durian, cemayi = fermented coconut cake, madu mongso = sweet from fermented sticky rice, oncom = fermented peanut cake, beras kencur = fermented rice and kencur, manggo pickles, cucumber pickles, balinese wine) from terrestrial ecosystem types, and two fermented foods (terasi = fish paste, kecap ikan = fish sauce) from the marine ecosystem were tested in microbiology laboratory. Results of this research indicate that Sacharomyces, Lactobacillus, and Zygosacharomyces are among the microorganisms that have a central role in Indonesian traditional fermented food. The production of fermentd food was then repeated and optimized using microorganisms isolated from the traditional fermented food so the fermented foods obtained have a good quality (healthy, and safe). Standard Operation Procedures of making Indonesian traditional food fermentation has been estalished.

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Session 41: Free Topics - PosterP41-19

Tree biodiversity conservation value estimation for environmental service payments: methodology design and application for small farms

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Biodiversity conservation has been estimated in terms of land use change, without contemplating tree characteristics. This study was carried out in five communities in Mexico's southeastern Lacandon Forest, an important Mesoamerican biological corridor. A methodology was developed to permit environmental service payments more focused on tree functional value and specific conservation objectives. Tree-related conservation value was considered as the product of three components: food and habitat provision for wildlife, and existence value; empowerment of people and land evaluation were facilitated by training local promoters for sampling.Tree species value was measured by functional traits and other attributes, and tree cover value was estimated combining species value and tree dimensions. Regarding food, emphasis was given to provision during dry periods and diversity of resources; for habitat, to foliar density and phenology. Existence value was measured considering native/introduced, threat category, local destructive use, wood density and dispersability.For each value component, tree cover value was related to land use type and highly correlated to tree density and basal area (r>0.7); riparian forests showed greater values, followed by second-growth and coffee plantations. 30-40% of food and existence value variation was explained by species value, high value species being more frequent in higher-density stands.

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Session 41: Free Topics - PosterP41-20

Trichome evolution in Bignonieae (Bignoniaceae)

A. Nogueira, J.H.L. El Ottra & L.G. Lohmann

Natural selection is thought to favor individuals that present defense traits that decrease leaf damage. More specifically, selection is thought to act directly over defense traits, fixing advantageous character states within evolutionary time. Trichomes are epidermal outgrowths, distributed across different plant parts (e.g., leaves, stems and reproductive structures) that are among the most important defense strategies in plants. However, very little is known about the patterns of trichome evolution in general. In this study, we characterize trichomes in selected members of Bignonieae and use a phylogenetic approach to study the patterns of trichome evolution in this diverse group of Neotropical plants. The wide variation of trichome types in Bignonieae makes it an excellent group within which to address trichome evolution in the Neotropics. Specifically, we investigate the patterns of evolution of glandular, non-glandular and scale-like trichomes using a robust molecular phylogeny of Bignonieae as basis. In addition, we investigate the order of evolution of each trichome type within different plant parts. For that, we used different methods of phylogenetic reconstruction and analysis of scanning electron microscopy. These findings represent a first step towards testing adaptation hypotheses.

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Session 41: Free Topics - PosterP41-21

The effect of deforestation on pollinators diversity and its consequences on coffee productivity at silo-East Java Indonesia

T. S. Syamsudin & D. S. Anggraeni

The objective is to find out the effect of deforestation on pollinators diversity and its consequence on coffee productivity. Sampling was conducted at two sites in coffee plantation at Silo District-East Java: near the protected forest (site A) and site B was far from protected forest. Flower visiting insect and pollinator activity was observed during flowering season. Coffee productivity was measured by frequency of peaberry formation and its fruit set of Coffea canephora. The results found that number of species flower visiting insect near the forest was higher than the site far from the forest. Nine species of Hymenoptera and 4 species of Diptera found near the forest however at the site far from the forest found 6 species of Hymenoptera, 5 species Diptera and 2 species of Coleoptera. The social bee (Apis sp) and the solitary bee contribute to the increased percentage of fruit set. The abundance of other visiting insects (ants, butterflies, and beetles) is too low for a species to be considered as an effective pollinator. At site A, the frequency of peaberry formation was lower by 50.84% than site B, however the fruit set was higher by 19.32%. Keywords: Coffea canephora, deforestation, diversity, pollinator, productivity

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