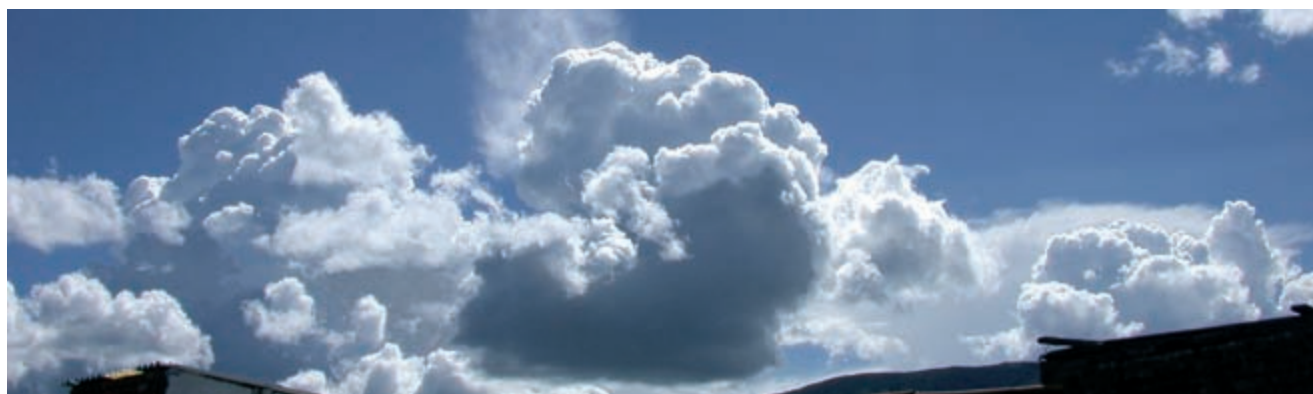


Newsletter



DFG Research Unit 816:
Biodiversity and Sustainable Management of a Megadiverse
Mountain Ecosystem in Southern Ecuador

Issue 13
July 2011



Rütger Rollenbeck summarized eight years of research on precipitation dynamics in the study area. His habilitation is the second completed habilitation elaborated in the Research Unit (RU, see rubric "People & Staff" for details, page 17).

Speakers' Corner

Preparing a Book, Synthesis Papers, and the Research Platform

The summer term 2011 was full of activities regarding the synthesis publications of the running Research Unit (RU 816), but also with substantiating our plans for a follow-up biodiversity research platform for a long-term monitoring of global change in South Ecuador.

Book about Ecosystem Services, Biodiversity and Environmental Change

Following a long process of coordination with all PI's, an annotated structure for our concluding synthesis book in Springer's Ecological Studies series was submitted to the publisher for review by the series editors. The issue with the title „Ecosystem Services, Biodiversity and Environmental Change in a Tropical Mountain

Ecosystem of South Ecuador“ shall be edited by the scientific advisory board (Jörg Bendix, Erwin Beck, Achim Bräuning, Franz Makeschin, Reinhard Mosandl, Stefan Scheu, and Wolfgang Wilcke). The external reviews were very enthusiastic, rating the planned book as an „extremely important contribution“. Meanwhile, the contract has been signed by all editors and was returned to the publisher. The next step - as decided by the member assembly in Frankfurt (*gtö*) - is the identification of leading authors for each chapter by the editors. This has been almost accomplished. The editors would like to thank all colleagues who complied to act as a leading author. The next steps to be organized by these persons are to provide a structure for the respective chapters, to assemble the team of authors and to steward the joint writing process. A list of the responsible authors will be provided in the intranet of the RU soon. We are very grateful to Dr. Esther Schwarz-Weig who again will supervise and accordingly coordinate the whole process in a professional manner. She will communicate with all authors if necessary.

Preparing three Topics for Research Papers

Based on a survey of the Principal Investigators' recommended topics for synthesis papers submitted to high ranked journals, the scientific advisory board decided to pursue three topical fields which were discussed at the member assembly in Frankfurt (*gtö*). It was decided to start the writing process with meetings of small proactive groups structuring the papers, collecting the data and constituting the team of authors. The first topic "Grass or Trees" addresses the restoration of abandoned areas as pastures or forests comparing the ecological and economic aspects of the restoration process and of the subsequent measures for a sustainable management. The kick-off meeting was in Freising and two follow-up meetings have been organized by Perdita Pohle in Erlangen. Thomas Knoke has kindly agreed to coordinate the data compilation and analysis, and the writing process. The second approach evaluates the available time series from respective subprojects to find changes of interacting ecosystem parameters, among others related to ongoing global change and local extreme events. A first meeting has taken place in Marburg where, after discussing a bunch of time series, Wolfgang Wilcke has kindly agreed to head a paper initiative shedding



An initiator group met at the Naturmuseum Senckenberg, a museum of natural history, in Frankfurt, Germany. During the discussion the group specified the focus of research for the new platform beyond the RU. Photo: Felix Matt.

light on possible system changes in the San Francisco area. A second topic devoted to extreme events will be coordinated by Rütger Rollenbeck. The third recommended topic was to investigate biodiversity and its causes along the altitudinal gradient. The group of Matthias Rillig has offered to coordinate the topic, a first data screening has been conducted the kick-off meeting is still pending. All paper writing initiatives will report their progresses at the member assembly in Loja (See Event Calendar, page 18).

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Initiator Group Discussed Details and Research Focus of New Research Platform

With regard to our discussion on the establishment of a platform for biodiversity, ecosystem research and monitoring (see last Newsletter: <http://tinyurl.com/TM-Fnews12>), an initiator group has met in Frankfurt/Main (University of Frankfurt and Senckenberg Natural History Museum 29-30 June 2011), kindly funded by DFG. The group consisted of representatives from Germany and Ecuador who at the same time act as representing experts for all relevant disciplines: Erwin Beck (plant science, functional ecology), Jörg Bendix (climatology, remote sensing, database), Jan Feyen (hydrology, Universidad de Cuenca), Konrad Fiedler (fauna, biodiversity, monitoring concept), Thomas Knoke (land use, socio-economy), Alfredo Martinez (Cajas National Park, ecosystem studies, ETAPA), Reinhard Mosandl (forestry science), Bruno Paladines (RBSF area, dry forest, citizen science, NCI), Juan Pablo Suárez (molecular biology, ecosystem services, Universidad Técnica Particular de Loja), Carlos Valerezo (soil science, biogeochemical cycle, Universidad Nacional de Loja) and Felix Matt (manager of the research station). We are very grateful to Dr. Roswitha Schönwitz (DFG) for attending the meeting and providing important aspects, particularly with regard to DFG procedures.

Main points of discussion were: (i) Suitable indicator systems (particularly biotic) and their identification and selection, (ii) platform concepts (combining compositional and functional biodiversity monitoring), (iii) research sites, (iv) contribution of citizen science, (v) funding concepts and (vi) promising collaborative research concepts.

The extracts of the minutes may be of interest to potential applicants for platform projects:

»The importance of the impact of overexploitation, habitat (land-use) change, pollution, invasive species, climate change and social conflicts, as compiled by the Global Biodiversity Outlook 2 were discussed. Although "Land-use Change" is considered the most serious driver for loss of biodiversity and ecosystem services in South Ecuador, the group finally agreed to use the term "**Global Change**" which includes all drivers irrespective of their respective significance for the individual areas. By applying the **space-for-time approach**, global change shall be examined along **two types of gradients**: An altitudinal and a disturbance gradient. In that context the question how to normalize land use changes was discussed. A **land use change index** (0 = no change, 1 = complete change) could be developed on the basis of energy, biomass, biodiversity, economy or the **hemeroby index** (index of naturalness). For developing such an index for South Ecuador, covariance of biodiversity or species invasion (as covariables) and land use changes can be used. Important is the sensitivity of the used indicators for changes in land management.

All participants in the meeting appreciate the idea of a "research and monitoring platform for biodiversity and ecosystem functioning and services" very much and without any reservation. With the option of a future involvement also of other ecosystems, the participants agreed with the idea of the RBSF as a reference ecosystem and the Páramo ecosystem Cajas and the dry forest ecosystem Laipuna, both fragile ecosystems as satellite ecosystems.

The platform shall consist of a core of regularly monitored parameters, e.g. climate, parts of the carbon and water cycles, on which individual projects with a run-time of about three years can be based.

Indicators: Given the status of available knowledge, particularly organismic indicators are most difficult to establish, as those should meet



The intensive discussions were extended to a joint traditional Hessian dinner in the restaurant „Zum Gemalten Haus" offering apple wine and Frankfurt green sauce. Unfortunately Carlos Valarezo broke his arm at the hotel in Frankfurt. Everybody feels very sorry about the accident and wishes him a fast recovery. Photo: Felix Matt.

several requirements. As a basic requirement the indicators must be multifactorial, i.e. one indicator provides information on several aspects. Indicators may be structural (from landscape to genes), functional (focusing on processes) or compositional (communities). The latter two are typical biotic indicators, the first is abiotic and biotic (anthropogenic). Effective indicators should not only indicate the change but should also provide information about the cause of changes. It should have cross-taxon suitability, i.e. covariate with other indicators.«

The results of the meeting will be discussed in detail on the member assembly in Loja in October; the next meeting of the initiator group is scheduled for 10th October 2011 following the Status Symposium.

On demand of the Ecuadorian ambassador in Berlin, a meeting has taken place between DFG (President Prof. Dr. Matthias Kleiner, Dr. Roswitha Schönwitz, Dr. Dietrich Halm) in July 2011 to discuss cooperation between German and Ecuadorian researchers. On that opportunity the importance of our RU was appreciated and the state of the preparations of a memorandum of understanding between DFG and SENECSYT was discussed. Additionally our plans for the platform were mentioned as well as the start of the Transfer Project for reforestation.

Upcoming Events


Inauguration of New Reforestation Project

Knowledge transfer is now starting with the first DFG-transfer project outsourced from our RU. The program „Facilitation of biodiversity in montane ecosystems by large-scale conversion of monocultures into mixed forests“ coordinated by Reinhard Mosandl was recently approved by the DFG and can now be implemented. Because it is a pilot transfer project with a foreign country and a non-industrial partner, it is planned to be officially inaugurated in Loja in advance to the Status Symposium of the RU. The inauguration ceremony will be headed by DFG vice president Professor Dr. Elisabeth Knust accompanied by Dr. Roswitha Schönwitz and presumably by Dr. Dietrich Halm.

Next Status Symposium

Our yearly Status Symposium in Loja is scheduled for 6-7 October 2011. A respective application for travelling funds has been submitted to DFG and is currently under review. More details of the meeting will be distributed by the station managers a.s.a.p. Good news is that the announced closing of Catamayo airport for the renewal of the runway is postponed to December 2011 so that travelling to Loja should be as per normal.

Next Conference Society for Tropical Ecology



The annual conference of the Society for Tropical Ecology (*gtö*) will be organized by Achim Bräuning in Erlangen, Germany. The date will be from 22th to 25th February 2012. Our first member assembly next year will be in the frame of that meeting. The call for sessions is expected for the beginning of August with respect to the presentation of the progress of the RU and the application for projects on the future platform, participation of all RU members is essential highly encouraged.

For those, who will shortly start their summer holidays, we wish a recreative time. Looking forward to meet you soon in Loja.

Jörg Bendix & Erwin Beck
Speaker & Deputy Speaker of the RU

The **Gesellschaft für Internationale Zusammenarbeit (GIZ)** is a federal enterprise uniting three organizations which have worked on their own until recently. Since January this year the GIZ unites the capacities and long-standing experience of the Deutscher Entwicklungsdienst (DED) gGmbH (German Development Service), the Deutsche Ge-

News from the ECSF

High ranking Ecuadorian Delegation at the Research Station

In the afternoon of May 12th a high ranked Ecuadorian delegation lead by Dr. Manuel Baldeón at that time minister of SENESCYT (Secretaría Nacional de Educación Superior, Ciencia, Tecnología e Innovación) and Dr. Mercy Borbor, viceminister of the MAE (Ministerio de Ambiente), visited the research station (ECSF). They were accompanied by representatives of the institutions SENPLADES (Secretaría Nacional de Planificación y Desarrollo) and MIPRO (Ministerio de Industrias y Competitividad), as well as members of both Lojan Universities, the UNL (Universidad Nacional de Loja) and the UTPL (Universidad Técnica Particular de Loja), and people from the Technical University of Machala (UTMACH) and NCI (Nature and Culture International). The reason for their visit was the official announcement of the program “Bioconocimiento” by the authorities the same morning in Loja. Their visit provided us with an excellent opportunity to introduce the research station and to present the work of our RU to the authorities.

Visit from GIZ Ecuador

Another important visit was a group of the GIZ Ecuador (see box below) headed by Dr. Lothar Rast, their General Representative, on June 2nd. The delegation was impressed by the investigations conducted by the members of the RU. A future possible cooperation was also addressed.

Closing of the Airport of Loja

Latest news are pointing to a closure of the airport at Loja from January to June in 2012 due to the renovation of the terminal building and of the runway. According to the authorities the airport of Cumbatarza near Zamora will offer an alternative for small aircrafts whereas the airports of Cuenca and Santa Rosa are viewed as alternatives for larger planes. We will keep you informed.

Jörg Zeilinger & Felix Matt

sellschaft für Technische Zusammenarbeit (GTZ) GmbH (German technical cooperation) and Inwent – Capacity Building International, Germany. The GIZ supports the German Government in achieving its objectives in the field of international cooperation for sustainable development. More information: www.giz.de/en/home.html.

News from NCI

Ecuadorian Government Backs Process to Create Cajas Biosphere Reserve

NCI's new office in Azuay province is helping to guide the process for the declaration of Ecuador's fifth UNESCO biosphere reserve, which would be the first located in the extremely threatened western foothills of the Andes. National support for this initiative was officially achieved last month through the signing of an agreement driven by NCI by a number of Ecuadorian agencies including the Ministry of Environment, the Secretariat of National Planning, the Provincial Government of Azuay, the Municipality of Cuenca, the Water Supply Company of Cuenca, GIZ (see box page 4) and NCI, which is committed to providing institutional support, as well as the technical and political support leading up to the official declaration by UNESCO.

This proposal will include the Cajas National Park as a core area and will seek the protection of biodiversity and the environmental services provided by Páramo, cloud forest, tropical forest and mangrove ecosystems. In addition to the spectacular richness and endemism of the flora and fauna in this region, these ecosystems provide water resources for over one million people, plus the provision of 1,100 megawatts of hydroelectric power and support for productive systems such

Endemic Organisms

The Cajas Nacional Park harbors endemic plants and animals, species that exclusively life in this area. Many of them are specialists and have very specific requirements for their survival. They are therefore dependent on special ecological niches and are easily threatened by habitat destruction.

as cocoa, bananas, and shrimp. Biosphere reserves are places that seek the promotion of sustainable development and scientific research, the protection of natural resources and local cultures and the demonstration of practices that can improve the livelihood of local people. Prior to this agreement, NCI promoted the formation of a Technical Committee that has been working on the preparation of the official proposal to be submitted to UNESCO in late 2011.



The mountains of the Cajas Nacional Park are proposed to be the center of a future Biosphere Reserve besides other sensitive ecosystems. A protection of this area will provide over one million people with water and other valuable resources. Photo: NCI.



The Nangaritza Valley builds an important corridor between two natural areas and is the territory of indigenous Shuar which practice a sustainable form of land use that maintains the high biodiversity in that area. Photo: NCI.

Conserving the Ecuadorian Amazon

NCI's Andes-Amazon Program in Ecuador has been prioritizing conservation efforts in the tropical forests of the Nangaritza Valley due to their strategic importance as a biological corridor connecting Andean ecosystems and the highly biodiverse Cordillera del Condor mountain range to the east (see also Newsletter No 4: tinyurl.com/TMFnews04). Increasing conservation efforts here will also help to ensure the integrity of Shuar indigenous territories in the region. The area's ecosystems are threatened by the construction of a new road, facilitating rapid colonization of the area. NCI has added four new staff members to our Zamora, Ecuador office in order to identify ecologically sensitive areas in the valley, design and implement conservation initiatives with farmers and indigenous Shuar communities and promote monetary incentives for conservation to private landowners living along the road through the Ecuadorian government's Socio-Bosque (Forest Partners) Program.

So far, we have successfully worked with the Orquídeas community and the ShuarTayunts Association to identify and preserve a natural area in the Nangaritza river canyon where several new plant and lizard species have recently been discovered. Through detailed mapping and the development of a number of technical documents, we will soon be able to declare

the area a Communal Reserve approved by the Ministry of Environment. The area will also be registered as part of the Socio Bosque Program, and monetary incentives from the program will support Shuar and colonist conservation activities for the next 20 years. We are also working with private landowners along the new road, and have already signed 13 conservation agreements, adding 1,700 acres for conservation as part of the Socio Bosque program. Finally, one of the most sensitive areas identified through our work is an area of State forest land in the upper basin of the Numpatkaim River, which represents a critical corridor between the Podocarpus National Park and the Cordillera del Condor. Here, we have been in contact with local community leaders and we are negotiating an agreement between the Environmental Ministry and the colonists to legalize occupied farmlands with the condition that a forest conservation area along the upper Numpatkaim River will be created. Once farmlands are legalized, we can also negotiate land purchases or Socio Bosque incentives for conservation with the colonists.

*Bruno Paladines,
is an ecologist who directs NCI's
programs for community development*

In this section Nature and Culture International (NCI, www.natureandculture.org) introduces its activities and reports recent progress. NCI is a non-governmental organization whose mission is to assist in the conservation of biological and cultural diversity.

Science News

Fate of Epiphytes on Remnant Trees

Epiphytes constitute about half of the plant diversity in the Reserva Biológica San Francisco (RBSF). The bark of single trees can harbor as many as each 100 species of lichens and vascular plants and 40 bryophytes. A recent paper in the journal *Basic and Applied Ecology* presents results of a field experiment at ECSF that addressed the mortality of well-established (late juvenile and adult) plants as a potential driver of epiphyte diversity in fragmented or degraded forest [1].

Epiphytic ferns and flowering plants were tagged and measured on isolated remnant trees in a fresh clear-cut created by a local farmer above the village of Sabanilla, and in control plots at RBSF. The study documents dramatically increased plant mortality on remnant trees (Figure 1), adding up to 72% over 3 years relative to 11% in undisturbed forest. Mortality was highest among moisture-demanding taxa including most ferns (Figure 2). Plants surviving on remnant trees generally showed decidedly negative growth. These results provide first experimental evidence for a strong negative effect of increased exposure to light and wind (which also exacerbates drought stress) on the resident epiphyte flora. The study thus shows that growth conditions can be a more important predictor of epiphyte diversity in disturbed habitats than dispersal constraints. Because similar plant responses can be expected to occur along forest edges, the retention of scattered green trees, narrow strips or small fragments of forest are unlikely to be sufficient management tools for the conservation of epiphyte diversity in tropical landscapes.

Interestingly, the data also reveal significantly increased plant mortality in intact forest during the drought year of 2006 (year 3 in Figure 2); and new data indicate that this also holds true for the unusually dry year of 2010. Due to management limitations agreed upon with the owner of the clearing, the plot has never been burned after clear-cutting in 2003. For this unusual condition this clearing has also yielded interesting data on terrestrial plant succession (AG Richter), tree mycorrhiza (AG Haug) and soil development (AG Makeschin) following land-use change.

Florian Werner

Reference

[1] Werner, F.A. 2011. Reduced growth and survival of vascular epiphytes on isolated remnant trees in a recent tropical montane forest clear-cut. *Basic and Applied Ecology* 12:172–181.

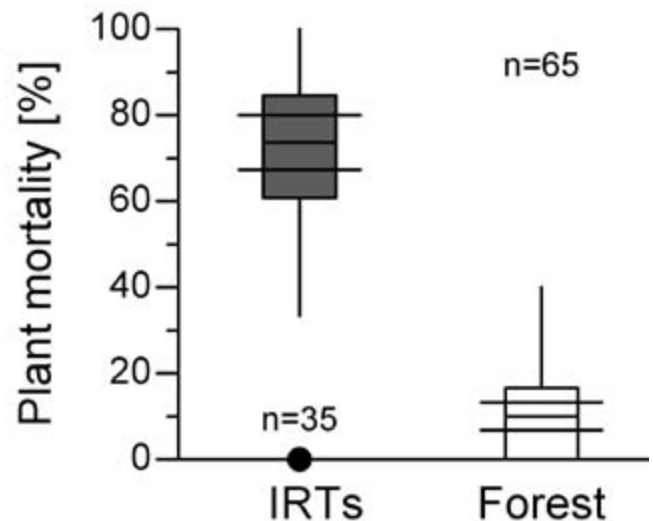


Figure 1: Rates of epiphyte mortality per host tree during the first three years after isolation of remnant trees in a clear-cut (IRTs) and in undisturbed forest. Figure from [1] with permission from Elsevier.

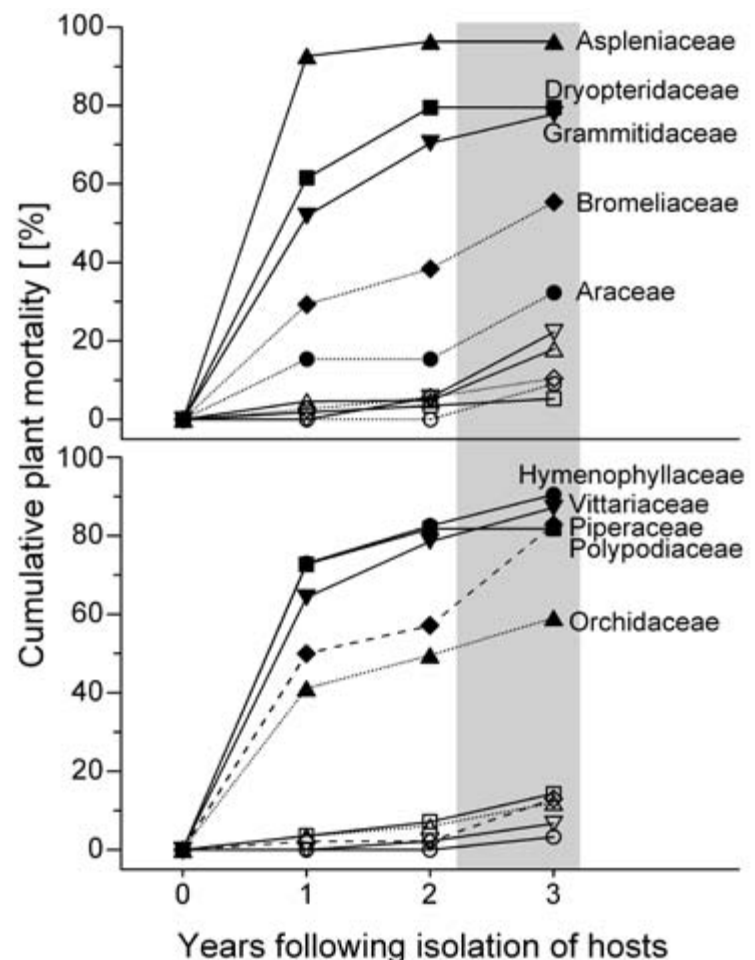
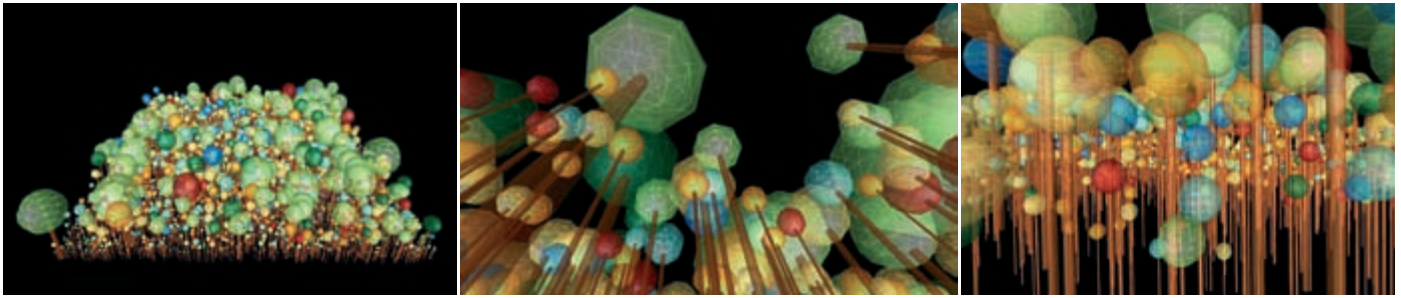


Figure 2: Cumulative epiphyte mortality (in % of plants) on remnant trees (filled symbols) and in forest (open symbols) over the course of three years after forest clearance. Solid lines: ferns; dashed lines: dicots; stippled lines: monocots. Plant families are divided alphabetically between panels. The dry year of 2006 is shaded in grey. Figure from [1] with permission from Elsevier.



How Different Disturbance Regimes Affect Forest Dynamics

We utilize forest simulation models (see Figure 3) to study forest dynamics in the RBSF forest [1]. Different types of disturbances influence forest dynamics: forest gaps are created by falling (dead) trees and shallow landslides clear forest patches (400-1500 m²). These two disturbance types involve different “disturbance fingerprints”: while in small forest gaps the environmental conditions like soil condition, seed bank etc. are not changed, landslides result in harsh conditions for forest recovery (e.g. Wilcke et al. 2003).

With our forest model, we study the impact of these different disturbances on total forest biomass, biomass dynamics (gains and losses) and the spatial distribution of biomass in the ridge forest of the RBSF. The model predicts that the forest without any of the two disturbances would have ~15% more biomass compared to the biomass estimation from field data (Figure 4). In the presence of disturbance, forest biomass is reduced but forest productivity increases due to more available space for regeneration and succes-

Figure 3: Snapshots from a 3D-visualisation of the FORMIND model: different colors of tree crowns represent different plant functional types. Images: Claudia Dislich.

sion (Figure 4). Additionally, the two disturbance types considerably change the spatial distribution of tree biomass: particularly landslides produce a higher heterogeneity of biomass distribution (Figure 5).

Assessing disturbance rates of different disturbance types is possible with high resolution remotely sensed data. This information will be important for estimating biomass stocks as well as carbon dynamics of the whole RBSF area.

Claudia Dislich & Andreas Huth

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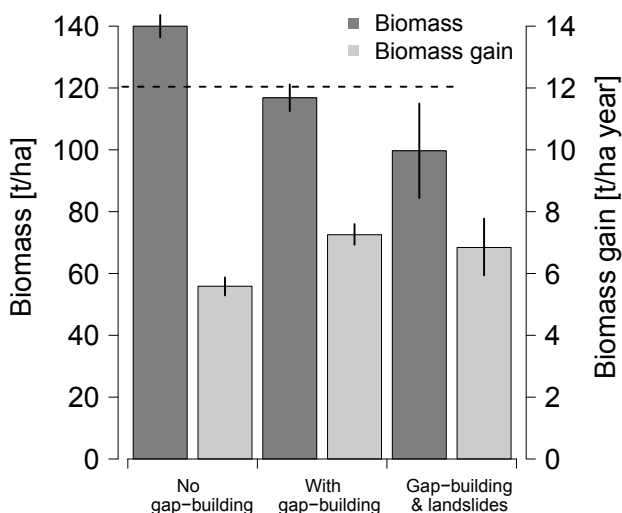


Figure 4: Above-ground biomass and biomass gains for forests without gap-building disturbance, forests with gap-building (falling probability 0.2 for dead trees above 10 cm DBH) and forests with gap-building and landslide disturbances (frequency 0.02 per hectare and year). The dashed line marks above-ground biomass estimated from field data (inventory plots of AG Günter/Mosandl/Stimm/Weber and Homeier). Image: Claudia Dislich.

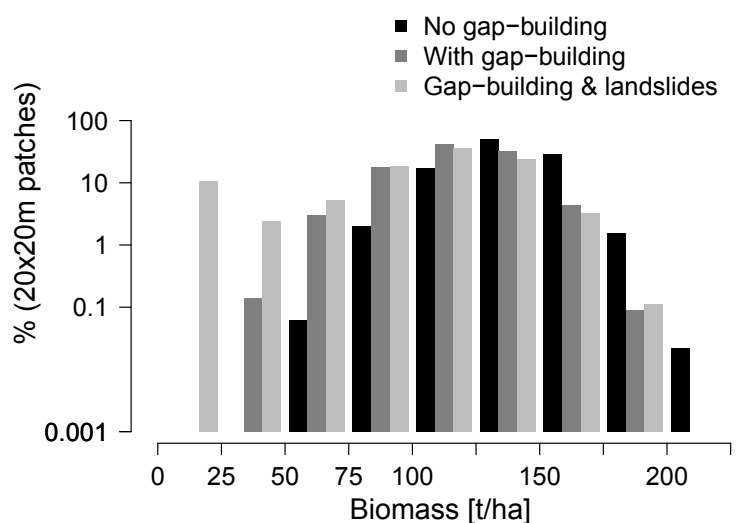


Figure 5: Frequency distribution of biomass on patches (20 x 20 m) for forest without gap-building (black) with gap-building (dark grey) and with gap-building and landslides (light grey) respectively. All bars show the mean of 20 simulation runs (over 1000 years) on one hectare; error bars display the standard deviation between runs. Image: Claudia Dislich.

NUMEX: Nutrients and the Regeneration of Forest Trees

Processes affecting the seedling stage act as a strong selective filter in tree regeneration not only in tropical forests, controlling patterns of recruitment and thereby influencing future forest composition. In general, there are three main resources tree seedlings compete for: light, water and essential nutrients. Studies carried out more recently intended to separate the effects of above- and below-ground seedling competition, by e.g. using pot experiments, transplantation, trenching or experimental nutrient addition. The results showed that below-ground competition for nutrients has to be considered as an important factor influencing seedling growth, especially on less fertile soils. However, the degree to which species respond differentially to soil

resources depends on species-specific nutrient requirements and the resulting long-term effects of nutrient addition on species composition remain unclear (see: e.g. [1], [2], [3]).

As reported earlier in this newsletter (see: Issue no 6: <http://tinyurl.com/TMFnews06>) we found alterations in several measures of tree growth and forest productivity after only one year of duration of NUMEX (NUTrient Manipulation EXperiment, addition of moderate amounts of nitrogen (N: 50 kg ha⁻¹ yr⁻¹) and/or phosphorus (P: 10 kg ha⁻¹ yr⁻¹ to representative forest stands). Since tree seedlings are thought to be more responsive to changes in their environment than mature trees we expected sizeable species-specific effects in the performance of seedlings leading to changes in the composition of the whole seedling assemblage.

During 2010 we established in total 576 tree regeneration plots (1 m² each) within the existing NUMEX plots from 1000 to 3000 m a.s.l. and a first census at the lower montane forest site (San Francisco, 2000 m) was carried out at the end of last year (Figure 6: B.Sc. thesis of Kerstin Bruns).

N and P Effect Seedlings' Growth Differently

There was no significant effect of nutrient manipulation on plant density (Figure 7 a, next page). However, in the N and N+P treatments the plants were taller and had larger diameters (Figures 7 b-c). Moreover, leaf area loss was highest among the seedlings in these treatments (Figure 7 d). Additions of P did not show any effects on the plants so far.

The preliminary results thus probably point at higher growth rates after addition of N or N+P. On the other hand, in these treatments there were fewer individuals in the smaller size classes what could be the result of poor recruitment of new plants. The following censuses will show how recruitment and growth rates of the different species are affected by the added nutrients.

Jürgen Homeier



Figure 6: A seedling of *Endlicheria oreocola* (Lauraceae) in one of the regeneration plots at 2000 m a.s.l. in the San Francisco area. Photo: Jürgen Homeier.

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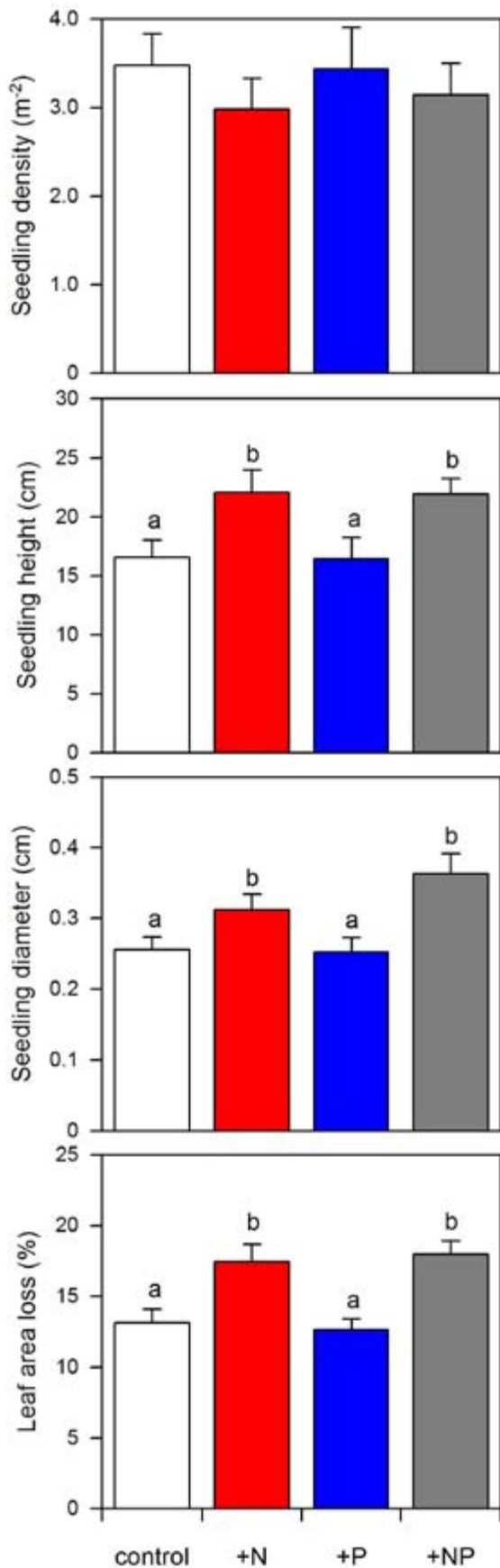


Figure 7: Effects of nutrient addition on density (a), height (b), diameter (c) and leaf area loss (d) of tree seedlings after 2.5 years of experiment duration. Shown are means \pm 1 SE. Different letters indicate significant differences between the treatments (Fisher's LSD test, $p < 0.05$). Data and graph: Jürgen Homeier.

NUMEX: Tree Growth Along Elevational and Nutritional Gradients

The first complete year of high-resolution tree-growth measurements detecting the impact of nitrogen (N) fertilization on stem diameter variations is now available. Our aim is a continuous monitoring of seasonal tree growth dynamics at the NUMEX-plots, because there are strong indications that N is the most limiting nutrient for tree growth at RBSF, as highlighted by Jürgen Homeier in this newsletter (see page 9).

For this reason 16 dendrometers were established at N-manipulated-plots and non-manipulated control plots at 2000 m and 3000 m a.s.l.. Stem-diameter variations of the tree species *Podocarpus oleifolius*, *Graffenrieda emarginata*, *Persea feruginea*, *Alchornea grandiflora*, *Prunus sp.*, *Weinmannia elliptica*, *Weinmannia ovate*, *Graffenrieda harlingii* and *Prumnopitys montana* are measured in 30 Minutes intervals. These measurements provide data of species-specific diurnal stem variations during a daily cycle. They will be the basis to understand the impacts of long- and short-term changes in environmental and climatic conditions on tree growth.

Responses to Nitrogen Fertilization

Results for four different tree species at the 2000 m-site are shown in Figure 8: The graphs illustrate cumulative daily radial changes for the species *Graffenrieda emarginata*, *Podocarpus oleifolius*, *Prunus sp* and *Alchornea grandiflora* which are growing on N-manipulated and non-manipulated plots, respectively. At the first site, it is obvious that the cumulative growth curves are quite homogenous between all studied trees species and reveal highly synchronous growth variations during the first year of the measurements. Beside *Graffenrieda emarginata*, all individuals growing on N-manipulated plots (dashed curves) show more stem diameter growth than the individuals at the non-manipulated reference plots. However, to prove whether these differences are statistical significant, the measurements need to be continued.

How Climate Influences Stem Diameters

These stem diameter variations can be linked to climatic factors like precipitation and temperature. Figure 9 illustrates short-term variations of the different tree species (lower panel), and their connection with daily sums of precipitation and daily mean temperature (upper panel): During periods of several successive days without rainfall stem diameters decrease and vary synchronously even between the different tree species of different plant functional types.

These first results are extremely useful for the intra-annual analyses of stable isotopes ($\delta^{13}\text{C}$ and $\delta^{18}\text{O}$), that are planned as next steps of investigation. We ex-

pect that intra-annual variations of stable carbon isotopes provide a further technique to detect seasonal, environmental-induced plant physiological reactions.

Susanne Spannll & Achim Bräuning

Figure 8: Cumulative daily radial changes of four different tropical tree species. Individuals growing on N-manipulated-plots are shown in dashed lines; individuals growing on non-manipulated plots are in continuous lines. Data gaps are highlighted with grey hatched boxes. Image: Susanne Spannll & Achim Bräuning.

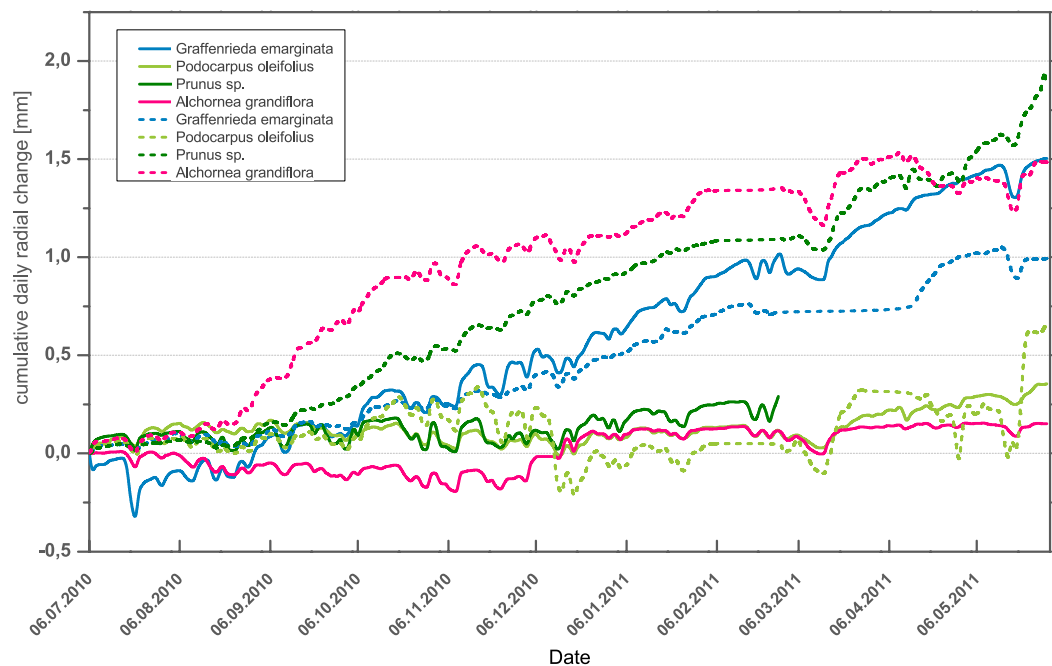
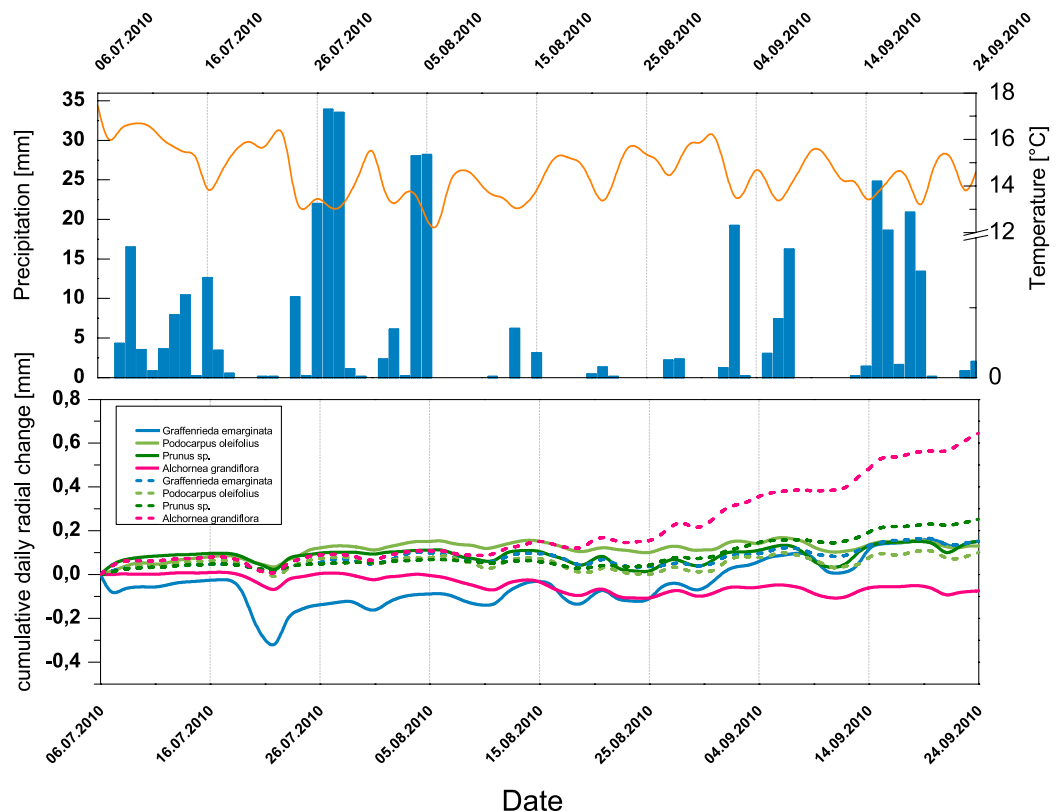


Figure 9: Cumulative daily radial changes of different tree species at RBSF and climatic conditions during July and September 2010. Despite of different absolute growth rates, stem diameters react synchronously on periods with short-term drier conditions. Individuals growing on N-manipulated plots are depicted with dashed lines. Individuals growing on non-manipulated plots are depicted with continuous lines. Image: Susanne Spannll & Achim Bräuning.



Ways of Water in the Ground

Water flow paths in soils of an undisturbed and landslide affected natural Andean forest ecosystem were identified, characterized, and modelled in subproject D5. Here, in the core investigation area of the Estación Científica San Francisco (ECSF), in gentler slopes and altitudes above 2100 m a.s.l. mainly Stagnosols and Histosols prevail with low to negligible rock fragment content. With increasing altitude the abundance of these soils increase, while the presence of Cambisols and Regosols is most pronounced below 2100 m a.s.l. and are mainly encountered in steeper, particularly landslide affected sites often resembling a melange of fine soil and high contents of rock fragments. We found that in these soils both rock fragment content and bulk density control significantly but not largely the saturated hydraulic conductivity ($= K_{sat}$). Dye tracer experiments and soil parameters document a deeper percolation at least until the weathered bedrock (Figure 10).

Flow Paths in the Soil

In the landslide unaffected hillslopes situated above 2100 m a.s.l., however, preferential flow in root channels with low soil matrix interaction dominates in the mineral topsoil; a quasi impervious layer along the interface between topsoil and subsoil limits deeper percolation of the water. Consequently, conditions are given to favour lateral shallow subsurface flow within the topsoil featuring an average thickness of 20 cm, and/or along the interface between topsoil and organic layer (Figure 11). The existence of this flow has already been indirectly proven by previous studies in this area. In combination with a recently published digital soil map, we can link the shallow lateral subsurface

flow particularly with slopes of less than 30° above 2100 m a.s.l.. However, even if the conditions for shallow subsurface flow are not evident for the landslide affected hill slopes, we cannot exclude its occurrence here since soil cover of the steep terrain is relatively shallow while rainfall is high throughout the year.

Modelling Flow Paths

Therefore, we conducted a series of virtual experiments in order to assess the potential occurrence of shallow subsurface flow in Cambisols below 2100 m a.s.l.. The virtual experiments were based on a two dimensional finite element model representing a steep forested hillslope transect of ~54 m length. Aside soil properties, evapotranspiration and interception, the model included the spatial variability of the saturated hydraulic conductivity, and the organic layer being highly abundant in the forested part of the investigation area. Results show that occurrence of shallow subsurface flow requires at least an impermeable bedrock and depends on the spatial variability of K_{sat} . However, water losses through evaporation and probably the bedrock need to be more profoundly investigated, if shallow subsurface flow occurrence, solute and matter transport, and landslide initiation want to be properly considered in process conceptualizations.

Folkert Bauer

Reference

Bauer, F. (2011): Water flow paths in soils of an undisturbed and landslide affected mature montane rainforest in South Ecuador. PhD thesis, University of Bayreuth, department of soil physics. The thesis is available online: http://opus.ub.uni-bayreuth.de/frontdoor.php?source_opus=761.

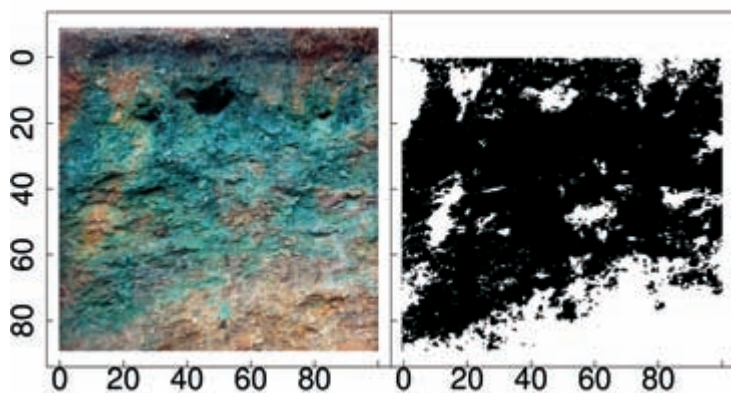


Figure 10: Profile photo (left) showing a Regosol within the depletion zone of a landslide (approx. 50 years of age) situated in the study area. The corresponding binary image (right) shows the dye tracer distribution represented by black pixels. Note that the dye tracer has percolated until the weathered bedrock. Units of the depth- and width axes are given in cm. Image: Folkert Bauer.

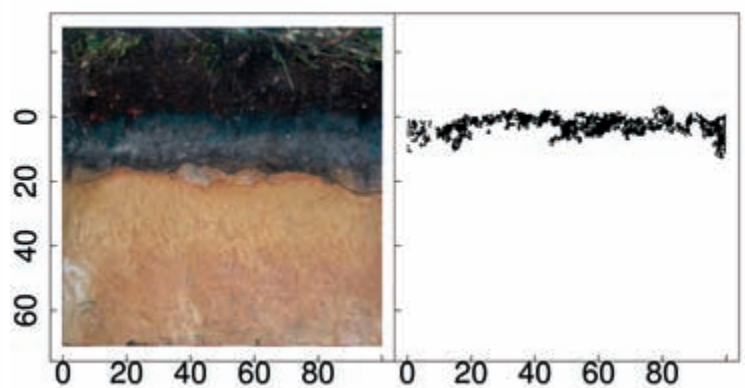


Figure 11: Profile photo (left) showing a Stagnosol within a landslide unaffected area (at approx. 2080 m a.s.l.). The corresponding binary image (right) shows the dye tracer distribution represented by black pixels. Note that the dye tracer remained at the interface between organic layer and mineral topsoil. Units of the depth- and width axes are given in cm. Image: Folkert Bauer.

From Forests to Pastures: Molecular Biomarkers as Tracer for Organic Carbon Sequestration in Soils

Dr. Ute Hamer got a grant from the European Science Foundation (ESF) for a long-term exchange visit to the *Laboratoire de Biogéochimie et Ecologie des milieux continentaux, UMR CNRS, UPMC, Centre INRA Versailles-Grignon*, France. The aim of her 2.5 months visit to the group of Dr. Cornelia Rumpel and Dr. Marie-France Dignac was to deepen the knowledge on stabilization mechanisms of organic carbon (OC) in the Ecuadorian mountain soils after forest to pasture conversion. The data obtained for the tropical mountain rainforest ecosystem will contribute to the overall goal of the ESF-Network MOLTER “MOlecular structures as drivers and tracers of TERrestrial C fluxes” (www.molter.no) to create a database of molecular biomarkers derived from distinct ecosystems to unravel terrestrial carbon fluxes. Especially, the contribution of plant root and plant shoot organic matter to the formation of soil organic matter (SOM) in mineral top soil (0-5 cm depth) was examined. Along the land-use gradient (natural forest → 8 year old pasture → 20 year old pasture → 53 year old pasture → abandoned pasture) root and shoot specific molecular biomarkers of *Setaria sphacelata*, *Pteridium arachnoideum* and forest organic layer were identified. To release biomarkers saponification was applied (Figure 12) as described in Mendez-Millan et al. [1]. Using differences in the natural ^{13}C abundance of specific biomarkers the turnover of forest and grass derived organic matter was assessed.

Significant differences between grass and bracken or forest organic matter existed regarding the chemical composition as well as the $\delta^{13}\text{C}$ -signature of the respective compounds [2]. In pasture soils the roots of *Setaria sphacelata* were more important as OM source than the shoots as indicated by the composition of aliphatic monomers of the bound lipid fraction. Especially, the grass root biomarker $\omega\text{C}_{16:0}$ contributed to the temporary accumulation of SOM. In the 53 year old pasture about four times higher concentrations occurred compared to forest soil. After pasture abandonment, however, this grass root biomarker was decomposed rapidly. Thus, the main mechanisms for SOM accumulation in pastures seemed to be the high input of root OM exceeding decomposition rates. Some grass root and shoot derived biomarkers persisted in soils after pasture abandonment but their contribution to the total pool of the respective biomarker was low. Generally, forest derived OM was more important for the long-term stable pool of SOM than grass derived

OM. Discrepancies in the behavior of forest versus grass derived monomers point to the importance of the stabilization of forest derived OM via bonding to soil minerals.

Ute Hamer

References

- [1] Mendez-Millan, M., Dignac, M.F., Rumpel, C., Rasse, D.P., Derenne, S., 2010. Molecular dynamics of shoot vs. root biomarkers in an agricultural soil estimated by natural abundance C-13 labelling. *Soil Biology & Biochemistry* 42, 169-177.
- [2] Hamer, U., 2011: Final Report of the long-term exchange visit within the ESF-Network MOLTER (www.esf.org).



Figure 12: Soil, plant and litter samples were refluxed for 18 hours in an aqueous methanol solution with 6% KOH to release biomarkers for further analysis. Photo: Ute Hamer.

Cooperations

Weaving a Network to Create a Platform for Biodiversity Research and Monitoring in southern Ecuador: A UTPL Perspective

The southern region of Ecuador has, over the past decade, been traditionally viewed as a key area for research, especially with regard to biodiversity. Collaboration between the Universidad Técnica Particular de Loja (UTPL), the Universidad Politécnica de Madrid (UPM) and the Universidad Rey Juan Carlos (URJC), commenced around 2001. The basis of this collaboration was a UPM-training program for UTPL professors on the "Management of Plant Genetic Resources". Since 2004, 25 PhD students have received training (some of which are still undergoing their training) through this program. Apart from facilitating academic training, these academic linkages have also aided the development of several projects funded by the Agencia Española de Cooperación Internacional (AECI), Programa Iberoamericano de Ciencia Y Tecnología para el Desarrollo (CYTED), Banco Bilbao Vizcaya Argentaria (BBVA) and the Ecuadorian research agency (Secretaría Nacional de Ciencia y Tecnología, SENACYT).

The UTPL and both RUs

In addition to the development of the "Spanish node", UTPL has acted as counterpart in several projects within the framework of the preceding DFG-Research Unit (RU 402). More specifically, three UTPL professors commenced their PhD studies within the framework of RU 402 in 2003, funded by the German Research Foundation (Deutsche Forschungsgemeinschaft, DFG). What's more, five UTPL professors started their PhD studies under the new umbrella of "bilateral cooperation" in topics related to the present Research Unit (RU 816). Over this period, several key activities were carried out, including important support for laboratory equipment, namely a molecular biology laboratory, with the support of DFG and the German Federal Ministry of Economic Cooperation and Development (BMZ). Since October 2010, UTPL has acted as counterpart for the DFG project package "Acceleration of Biodiversity Assessment" (ABA Ecuador) and has subsequently contributed to the development of a project entitled "Acceleration of Biodiversity Assessment in Orchids (ABA-ORCH)", which obtains funding by the National Secretariat of Science and Technology of Ecuador (SENACYT) since July, 2011.



On the other hand, UTPL and the University of Idaho (UI), USA, launched a pilot project in 2008 on the Ecology of Andean Mammals. A next step was a project funded by the National Science Foundation (NSF) that supports short-term research projects which have to be developed by researchers from both Universities.

A preliminary multi-lateral network was established in August 2010 by a group of professors from the University of Idaho, the Universidad Rey Juan Carlos (URJC) and the UTPL, during the 1st workshop entitled "Long-term collaborative research and education programs on biodiversity conservation in the Ecuadorian Andes". The aim was to develop an integrated and long-term initiative to improve the local capacity for research. As a result, the group wrote a draft proposal for the first in-situ Master Program in Tropical Ecology. It is worth mentioning that SENACYT encouraged the group to submit the proposal as a PhD program. The latter organization also strongly supports the idea of integrating initiatives and establishing a common platform for Science and Educational development in the South of Ecuador.

The New Research Platform

The first meeting of the "initiator group" to design a new "Platform for Biodiversity and Ecosystem Research and Monitoring in South of Ecuador" was organized in Frankfurt, Germany in June 2011. The German side was represented by Jörg Bendix (Speaker of the RU 816); Erwin Beck (Deputy Speaker of the RU); Konrad Fiedler; Reinhard Mosandl, and Thomas Knoke. The Ecuadorian partners were represented by Carlos Valarezo from the Universidad Nacional de Loja (UNL), Jan Feyen from the University of Cuenca, Alfredo Martinez (ETAPA), the Director of the Ecuadorian Cajas National Park, Bruno Paladines from Nature and Culture International (NCI), and Juan Pablo Suárez from UTPL. After the meeting, the Ecuadorian group is encouraged to weave the network. Although this common platform is currently under construction, some additional work is still required to integrate the network with on-going research projects that are currently being carried out at Ecuadorian Universities.

Juan Pablo Suárez & Rodrigo Cisneros

Experimental Draught Impacts Ant Assemblage

Models of global climate change generally predict higher rainfall variability, with more intense rainfall events separated by extended drought periods. We studied experimentally the effects of prolonged droughts on diverse ant assemblages found between 1000 and 2000 m a.s.l. in mountain rainforests of Ecuador. The experiment was designed to test three predictions:

- (1) prolonged droughts will lead to a decline in ant species richness and abundance;
- (2) this decline will be stronger at higher elevations where ants are adapted to moist conditions;
- (3) soil-nesting species will be less affected than species nesting in dead wood or in leaf litter because the moisture decrease will be more important above-ground than below-ground.

Three 3x3 m experimental tents and three controls were installed at three elevations (1000, 1500 and 2000 m a.s.l.). Ants were collected six months after the experiment started. At that time, dead wood, leaf litter and soil samples were ~45%, ~50% and ~20% drier underneath tents than controls, respectively.

Total species richness was not significantly affected by the experiment but the ant abundance increased and the assemblage composition was modified. Changes differed among microhabitats. *Camponotus* (Figure 13) and *Solenopsis* in dead wood, *Dacetini* in leaf litter, were more frequent underneath tents. At the other side, *Pheidole* species (Figure 14) seemed to prefer moist conditions.

Ant response was globally consistent over the altitudinal gradient. It appears that moisture limits the number of individuals of a majority of Andean ant species, maybe by causing a physiological distress and/or limiting nesting site quantity.

*Thibaut Delsinne, Tania Arias Penna
& Maurice Laponce*

EDIT at the Royal Belgian Institute of Natural Sciences: <http://www.naturalsciences.be/cb/ants/projects/andes-mountain-forests.htm>, Belgium



EDIT is a collective of 29 institutions which aims to provide accountable tools to taxonomists, to significantly accelerate global taxonomic knowledge. The RU cooperates with researchers from EDIT since 2009.



Figure 13: Major worker of *Camponotus*, a genus living in dead wood, whose abundance increased during rainfall shortage. Image: Y. Laurent & I. Bachy (RBINS)



Figure 14: Major worker of *Pheidole*, a genus widely spread in the leaf litter and soil and suffering from rainfall exclusion. Image: Y. Laurent & I. Bachy from RBINS.

Data Warehouse News

The Information System

With the purpose to enhance the usability and transparency of the data warehouse (FOR816dw) we introduced two new categories to inform about the information system. On the one hand a completely new help category has been developed. It is HTML-based and much more flexible, linkable and interactive than the present static PDF documents. On the other hand the subpage displaying statistics about the usage and acceptance of the data warehouse has been basically rebuilt and extended.

The New Help Pages

You find the new category "Help" on the right of the horizontal navigation bar on the top of the website. It contains six subpages which will be filled step by step with information:

FAQ: this collection of frequently asked questions is a first address to become familiar with the FOR816dw. You find short answers and helpful links.

Website: describes the structure and usage of the website. It contains an interactive Site Map to navigate through the pages, explains the mail communication possibilities and describes how to administrate personal and project data.

Accounting System: here you find all information concerning the application and accounting of travels and other expenses.

Data Service: this page describes the comprehensive functions on the scientific data and metadata storage, management and exchange, which is the core of the FOR816dw.

ECSF / Ecuador: this is the information page maintained by the station managers, where you find all information regarding a travel to Ecuador and the stay on the ECSF.

Tips + Tricks: this is an open category for all hints carried together by the research members. This might contain how to organize the flight transport for technical stuff, where to find the best metal worker in Loja, what to avoid to eat in Ecuador/Germany or who to ask for help with administrative formalities. Please

send your contributions to webmaster@tropicalmountainforest.org.

The New Data Warehouse Statistic Page

You find the new statistic page of the data warehouse in "Data" >> "FOR816dw statistics". For full functionality JavaScript must be activated. The page presents daily updated graphs, figures and tables. It is divided into the following rubrics:

The "**Key figures**" show that actually 245 members have access to 362 publications and 364 datasets with about 29 Mio single values of 517 different attributes/variables.

The "**Website and User Statistics**" certify the high uptime rate (actually 99%) and a good response time (actually 530 ms) of the website. The interest in the online presence of the RU and the acceptance of the information platform by the RU members can be seen in the visitors statistic. A "Member by country" statistic gives an impression of the internationality of the RU.

The "**Dataset Statistics**" show in the list of the mostly downloaded datasets (top 30) that climate datasets are predominantly asked, followed by soil classifications and tree growth data. A further graph shows the monthly downloads of datasets (~50), single attributes (~30) and literature (~60) during the last 12 month and verify that a central data exchange platform in such a comprehensive research consortium is advisable.

Station Booking System Redesigned

In these days a new version of the "ECSF Station booking system" is online. It is still accessible via the TMF-website following "Documents + Services" >> "Booking System". The external webpage has been developed by the subproject Z1 (namely the student assistant Matthias Brandt). The existing functions of the recent system are extended by the possibilities of day specific reservations and online reservation changes. This supports the station manager in planning the capabilities of the station. To administrate the reservations a more sophisticated and comfortable backend has been developed in collaboration with the station managers.

Station Pass

Another product Z1 has established for the management of the ECSF is the "Station Pass", which enhances the security on the station and in the field. You find all information on how to use and how to generate the station pass on the new help page "ECSF / Ecuador" in the new help menu on the TMF website:

www.tropicalmountainforest.org

Thomas Lotz (Data Warehouse Manager),
Maik Dobbermann (Data Warehouse
Developer and Webmaster)



The new help menu is offered at the right end of the top navigation. Screenshot: Thomas Lotz.

Miscellaneous

Ecuador goes Tanzania

During the international joint meeting of the Association for Tropical Biology and Conservation (ATBC) & African Section of the Society for Conservation Biology (SCB) in Arusha/Tanzania, in June 2011, a symposium called "Comparative functional ecology of montane forests in South America and East Africa" was organized by Georg Guggenberger (Leibniz University Hannover), Achim Bräuning (University Erlangen-Nuremberg) and Masresha Fetene (Addis Ababa University).

The goal of this symposium was to join forces between two DFG-funded research groups working in tropical mountain forests (FOR816 and PAK188) and to provide a comparative analysis of the ecophysiological traits of montane forests in South America and East Africa. The symposium highlighted how important different ecosystem functions and services are altered by both uncontrolled disturbances and forest management.

The following four talks were given by members of the RU:

- Achim Bräuning "Do tropical evergreen conifer forests grow continuously – intercontinental comparison of the Podocarpaceae family"
- Thomas Knoke "Montane tropical forests as part of economically diversified land-use portfolios"
- Thorsten Peters "Why is it hot? Vascular plant diversity in the tropical Andes of Southern Ecuador"
- Florian Werner "Effects of land-use change on the diversity of different groups of plants and animals in a neotropical montane moist forest"

Thorsten Peters & Achim Bräuning

More Information:

The complete meeting program of the conference entitled "Adaptability to Climate Change and Attaining the Millennium Development Goals for Tropical Ecosystems" which took place from 12 – 16 June, 2011 in Arusha, Tanzania, is available at: www.atbc-scbafrika2011.org/fileadmin/downloads/Arusha_2011_Meeting_Programme_v2_FINAL_Printed6June2011.pdf

People and Staff



Photo: private

Dr. Rütger Rollenbeck, Post Doc in project D3 (Impacts of environmental change on climate and ecosystem in southern Ecuador) and member of the local advisory board in Ecuador, successfully concluded his **habilitation** at the Faculty of Geography, University of Marburg, on 13th July 2011. His cumulative habilitation thesis

„*Precipitation dynamics in tropical mountain forests*“ compiles eight years of research on the dynamic processes of rainfall formation in southern Ecuador conducted in the preceding RU (RU402) and the present RU (RU816). He published this research results in 28 papers; 14 of them are included in his cumulative habilitation. After the work of Sven Günter, this is the second completed habilitation elaborated in the RU. All of Rollenbecks publications can be retrieved from: <http://lcrs.geographie.uni-marburg.de/index.php?id=94>.



Photo: private

Amelie Bucker finished her PhD thesis on chemical and biological water quality in the ECSF catchment in 2010 (former subproject B3.2 now D4). Having found her affinity to the topic of 'water and land-use', she now works in a project concerned with the "Georesource water – challenges of global change". In this project supervised by the German Academy of Science and Engineering (acatech) and the GeoForschungsZentrum Potsdam (GFZ) she works on synthesizing current knowledge on water-related problems and formulates recommendations on how to sustainably manage water in Germany during times of Global Change.

Folkert Bauer left the RU and now works as an environmental expert for soil & water at the BASF SE Company in the field of "Sustainability and Product Stewardship".



Photo: private

Susanne Spann will start her PhD thesis in the work group D2 of Professor Achim Bräuning in August. She will analyze the NUMEX Plots and the Laipuna forest for her thesis entitled "Environmental changes in tree growth and variations in stable isotopes of different tree species in tropical forests in Southern Ecuador". She is already familiar with the study site and the RU since she had worked in Ecuador before and just finished the maternity cover for Franziska Volland (also working group D2).

Event Calendar

- 6 / 7 Oct. 2011 Annual Status Symposium of the RU at the Universidad Técnica Particular de Loja, Ecuador
- 7 Oct. 2011 Member Assembly of the RU after the Status Symposium, Ecuador
- 10 Oct. 2011 Meeting of the initiator group for the new Research Platform at the ECSF, Ecuador.
- 22-25 Feb. 2012 The next conference of the Society for Tropical Ecology (*gtö*) is entitled "Islands in land- and seascapes - The challenges of fragmentation" and will take at the University of Erlangen, Germany.
- Feb. 2012 Member Assembly in proximity to the *gtö* conference, Germany.



Deadline

The editorial deadline for the forthcoming issue of the TMF Newsletter is:

October 28th 2011.

Please send all information, your manuscripts and images to the editorial office (See contact).

Credits & Contact

DFG Research Unit 816



More information about the Research Unit (RU 816) investigating Tropical Mountain Forests (TMF) is available at: www.tropicalmountainforest.org

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