Newsletter

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

Issue 5 - 3/2009

Speakers' Corner

The year 2009 will be much influenced by the application for the extension phase of our Research Unit (RU) for the second phase 2010-2013. Already in late 2008, the scientific advisory board (SAB) met in Marburg to specify the baseline of the structure and the scientific program for the second phase. With regard to future developments beyond that phase, it was decided to start the consolidation of the field program by concentrating on three well-equipped scientific platforms:

(i) The NUMEX forest sites,
(ii) the pasture experimental core site and
(iii) the landscape site encompassing both, the natural forest and the anthropogenic replacement system.

During our preparatory workshop in Freising from 16th to 17th February 25 new scientific proposals for the second phase were presented and intensively discussed. The new structure for the extension phase will encompass four scientific foci:
(A) Biodiversity & Global change,
(B) Pastoral ecosystems,
(C) Rehabilitation and sustainable development and
(D) Landscape dynamics.

The new program is mainly focussed on ecosystem functioning and services, with special regard to local and global change aspects. With this, we are confident that we can thoroughly integrate our unique data and knowledge from more than ten years of investigation into an overall understanding of the ecosystem(s) in the Riserva Biologíca San Francisco (RBSF) and to derive science-directed recommendations for a sustainable management of our biodiversity hotspot. The review process for the second phase will take place in Loja from 31st October to 4th November 2009 where the public part of our status meeting will be held on the afternoon of the 3rd November. Following the evaluation, a three-day excursion for principal investigators and reviewers to the south-Ecuadorian Oriente is planned. The next member assembly of the RU will be held along the gtö-ATBC meeting in Marburg on 29th July 2009 in the afternoon.

The DFG Science TV project has recently released the English version of our 12 movies produced in early 2008. DVDs were distributed at the Freising workshop. The movies were also published on the DFG science TV: http://dfg-science-tv.de.

Jörg Bendix and Erwin Beck,
Speaker and Deputy Speaker of the RU

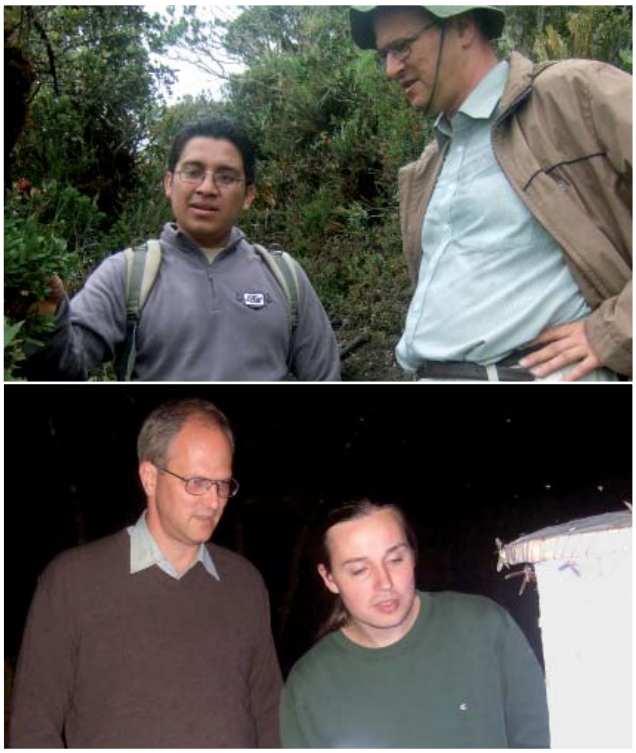
Contents

News from the ECSF

Ambassador Visits Research Union

Christian Berger, the German Ambassador in Ecuador, visited the Estación Científica San Francisco (ECSF) on 17th and 18th February. Jörg Zeilinger introduced the objectives of the RU, and Ph.D. students from various projects presented their lab and field work. Ambassador Berger was very impressed by the enthusiasm of the Ph.D. students. Since he loves orchids he was fascinated by the high diversity of orchid species in the forests of the research station.

On the second day Ambassador Berger visited Cajanuma were he studied the plots of the **Nu**trient **M**anipulation **Ex**periment (NUMEX) as an example of the scientific ecological experiments conducted by the RU. Later he visited the NCI offices (see News from NCI) and met the new regional director of the Ministry of the Environment (MAE) in Loja Eng. Carlos Espinoza. Three publications written by members of the RU were handed over to the director and are now at disposition of MAE. Former issues of the newsletter already reported about the two books „Ecological Studies: Gradients in a tropical mountain ecosystem of Ecuador“, “Checklist of Organisms” and the brochure “El Bosque Húmedo de la Montaña”. *Jörg Zeilinger*



Nixon Cumbicus the Ph.D. student from the group around Leuschner who is responsible for NUMEX informs ambassador Christian Berger about the plants at Cajanuma (top). Florian Bodner Ph.D. student from Fiedler‘s group demonstrates how the traps with artifical light (right) are used to allure and caputure moths in the rain forest at night (bottom). Photos: Jörg Zeilinger.

News from NCI

Training of ECO-Club Coordinators

On December 17th/18th RU and Nature and Culture International (NCI) organized a workshop with ECO Club coordinators from the provinces of Loja and Zamora Chinchipe. In ECO Clubs pupils can engage in ecological activities. Teachers are coordinating the activities and education programs. During the training the brochure “El Bosque Húmedo de la Montaña” was introduced to the coordinators. NCI would like to thank the colleagues of the RU for their essential help in organizing the event and for their excellent expositions and field trips.

Dipl. Geogr. Andreas Fries explains one of the climate stations of the ECSF and the use of climate data during the field trip of the ECO Club coordinators. Photo: NCI Ecuador.

Successful Commercialization

In recent years, NCI has developed initiatives to improve the economic situation of regional farmers. One successful approach is introduced by José Romero who describes the commercialization of the native cherimoya fruit on the next page. *Helmut Sonnert*

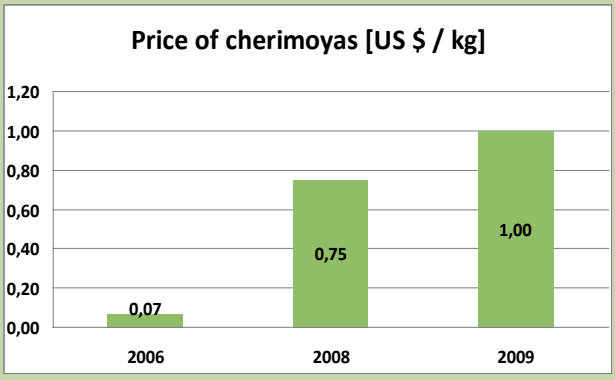
During his trip to the RU, the German ambassador Christian Berger (back row third from left) visited NCI‘s office in Loja on February 18th. Representatives from NCI, the Universidad Técnica Particular de Loja (UTPL), and the Universidad National Loja (UNL) acquainted him with the objectives of their organizations and their relationships with the RU. Photo: NCI Ecuador.

Joint Venture of Local Farmers Improves Marketing

Funded by the European Union, the Cherla project (www.cherla.com) seeks to promote sustainable production systems of the cherimoya fruit (*Annona cherimolla*). The cherimoya is a fruit tree originated in the Andean region and presents excellent qualities and nutritional values. The Cherla project is partnered with the Coffee Growers Association of Espindola and Quilanga (PROCAFEQ) in southern Ecuador, an association that produces award-winning coffee. In the last two years the organization has won the prize for the best coffee quality throughout Ecuador at the "Golden Cup" Competition. PROCAFEQ also offers innovative developments in administrative management, marketing and sales. PROCAFEQ is part of the Regional Federation of Ecological Small Coffee Growers Associations of Southern Ecuador (FAPECAFES) through which they are able to sell their products on international markets.

Coffee is traditionally produced by most farmers in the southeastern region of the province of Loja in a polyculture system. In these systems coffee is collocated with important timber plants like *Tabebuia chrysantha*, and *Podocarpus* sp. or with non-timber species like cherimoya, *Tara* sp., or *Vasconcellea* sp. Some of them are native to the area such as the cherimoya and the *Vasconcellea*. Over 200 local varieties of cherimoya have been identified in this region, 25 of which could easily compete with current „commercial varieties". Many producers few the cherimoya as a weed since it grows so easily despite the sometimes adverse soil, water and temperature conditions present in the region. The production system has allowed PROCAFEQ to obtain a number of accreditations (organic, bird friendly, fair trade) that have distinct advantages in the market.

Nature and Culture International (NCI) has been helping local farmers to benefit from the cherimoya plants that exist within coffee plantations. The plants are an integral part of the polyculture production system and provide alternatives of additional generation of income to the associates. When the program was initiated in 2006, the price of the fruit was so low that the people had little interest in its cultivation. NCI furthered the improvement of production methods like pruning, insect control, harvest, transport. After that and after the farmers decided to enter the market through the association the fruit prices increased noticeably (see Figure). Furthermore, the number of associates growing cherimoyas increased from 30 families to 175 families. 30% of the new families became involved in PROCAFEQ only through the growing of cherimoyas.



Price of cherimoya fruits paid to the producers.

The sweet cherimoyas which are offered on the markets are sometimes deriving from Peru or Colombia. Photo: NCI Ecuador.

Cultivation of coffee in an agro forestry system planted together with cherimoyas and other native fruits. Photo: NCI Ecuador.

Farmers seperate harvested chirimoyas according to quality and size. Photo: NCI Ecuador.

PROCAFEQ has established a marketing system for coffee including harvest, transport, and payments, which also works well for the cherimoya fruit. Upon joining the program, the farmers commit to the complete management of 10 plants per hectare (pruning, insect control, application of fertilizer). If all goes well, these 10 plants will mean an additional income of $ 750/year in the coming years. However, since the attractive prices being offered for the fruits on the market, farmers are dramatically increasing the number of plants per hectare. If the growth rate remains the same in the next five years, the cherimoya will represent an income similar to that produced by coffee (US $ 270,000/year).

With these results NCI has successfully demonstrated that farmers can increase benefit from diverse farms, and that the management of a crop native to the region represents a great advantage in an increasingly competitive market. It should be noted that the current price of cherimoyas coming to Lojas supermarkets from Peru is US $ 4.30/kilogram. This project shows how the price paid to producers can improve significantly as processes are consolidated.

In this section NCI (www.natureandculture.org) introduces its activities. This time José Romero describes the organization's success in improving the financial welfare of local communities. For more information, contact José Romero Motoche: jromero@naturalezaycultura.org. NCI is a non-governmental organization whose mission is to assist in the conservation of biological and cultural diversity.

Science News

Natural Forest Management Experiment

Water and Nutrient Fluxes Remain Unchanged after Selective Logging

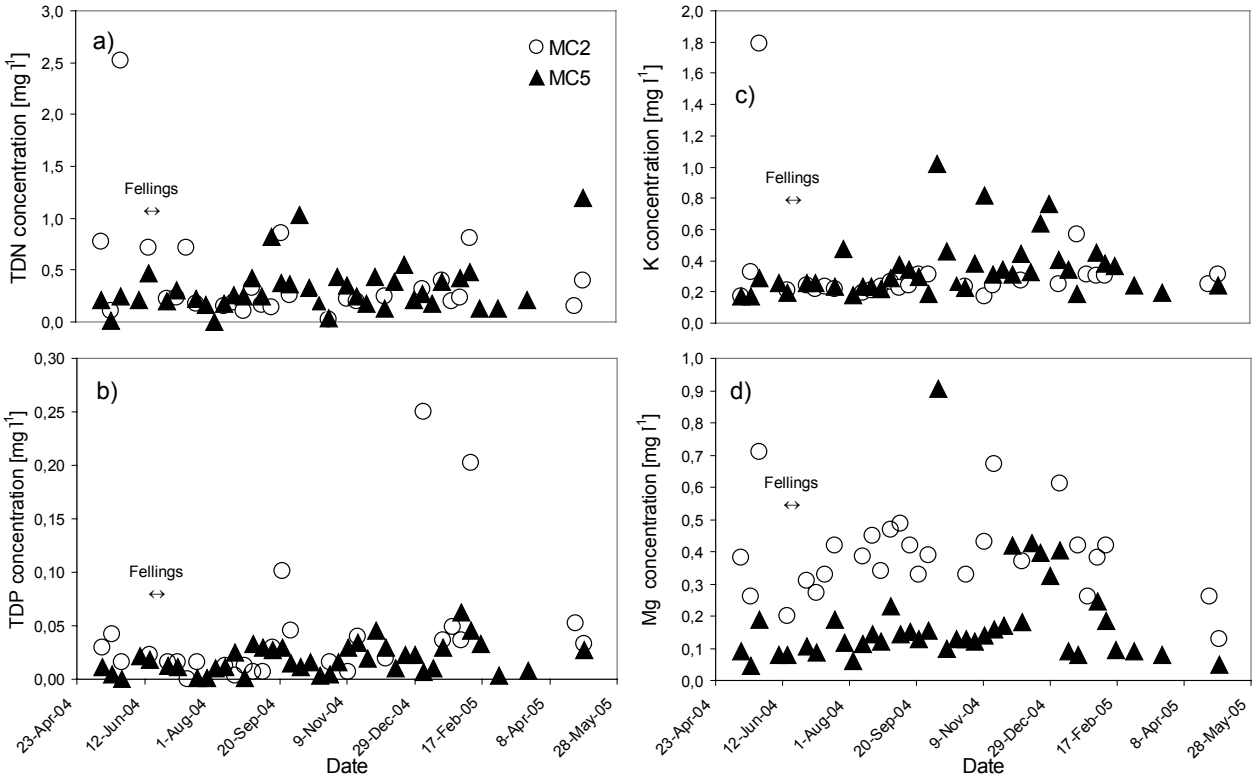
We evaluated the response of water and nutrient cycles in a natural tropical montane forest to selective logging ("improvement fellings"). In the Natural Forest Management Experiment (microcatchment MC5) the forest was thinned by felling 10.2% of the initial basal area (dbh ≥ 10 cm) on 30% of the catchment and the stems remained in situ. We monitored the course of the nutrient concentrations in ecosystem fluxes and compared the results from MC5 with those from the undisturbed catchment MC2.

In both catchments, we measured ecosystem fluxes from rainfall via throughfall and stemflow to soil solution (litter leachate, soil solution at 15 and 30 cm depth) and stream flow between May 2004 and May 2005. Furthermore, after the fellings in MC5, soil solutions were extracted from the gaps created by the felled trees and the forest next to the gaps. We determined aboveground water fluxes by direct measurement and soil water fluxes with a budget approach. In the solutions, we measured concentrations of NH_4^+-N, NO_3^--N, total dissolved N, PO_4^{3-}-P, total dissolved P, Ca, Mg, K, Na, and Cl^-. Fluxes were calculated as volume-weighted mean concentrations times water fluxes. Dry deposition was estimated using Cl^- as inert tracer.

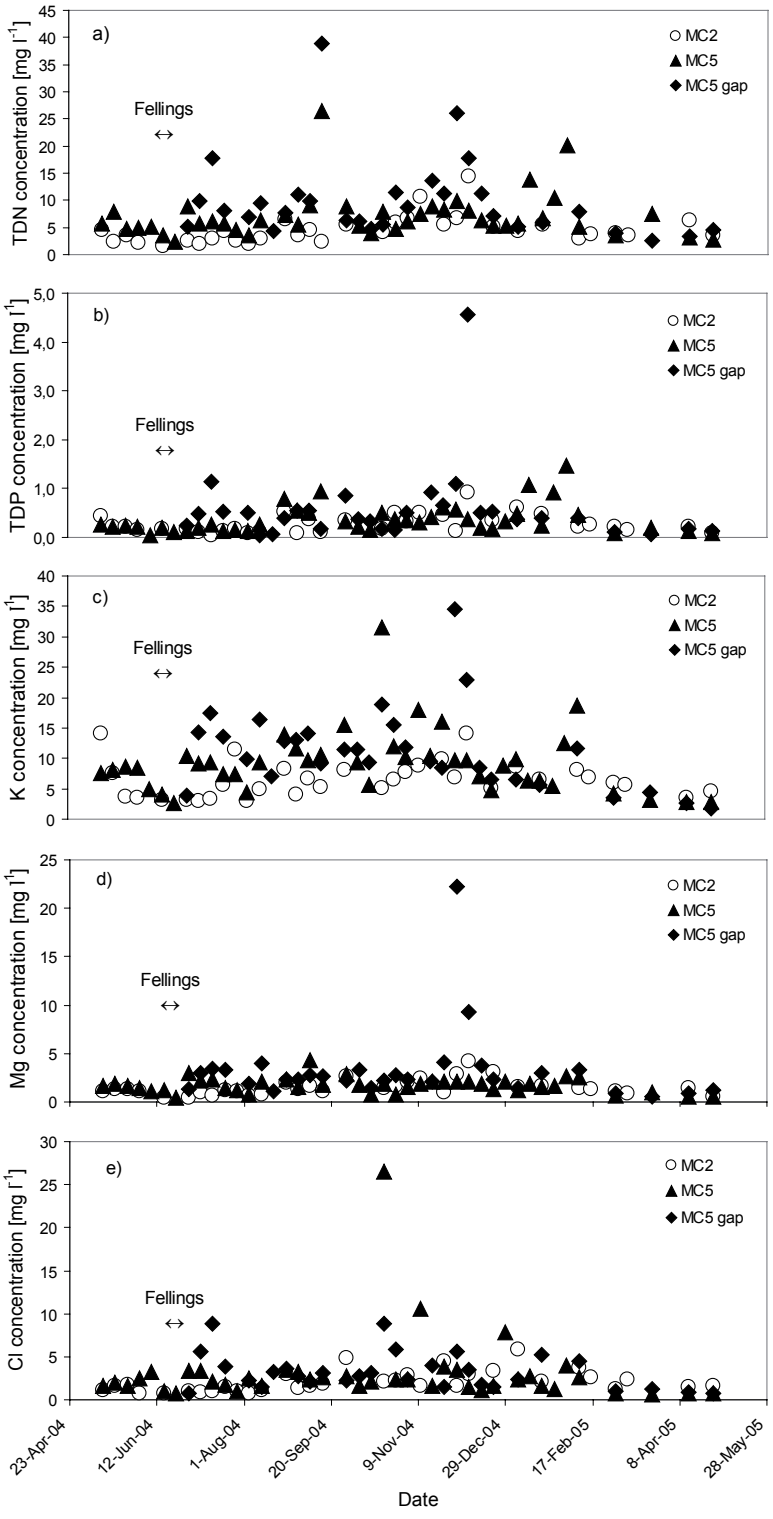
The fellings increased concentrations of N, K, Ca, and Mg in the organic layer of the resulting gaps compared with the forest next to the gaps (see Figure next page). Lower nutrient concentrations and fluxes in the mineral soil of the gaps than in forest next to the gaps suggested that these nutrients were taken up by ground vegetation and target trees (not shown). The paired modified and undisturbed catchments had similar water and nutrient budgets as illustrated e.g., by the lack of a response of nutrient concentrations in stream water to the fellings (see Figure below). The fellings did not have a significant impact on the water and nutrient budgets at the catchment scale.

We conclude that the used forest management can be considered as sustainable with respect to water and nutrient cycles at the catchment scale. However, the later logging and removal of the target trees will produce further disturbances of the ecosystem which require a thorough analysis of effects on water and element cycles before the sustainability of the suggested forest management can be fully judged.

Wolfgang Wilcke



Course of the concentrations of a) total dissolved N, b) total dissolved P, c) K, and d) Mg concentrations in stream flow between 5th May 2004 and 4th May 2005 in the undisturbed (MC2) and modified catchments (MC5; for MC5 mean of the eastern and western weirs).



Mean course of the concentrations of a) total dissolved N, b) total dissolved P, c) K, d) Mg, and e) Cl^- concentrations in the litter lysimeters between 05/05/2004 and 04/05/2005 of the undisturbed (MC2), the forest next to the gaps in the modified catchment (MC5) and in the gaps created by the improvement fellings (MC5-gap, n = 3).
The results were recently published: Wilcke, W., S. Günter, F. Alt, C. Geißler, J. Boy, J. Knuth, Y. Oelmann, M. Weber, C. Valarezo & R. Mosandl: Response of water and nutrient fluxes to improvement fellings in a tropical montane forest in Ecuador. For. Ecol. Manage. 257, 1292-1304, doi:10.1016/j.foreco.2008.11.036.

New Tree and Epiphyte Species

A new tree species was recently named: *Meriania franciscana* C. Ulloa & Homeier (above). With maximum heights of more than 25 m it is one of the tallest trees of the study area. The species is quite common in ravines between 1800 and 2100 m and until now only known from the San Francisco valley. *M. franciscana* is one of five new tree species described so far from material collected in the San Francisco Reserve. However, within the almost 300 tree species of the Reserve are at least five additional new trees still awaiting scientific description. Ulloa Ulloa, C. & Homeier, J. (2008) *Meriania franciscana* (Melastomataceae), una especie nueva de los Andes sur orientales del Ecuador. Anales del Jardín Botánico de Madrid 65(29): 383-387. Text and Photos: *Jürgen Homeier.*

Three new species of epiphytes from the Reserve, two of the genus *Anthurium* (Araceae, right and below) and one of the genus *Peperomia* (Piperaceae, bottom), have recently been identified by the taxonomists Tom Croat (Missouri Botanical Garden, St. Louis, USA, *Anthurium* spp. nov.) and Guido Mathieu (University of Gent, Belgium, *Peperomia* sp. nov.). Text and Photos: *Florian Werner*

Stonefly larvae of the genus *Plecoptera* (Perlidae, top) and caddisfly larvae of the genus *Trichoptera* (Hydropsychidae, bottom) found in the Rio San Francisco. Adult stoneflies fold their two pairs of membranous wings flat over their backs. Adult caddisflies are moth-like insects related to Lepidoptera. The larvae of both species are used in bioassessments since they are representatives for water quality. For example stoneflies are intolerant of water pollution and their presence is an indicator of good or excellent water quality. Photos: Amelie Bücker.

Aquatic Invertebrates as Indicators of Stream Conditions

In May 2008 our group began a preliminary study on macroinvertebrate occurrence in the Rio San Francisco. In Europe macroinvertebrates have been used as “bioindicators” for rapid assessment of water quality for quite some time. Pure chemical analyses entail the big drawback that they are costly and time consuming. They furthermore provide only a snapshot of the current status of a river. On the other hand organisms reflect the long term conditions of a stream because they have rather long life cycles - often more than one year - are ubiquitous, and are relatively easy to study.

Since November 2008 Martin Sondermann from project B3.2 is doing his master thesis on the differences of macroinvertebrate communities of three disturbed and three forested catchments in the San Francisco valley. Our first results indicate that macroinvertebrate communities really differ between sites. Whether this is due to different water chemistry, varying organic matter input, UV radiation, or shading intensity is still being analyzed. *Amelie Bücker*

Monitoring Bracken from the Sky

A new approach to monitor biomass development of bracken and *Setaria* before and after burning was introduced by the scientists from subproject C3.1. In September 2008, a helium filled balloon equipped with a standard digital camera made its maiden flight (see Figure next page) since a balloon turend out to be more suitable than a kite. The flight was successfully conducted generating digital RGB airphotos of the bracken experimental site (see Figure below). Based on these data, a method will be developed to discriminate between bracken and *Setaria* individuals and to map the fractional projective cover of both species.

Jörg Bendix and Erwin Beck

The flight director inside the bracken plot (arrow) navigates the balloon by directing three pilots on the ground who are pulling the balloon tethers. The plot is covered with the pasture grass *Setaria*, bracken ferns and scattered bushes before the first fire experiment took place. A corridor around it guards neighboring aras from fire. Photo: RU [M] Brenner Silva.

People and Staff

Nerida Gutiérrez (Universidad Tacna, Peru, left) and **Fausto Reátegui** (Universidad Nacional Loja) have recently finished field work for their Licenciatura theses on vascular epiphyte communities in the 45 yr old patch of secondary forest (the 'Handtuchfläche' in German) near transects T2 and Q2. They documented a surprisingly heterogeneous and rich community: up to 70 spp. per 5 x 5 m plot. With over 300 species, the total sampling area of 0.1 ha harbored substantially more species than most primary tropical forests. Gutiérrez and Reátegui are now busy exploring the relationships between patterns of epiphyte diversity/ composition and environmental predictors (light, stand structure, distance to old-growth forest).

Florian Werner

From October through December 2008, the volunteer **Leyda Rimarrachín** (Universidad Trujillo, Peru) helped setting up a joint experiment between Gradstein's and Leuschner's group, by depositing 1,000 leaf litter bags in the ridge and ravine forests of the MATRIX plots. Aims of this study are to test whether litter decomposition is slower in ridge forests than in ravines, and whether possible differences in decomposition between the two habitat types may be related to litter quality or environmental conditions.

Florian Werner

On the way to its maiden flight: Dr. Rütger Rollenbeck, Dipl. Georg. Andreas Fries and Janina Albert are filling the ballon with helium (left, f. l. t. r.). Rollenbeck and Brenner Silva (with tethers) transport it to the bracken site (middle), and finally launch it (top right). The airborne ballon transports the camera smoothly directly above the bracken site (bottom right). Photos: Jörg Bendix.

New Data and Publications

Data and Web News

Website

Minor changes on the general webpage www.tropicalmountainforest.org of the RU were done since the year started. These include fixing some links and inconsistencies in the multi language approach. Furthermore some texts and headers were rewritten. If you have any comments or wishes for the webpage please let us know by contacting our helpdesk via help@tropicalmountainforest.org. All registered users are able to download the protocols and presentations of the last meeting of the research group held in Freising, Germany, this February: Have a look under the „Documents & Services - Protocols“ section of the website. Please let me remind you that it is possible for all full members of the RU to post news on the webpage on your own. That will help to keep the webpage up to date and interesting for visitors from outside the group.

Data Warehouse

The data warehouse expanded as well. Some new datasets (mainly meteorological data) are inserted and older datasets are updated. Furthermore new articles from various groups are uploaded and can be seen in the „Publication“ section on the website. New functions to download only some parts of a dataset - for example only temperature data from a combined climatic dataset with multiple attributes - are implemented. The possibility to upload datasets which are not mainly time-driven (time series) but have a continuous measuring in one dimension (e.g. depth under ground) are implemented as well. All creators of datasets have now the possibility to edit their meta-information on existing data or are able to update the data values without reentering the meta-information. Finally the data warehouse is waiting for your data to be uploaded. So please give it a try and contact us if you have any questions with the upload procedure.

Dietrich Göttlicher

New Thesis

Cristhian Chiriboga finished his thesis “Medida de la respiración del suelo y determinación de biomasa en zonas de pastos acitvos y pastos abandonados” at the UTPL in the subproject B2.1 in December 2008. In November 2007 he started his work and focused on differences in mineralization processes between active pastures and abandoned pasture sites. Chiriboga studied the mineralization of bracken roots in a laboratory incubation experiment. Furthermore he measured in situ soil respiration rates at the corresponding sites. These measurements showed that after abandonment of pasture sites the CO_2 efflux declined significantly from 0.57 to 0.45 g CO_2 m^{-2} h^{-1}.

Ute Hamer & Karin Potthast

Miscellaneous

New Project Involves Ecuadorian and German RU Partners

Soil Microorganism Diversity for Sustainable Potato Production

Two groups active in the RU are now getting started in a joint project called VALORAM (VALORising Andean Microbial diversity through sustainable intensification of potato-based farming systems) financed by the Europian Union (EU-FP7). From the eight VALORAM working groups, three are from Latin America. The ‚mycorrhiza groups‘ of Juan Pablo Suarez (UTPL, Loja) and of Arthur Schüßler (LMU, Munich) will receive significant grants for five years, funding three Ph.D. students (two in Ecuador), one Post Doc, and state of the art molecular biodiversity surveys.

The collaborative network of the RU - with its strong bonds to the two universities in Loja - was a seed for the planning of a German-Ecuadorian participation in the VALORAM project. The project is based on a strategy that is also found in the RU: understanding biodiversity as a founder for sustainable use of natural resources.

About 3800 potato varieties are grown in central Andean highlands, mainly by small-scale farmers. VALO-

A woman of the Yatzatputzan harvests potatoes at Guaranda, Ecuador. Since potatoes are robust crop plants with a very high yield/ha they are very efficient in small-farming systems. Because such systems feed most of the world‘s human population, potatoes play a key role in world‘s food security. Photo: Jean Louis Gonterre in collaboration with the International Potato Center (CIP).

RAM attempts to explore and ‚valorise' the native soil microbial diversity for an improvement of sustainable potato crop management practices. The results should benefit partners in Latin America and small enterprises will be involved in fungal and bacterial inoculum production. The projects may raise synergies and further collaboration with the RU. For example, the EU has launched a programme called ‚twinning', which aims at joining FP7 projects with projects in non-EU countries. The Argentinean funding agency has selected VALORAM as a partner, and workshops, exchange of scientists, and communication programs will improve knowledge exchange starting in mid 2009.

The RU may provide important input in such a larger network. A collaboration of the RU with VALORAM could generally strengthen research on microbial diversity in the Andean region, for improved sustainable management practices. Changing management practices are required for sustainable agricultural systems. In general, many of us will agree that most of our general knowledge originates from basic research, but rising global problems perhaps will lead to stronger demands for its efficient application. With respect to soil-microorganism-plant interactions, we are still far away from understanding many ‚functional diversity' aspects, which drive most terrestrial ecosystems. More effort in this research field will certainly pay off.

Arthur Schüßler

More Information

More information about the VALORAM project will be published soon on its website: www.valoram.ucc.ie.

The FAO composed a site on the occasion of the international year of the potato: www.potato2008.org.

ATBC-gtö Conference

The deadline to submit abstracts for talks and posters for the conference is April 15th 2009. Please submit your information online. The conference will take place in Marburg Germany from July 27-30, 2009. Further details are at: http://www.gtoe-atbc2009.com/talksposters.html

Deadline

The editorial deadline for the next issue of the TMF-Newsletter is: May 21st 2009. Please send your information to the Redaktionsbüro Wissensworte: esther.schwarz-weig@wissensworte.de

A biologist surveys samples from the germplasm genebank of the International Potato Center (CIP) at Lima, Peru. Photo: Jean Louis Gonterre in collaboration with CIP.

Imprint

DFG Research Unit 816 (RU)

More information about research, the scientific and the local advisory board, and all principal investigators is available at: www.tropicalmountainforest.org

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