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NewsLetter

Monitoring and Research Platform | South Ecuador

Issue 1 | April 2014

The dry forest of Laipuna is also under investigation now. Photo: Jörg Bendix

In this Issue

Coordinators' Corner

News Since the Start of Research in Spring 2013

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This section in the first Newsletter about the joint German-Ecuadorian research covers the new structure of the research consortium, presents the plot design, describes the status of the research stations, introduces new research infrastructures and reports about progress in one of the transfer projects as well as outreach activities.

After one year of mainly administrative issues, we proudly hand over the first Newsletter of our Platform. This is a greatly pleasant moment, because it symbolizes the re-starts of our research activities after more than one year of administrative difficulties, hardships and drawbacks. First of all, we would like to appreciate our esteemed Executive Editor Dr. Esther Schwarz-Weig for the appealing new layout of the newsletter.

Final Structure of the Research Consortium

The year 2014 started successfully with the approval of still pending projects by the German Research Foundation (Deutsche Forschungsgemeinschaft, DFG). With this, the German Platform part (almost) reached its final structure (**Figure 1**, next page), now encompassing 15 (16) German projects. Almost because Kristin Roos left the team after successfully starting her project B2 in February/March 2014 at site for an employment in pharmaceutical industry. Her former supervisor Erwin Beck has agreed to take over the project if the DFG will agree. Her project is very important particularly for the knowledge transfer part of the Platform. The final decision is still pending but we will keep our fingers crossed that the successfully started project, which is primarily linked to our non-university partner Gestion

doi: 10.5678/lcrs/pak823-825.cit.1260

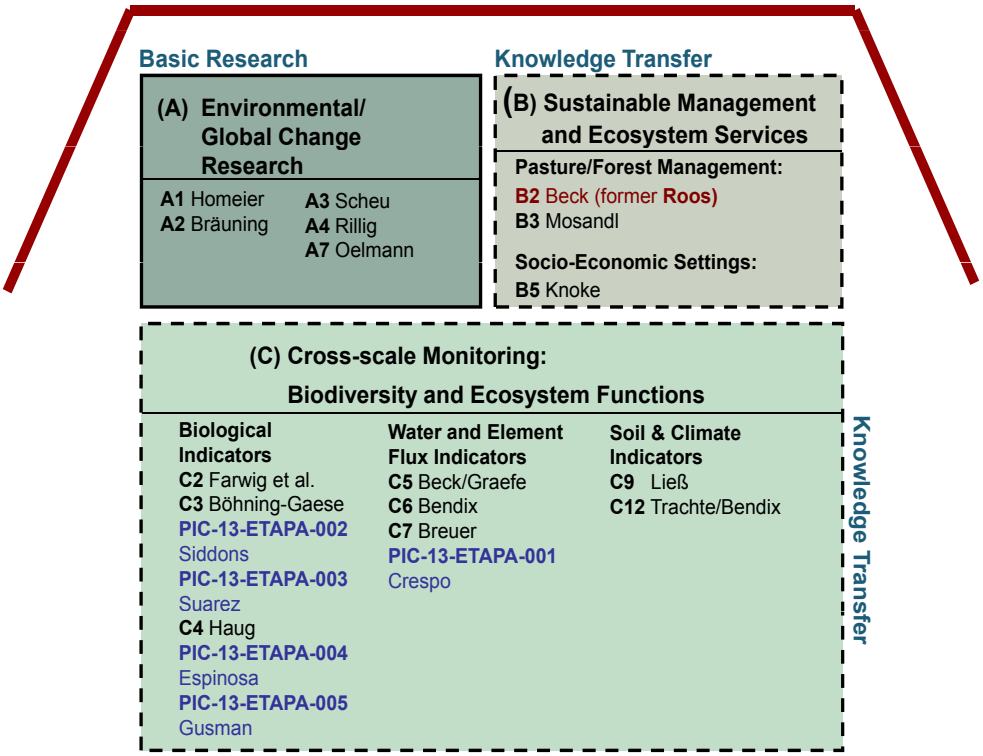

Figure 1: Final structure of the Platform. Black / red names of principal investigators and numbers: DFG funded research projects; blue names and numbers: SENESCYT funded projects. Graph: Jörg Bendix

Ambiental of the municipality from Zamora, can be continued.

New Projects in the German Part

We congratulate the projects A3 (Stefan Scheu), A4 (Matthias Rillig) and C4 (Ingeborg Haug) for successful re-evaluation. For C4, we have still to complete the required paperwork with our Ecuadorian non-university partners (addendum to the cooperation contracts) to get the DFG funds released, which unexpectedly took and still takes a lot of time of our station managers. Unfortunately, a central nutrient manipulation experiment (NUMEX-X) project (A6 Wulf Amelung, Roland Bol, Wolfgang Wilcke) did not pass the re-evaluation, but Professor Wilcke has expressed his willingness to continue working in the Reserva Biológica San Francisco (RBSF) area with own funds, as long as this is possible.

Status Quo of the Consortium

Due to administration problems the start of the SENESCYT (Secretaria Nacional de Educación Superior, Ciencia, Tecnología y Innovación) bundle project was delayed like the German projects. The money transfer system from SENESCYT via the partner ETAPA as a project managing agency to the Ecuadorian universities is a funding model that is new to Ecuador and required a lot of discussions and writings. The procedure has recently been appointed and the universities expect to obtain the first funds in May 2014. Nevertheless, some of the projects have started a forerun with university internal money.

To finally implement the framework field infrastructure of the Platform and the projects C5/C6, but also to clarify open and urgent administrative issues which came up particularly after the local elections in Ecuador, the German coordinator spent nearly three weeks at site in March and April 2014. The first urgently needed topic was to settle suitable core plots so that the subprojects can start their research.

New Plot Design of the Platform

After a preliminary survey and based on high resolution aerial photographs and a field inspection by Jürgen Homeier, the German Core Plot Working Group (Lutz Breuer, Jürgen Homeier, Nina Farwig, Jörg Bendix) had produced a draft of a plot design that was distributed and presented briefly in the General Assembly on February 28th.

To start with the implementation (for details please see text and figures about core plots in the next article) we formed core plot exploration teams for ECSF, Bombuscaro, Cajanuma and Laipuna (**Figure 2**) and finally could settle 19 core plots, 15 in the Rio San Francisco and Podocarpus National Park area (1000 – 3000 m a.s.l.) and 4 in Laipuna. The exploration during adverse weather conditions was an intensive and exhaustive endeavor but could be

Figure 2 left: Members of the exploration team to establish the core plots at the Estación Científica San Francisco (ECSF): Nina Farwig, Yvonne Tiede, Jan Schlautmann, Felix Matt, Christine Wallis, Jörg Zeilinger (f.l.t.r.). **Middle:** Felix Matt preliminarily marking a corner point in the very dense secondary forest. **Right:** Exploration team in the Laipuna Reserve: Jörg Bendix, Felix Matt, Jörg Zeilinger with differential Global Positioning System, Brenner Silva and Eduardo Cueva from NCI (f.l.t.r), Photos: Jörg Bendix

doi: 10.5678/lcrs/pak823-825.cit.1260

Figure 3 top: Formal opening ceremony of the second radar on the Cerro Guachaurco. **Bottom**: Jörg Bendix (left) and prefect Rubén Bustamante together with guests of the ceremony. Photos: Brenner Silva

conducted in a very good mood and with contributions of a lot of volunteers which were present at the stations. We would explicitly thank all persons who contributed to this important advance. Even the field-experienced participants were surprised yet again how long it takes to survey 100 m in these densely forested and steep areas.

In spite of the great efforts in identifying useful core plots, the exploration teams could not yet present all detailed coordinates of the core plot corner points. This was mainly due to the sometimes poor quality of D-GPS (differential Global Positioning System) measurements in the forest. In the next weeks, an implementation team led by Jörg Zeilinger and Felix Matt will refine the survey towards the final coordinates. Because this still is a major and demanding issue, the Technical University of Loja (Universidad Técnica Particular de Loja, UTPL) has generously offered to support the team with additional personnel and instrumentation.

We would like to appeal to all scientists working at the research stations over the next weeks to voluntarily join the implementation team and to support this joint common task. The station managers are going to approach you!

On a meeting with David Siddons and Edwin Zárate from the Azuay University (Universidad del Azuay, UDA) we coordinated the selection of the core plots in the Bosque Protector Mazán area (Cajas, Cuenca) which will now be started under guidance of David Siddons. In a meeting at UTPL, we also coordinated the core plot layout for Laipuna with Carlos Iván Espinosa (UTPL). Further core plots shall be implemented in other areas of the dry forests of La Ceiba and Arenillas. The definition of the core plot in the *Polylepis* forest Bosquete San Luis (Cajas) is still pending and will be discussed on a NUMEX-X meeting in Göttingen in May.

Cooperation with UNL

On a meeting with the National University Loja (Universidad Nacional de Loja, UNL) which currently isn't part of the Ecuadorian SENESYCT bundle, we have mutually agreed collaboration on our Platform. Joint and complementary projects shall be worked out and an agreement between UNL and the Platform will be signed. After the retirement of Carlos Valarezo, the scientific coordinator between the Platform and UNL will be Nikolay Aguirre (e-mail: nikolay.aguirre@unl.edu.ec). The person in charge of administrative questions is Romulo Chávez.

Transfer Project "Radar Net Sur"

A very pleasant and encouraging event was the formal inauguration of the second radar of the DFG transfer project "Radar Net Sur" together with representatives of the Provincial Government of Loja (Gobierno Provincial de Loja, GPL) on the 3100 m high Cerro Guachaurco close to Celica (**Figure 3**; details in section "Transfer News").

The prefect of Loja, Ing. Rubén Bustamante, stressed in his address the excellent collaboration in the project and the high importance of the radar network not only for weather forecast but also for planning matters of the province, disaster management, and technology development in the remote area (**Figure 4**, next page). The media, as well as important representatives of the Ministry for disasters management (Secre-

doi: 10.5678/lcrs/pak823-825.cit.1260

Figure 4 (clockwise from left): 1) Radar tower with housing of the electronics. 2) Radar dome covering the antenna. 3) Radar electronics including battery buffering for up to 8 hours power failure. Photos: Brenner Silva

taría Nacional de Gestión de Riesgos), the national weather service (Instituto Nacional de Meteorología y Hidrología, INAMHI), the army and local authorities were attending the event.

Laipuna Research Station

Our visit in Laipuna showed that Nature and Culture International (NCI) has finished all planned extensions, including the new cabana (**Figure 5**). The station now offers accommodation for 14 people. Internet is the only facility which is still missing; several possibilities are currently checked by the station manager Pedro Paladines (for details on the station please see section “News from Infrastructure Providers”).

Implications of Elections

Major changes at our non-university cooperation partners, except NCI, must be expected due to the recent provincial and municipal elections. There will be new mayors of Zamora (as the head of our partner Gestion Ambiental and current head of the regional water fund FORAGUA), of Cuenca (as head of ETAPA), a change in the leading positions of ETAPA and also of the Government of the Province of Loja. For a smooth implementation of the Platform, we already met with the new prefect Rafael Dávila and the vice prefect Nívea Vélez at UTPL and presented the Platform program and the Radar Net Sur transfer project. Both appreciated our endeavor and promised support of the programs. Our partner from the University of Cuenca could already present the program to the new administration in Cuenca (mayor and city councils), also receiving approving reactions. The official handing over of the administration is scheduled for mid of May 2014.

Figure 5: Laipuna research station with the new cabana at the left. Photo: Jörg Bendix

doi: 10.5678/lcrs/pak823-825.cit.1260

Figure 6: Provisional Cajas research station (clockwise from upper left): 1) one of the three two-bed rooms, 2) station building, 3) one of the three individual bathrooms, 4) extension building with lab space and work places, 5) patio. Photos: Jörg Bendix

Ecuadorian Deputy Speaker at the UC

One significant change concerns our friend Alfredo Martínez, the deputy coordinator of the SENESCYT bundle, who left ETAPA, taking a position at the University of Cuenca (UC). María Cecilia Carrasco (e-mail: mcarrasc@etapa.net.ec) temporarily took over his position at ETAPA.

Cajas Research Station Almost Ready

On a meeting at ETAPA headquarters we discussed the issue of the provisional research station for Cajas in San Joaquin, a part of Cuenca close to the main road to Cajas National Park. Fortunately, the house with facilities for six people has been rented by ETAPA and is ready for access. The rental agreement between ETAPA and the Platform will be signed in April, that researchers will be able to live in the station from May on. The photos show that this is most likely the most luxurious station building of our Platform (**Figure 6**).

Automatic Weather Stations

On a meeting with the regional water fund FORAGUA at NCI headquarters we decided that the first two of the committed automatic weather stations will be bought by the Loja council as soon a possible. Andreas Fries from the transfer project Radar Net Sur will kindly support the implementation of the stations.

New Research Infrastructures

For the Reserva Biológica San Francisco (RBSF), also a new infrastructure of the projects C5 and C6 could be realized, thanks to the effort of Simone Strobl and Brenner Silva: our new 100 m canopy tower stretch (**Figure 7**, next page). This is a real progress of the infrastructure in the station forest which is useful for a variety of future research plans. However, we have to stress that in the current phase, we are conducting very sensitive measurements. Thus climbing of the towers can not be permitted at present. We insistently urge everybody to respect the area between and around the towers when working in that part of the forest.

doi: 10.5678/lcrs/pak823-825.cit.1260

Figure 7 (clockwise from left): 1) New view onto the ECSF Research Station from the canopy platform at 19 m height. 2) 100 m twin-tower stretch. 3) East tower. Photos: Jörg Bendix

Data Warehouse

Because research is now starting in both programs, the German and Ecuadorian parts of the data warehouse system comes into focus. Considerable work has been invested during the past months in that data bases in the scope of project C12 (for details refer to the section "News from the Data Warehouse"). This includes the programming of a new booking tool for the Ecuadorian infrastructure body, which however, has not yet been formed. To become operational, we will intermediately install the station booking system at the Marburg server. The German database manager Rütger Rollenbeck will travel early in May to Ecuador, among others to start the implementation of the Ecuadorian data warehouse together with the Universidad del Azuay (UDA) and UTPL. The "SmartLand" initiative was launched in February by UTPL [1] in order to collect, manage and model data to improve land management with focus in the province of Zamora-Chinchipe.

Prizes at the gtö-Conference

Last but not least, the German part of the Platform met at the conference of the Society for Tropical Ecology (Gesellschaft für Tropenökologie e.V., gtö, [2]). The conference which was excellently organised by members of projects B3 and B6 took place near Munich, Germany, from 25th to 28th February 2014. The German Platform coordinators had again organized one of the biggest sessions during the conference (entitled "Between production and protection - Towards a sustainable management in the tropical Andes") but projects from the Ecuadorian group were also presenting in other sessions organised by individual principal investigators as well. Of course, the presented results were mostly from the preceding Research Unit 816 [3] but this will definitely change at the next gtö Conference in Zurich, Switzerland, in April 2015. We cordially congratulate two Platform members who won two of the three Merian poster awards (**Figure 8**). The awarded junior scientists are Roman Link (University of Göttingen, project A1) with his work on "Small-scale spatial distribution of Piperaceae and Rubiaceae in a tropical mountain ecosystem in southern Ecuador" and Brenner Silva (project C6, University of Marburg) with his poster "RendezWUE: Canopy evapotranspiration meets water use efficiency of leaves" which resulted from the collaboration of projects C6 and C5. Both present their results in the "Science News" section of this issue.

Figure 8: Merian award prize winners Dr. Brenner Silva (3rd from left) and Robert Link (3rd from right). Photo: Courtesy of Gerhard Kost from gtö

Assembly of German Researchers

Along the conference, also the first member assembly could take place which was a bit lengthy due to the many administrative issues we had to discuss. Unfortunately, no member of the Ecuadorian consortium could make it to the assembly so that the first joint assembly will be held on October 2nd-3rd 2014 along our first Status Symposium which will be kindly organized in the UDA by David Siddons and Edwin Zárate in Cuenca. We were lucky to welcome the new representative of the DFG, Dr. Meike Teschke, at the meeting, who will guide the Ecuador project from the side of the DFG.

References

[1] "SmartLand" initiative: http://smartland.utpl.edu.ec
[2] Conference of the gtö at Freising, Germany: www.gtoe-conference.de
[3] Preceeding Research Unit 816: www.bergregenwald.de/content_projects.do?phase=2&subpage=intro

doi: 10.5678/lcrs/pak823-825.cit.1260

News for Research at the Platform

Joint Core Plot Design

Jörg Bendix[1], Lutz Breuer[2], Nina Farwig[1], Jürgen Homeier[3]
[1]University of Marburg, [2]Justus-Liebig-University Gießen, [3]Georg August University of Göttingen, Germany – members of the DFG-PAK Research Consortium

The core plot system is presented together with information on locations, habitats, status and elevations of the first 19 core plots which are implemented in four research areas.

As stressed before (see Coordinator's Corner), the implementation of our joint core plot system has made substantial progress. 19 core plots in the Podocarpus National Park and the Rio San Franciso area are just before their final implementation (**Table 1**) and the plots in Bosque Mazan are currently under exploration. Only the location of the Cajas plot in the *Polylepis* forest of San Luis is still pending. Therefore it's time to briefly present the core plot concept in this issue of the Newsletter.

Description

Generally, the core plot system is following a scale-tiered plot design. The largest scale of the concept is given by catchment boundaries. Catchments are differentiated by nested subcatchments, where headwater catchments with intensive instrumentation provide the smallest level of resolution (**Figure 9**, next page). Within these subcatchments, core plots of 100 x 100 m extent are located (**Figure 10**). The core plots are generally replicated (n = 3), wherever possible.

Gradients

Plots are established along altitudinal gradients where appropriate in the natural and the disturbed ecosystem to be able to investigate climate and land use effects. Disturbed plots are located in typically present land use options in each research area, such as active or recently abandoned pastures or crop areas (covering at least 25%) and should also be covered by 50% of trees. At least on the subcatchment scale, important plots, experiments and instrumentation of the preceding Research Units (FOR 402, FOR816) are included to the core plots to warrant the availability of baseline data and the continuation of long time series of data which are of inestimable wealth for the ongoing research.

General information on the state of the development of the core plots is distributed among the principal investigarors and PostDocs, with some initial rules how to implement subplots. The final geodetic survey to fix the corner points after provisionally setting by the exploration team (refer to section Coordinator's Corner) is currently under work by the implementation team.

How to Find Plots

After final implementation, a handheld GPS-system readable file of the corner coordinates and the access paths will be distributed via the MRp|SE website so that scientists new in the area can easily find the plots. Also visualizations on high resolution aerial photos are provided for a first orientation (see example in **Figure 11**).

The implementation of the still pending Cajas plot is scheduled for mid 2014.

Table 1: Core plots description and location
(see figures below; note that the forest Bosque Mazán is not explicitly shown)

Site	Ecosystem	Elevation [m a.s.l.]	Number of core plots (status of plot)
a) Cajas National Park	Páramo (*Polylepis* Forest)	4000	1 (natural)
a) Bosque Mazán	Tropical Montane Forest (TMF) (Azuay province)	2700	1 (natural) 1 (disturbed) (organized by UDA)
b) Podocarpus National Park and Rio San Francisco Reserve	Tropical Montane Forest (TMF) (Loja and Zamora-Chinchipe province)	1000 (Bombuscaro, Copalinga) 2000 (San Francisco) 3000 (Cajanuma)	6 (3 natural + 3 disturbed) 6 (3 natural + 3 disturbed) 3 (3 natural)
c) Laipuna Reserve	Tropical Dry Forest (TDF) (Loja province)	600 - 800	4 (3 natural + 1 disturbed)

doi: 10.5678/lcrs/pak823-825.cit.1260

Figure 9: Exemplary layout of the 3-tiered plot approach. Core plots will be the essential part of the joint monitoring Platform to be developed in course of the project bundle. Graphs: Lutz Breuer

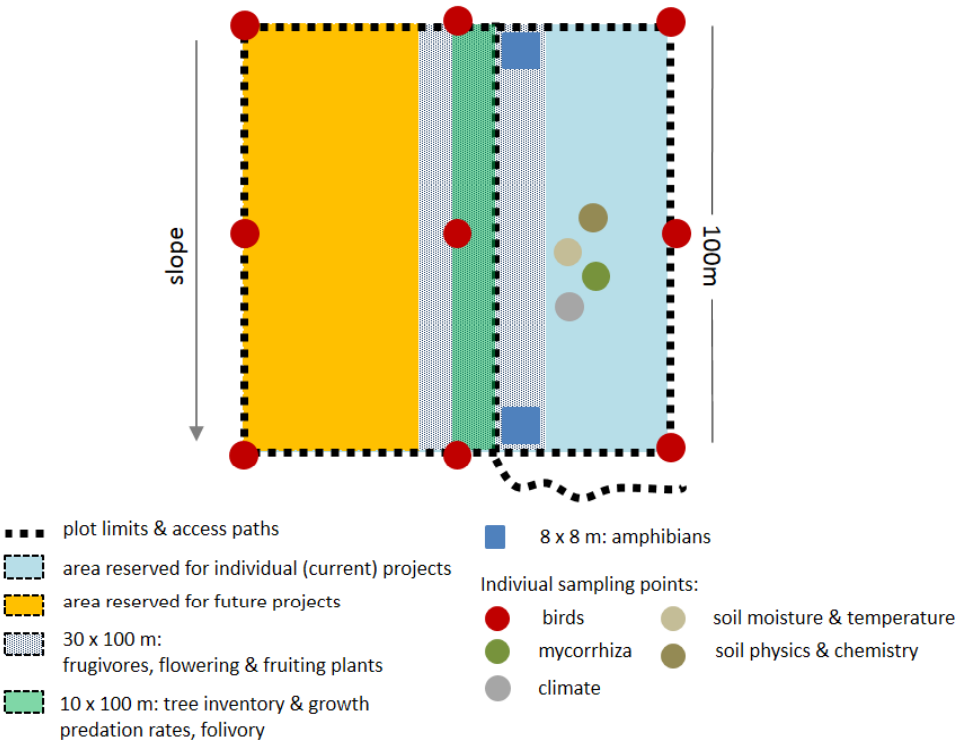

Figure 10: Core plot layout with individual monitoring sites during the current PAK823-825 project bundle. Access paths and limits are marked by ropes in the field. Graph: Lutz Breuer

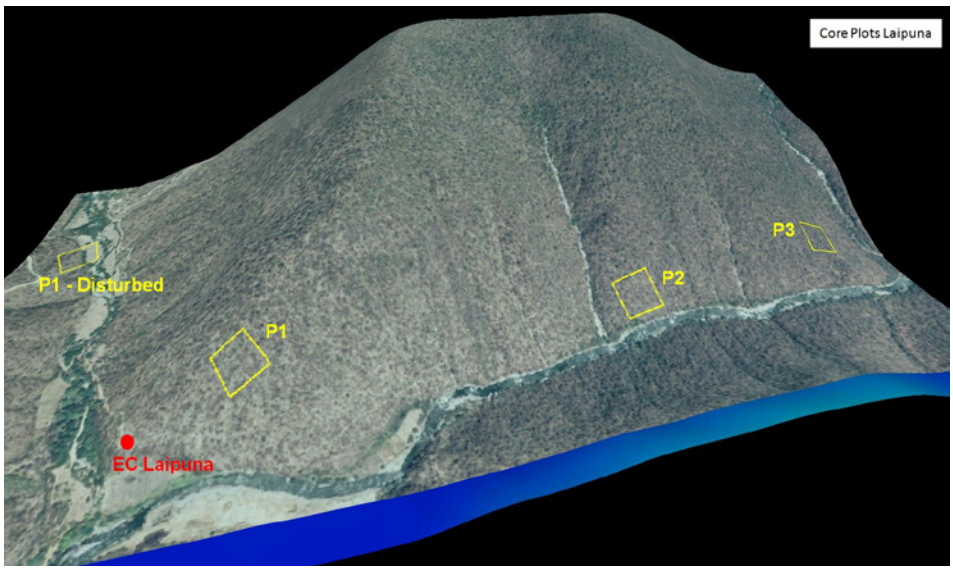

Figure 11: Undisturbed and disturbed core plots at 600 - 800 m a.s.l. in the Laipuna area. Graph: Jörg Zeilinger

How to Work in Core Plots

It should be stressed that work in the core plots must be least destructive and impacting. Any destructive sampling (e.g. digging of soil pits, tree climbing, trap based sampling, fogging) or impacting work (e.g. fertilization, tracer studies, tree logging) needs to be agreed with the plot design group and station managers.

On the Status Symposium in Cuenca in October, we will form the working group “Transfer” which then will select individual core plots which will be used as demonstration plots for functional monitoring, sustainable land use options and knowledge transfer training measures.

doi: 10.5678/lcrs/pak823-825.cit.1260

News from the RBSF

Observation Towers in the San Francisco Valley

Brenner Silva[1], Simone Strobl[2], Jörg Bendix[1], Erwin Beck[2]
[1]University of Marburg, Germany – members of the DFG-PAK Research Consortium
[2]University of Bayreuth, Germany – members of the DFG-PAK Research Consortium

We introduce the new research infrastructure for scintillometry, photosynthesis, and remote sensing. Please leave them totally untouched since sensitive measurements are carried out there.

Two years after the first meeting and concept discussion and seven months after funding approval the observation towers for scintillometry, photosynthesis, and remote sensing for **projects C5 and C6** are ready to operate at the Reserva Biológica San Francisco (RBSF, **Figure 12**). The projects included one 30 and one 36 meters high double-guyed-towers with two platforms each. The platforms are situated approximately 10 and 15 meters above ground and have been installed for observations on shaded and sunlit leaves of the forest canopy. The construction work took five months and involved local workers and Metalcom, a company from Loja, Ecuador.

Figure 12: Simone Strobl climbs the receiver tower to mark platform heights. Photo: Brenner Silva

Construction with Caution

High environmental performance has been achieved with minimal impact in the forest. No trees were cut. Tower parts were carefully carried and placed between the understory plants before mounted on the fundament. Tower and anchors fundaments are two meters in depth and tower stability is planned to be observed during first measurements with the laser scintillometer. As already mentioned the towers are exclusive for measurements of scintillometry (**Figure 13**), photosynthesis, and remote sensing (**Figure 14**). They are closed for unauthorized people due to fragile equipment and security issues. Future use should be agreed with the four researchers responsible for planning and execution: Dr. Brenner Silva, Dr. Simone Strobl, Prof. Jörg Bendix, and Prof. Erwin Beck.

Figure 13: Brenner Silva installing the scintillometer on top of the transmitter tower. Photo: Brenner Silva

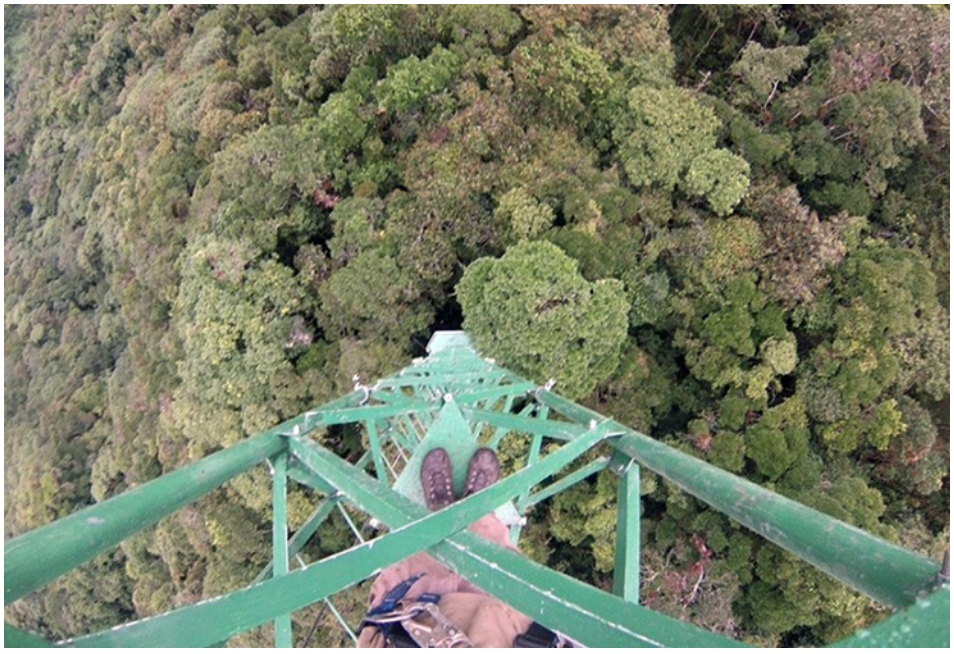

Figure 14: View from the top of the transmitter (eastern) tower, which will also be used for remote sensing. Photo: Brenner Silva

doi: 10.5678/lcrs/pak823-825.cit.1260

Science News

Small-Scale Spatial Distribution of Piperaceae and Rubiaceae Species

Roman Link and Jürgen Homeier
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We modelled overall species richness and distributions of individual species of two plant families. Species richness peaks at slightly different elevations. First results reveal that ensemble models might be more reliable than single modeling methods.

We investigated the role of small-scale topographic heterogeneity for the distribution patterns of plants in tropical montane ecosystems in **project A1**. We focus on how topographic gradients interact with the altitudinal gradient of species richness, and whether the distributions of individual species reflect adaptations to local microtopographic conditions.

Methods

Presence/absence data of the species of two model families (Rubiaceae: 66 species and Piperaceae: 47 species) from sample plots located in the San Francisco Reserve (1800–3150 m a.s.l.) were used to model overall species richness (*macroecological models*, *MEM*) and distributions of individual species (*species distribution models*, *SDM*). Modeling was performed in the computer programm R using a purpose-built ensemble modeling framework for presence/absence and count data [1].

Results

The correlation between observed and predicted values was high for Piperaceae and moderate for Rubiaceae. Elevation and topographic positions were the most important predictors of species richness, with Topographic Position Index (TPI) explaining a similar proportion of the variability in species richness as elevation.

Species richness decreased substantially from valleys to ridges for both taxa, and peaked at about 2000 to 2100 m a.s.l. for Piperaceae versus about 2300 to 2500 m a.s.l. for Rubiaceae. Species distributions were mainly controlled by elevation (**Figure 15**). Topographic heterogeneity influenced the distribution of most species, but few species were strictly limited to a particular topographic position.

Discussion

The observed spatial patterns in species richness are in accordance with theoretical assumptions, although the maxima were located at relatively high elevations. The distribution patterns of individual species suggest that topographic heterogeneity might be an important driver of the high overall plant species richness in the study area. The high predictive accuracy achieved in spite of the small number of observations highlights the benefits of using ensemble models instead of relying on single modeling methods.

Reference

[1] Link R (2014): Spatial distribution of angiosperm species in a tropical Andean mountain ecosystem in southern Ecuador, *Master thesis,* University of Göttingen, 76pp

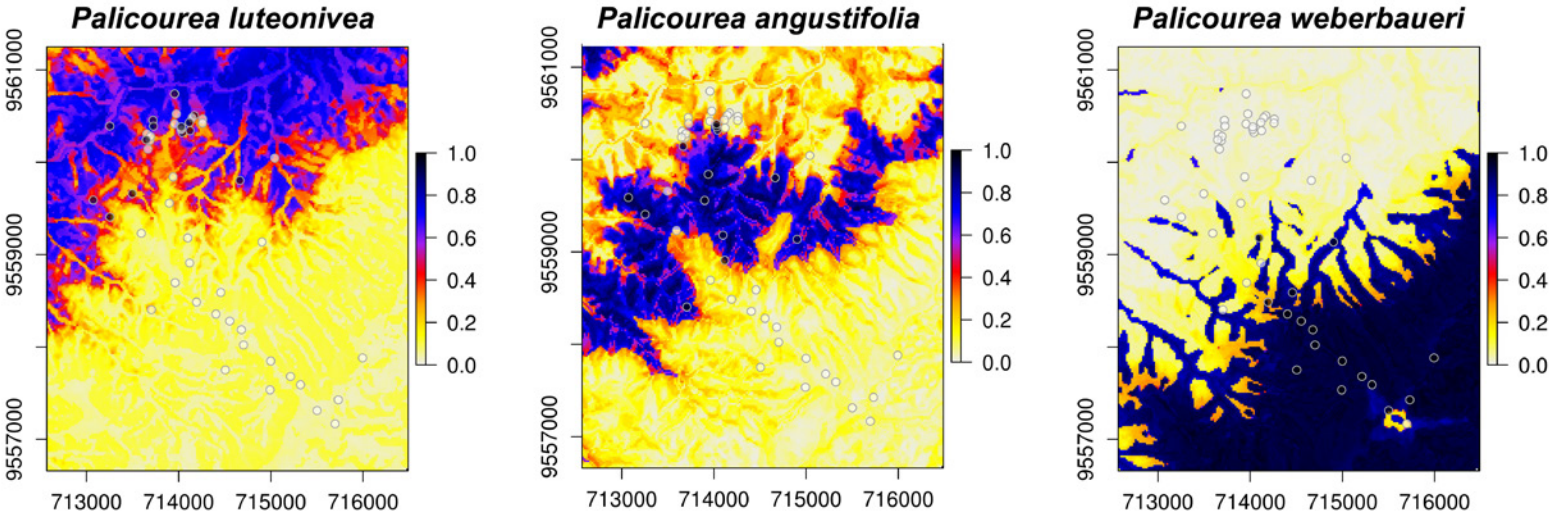

Figure 15: Predictive maps of the probability of occurrence of three shrub species of the genus *Palicourea* (Rubiaceae) showing niche differentiation along the altitudinal gradient. Filled circles: presence locations; empty circles: absence locations. Graphs: Roman Link

doi: 10.5678/lcrs/pak823-825.cit.1260

"Same but different" - Using Medicinal Methods for a Detailed Anatomical Wood Analysis of *Alchornea lojaensis*

Susanne Spannl and Achim Bräuning
Friedrich Alexander University of Erlangen-Nuremberg, Germany – members of the DFG-PAK Research Consortium

We report first results of the wood anatomy and seasonal growth rhythm of an endemic tree species of the research area on a cellular level. This method is timesaving as well as leaves the wood intact in contrast to microscopic techniques.

Alchornea lojaensis Secco is an evergreen broadleaved tree species which is endemic in the Reserva Biológica San Francisco (RBSF). Although the species has been described by Secco in the year 2008 [1], nothing is known about the wood structure or wood anatomical parameters so far. However, in regard to the influence of external environmental factors on the ecology and growth reaction of tropical trees it is essential to analyze the wood anatomical structures of a tree species on the cellular level. Therefore, we carried out the first ever descriptive and quantitative wood anatomical analyse of *Alchornea lojaensis* using branch wood of 15 individual trees.

Seasonal Growth Rhythms

Common microscopic preparation techniques have been used for the descriptive analyses [2, 3]. Our preliminary results (**Figure 16**) reveal that despite constant perhumid conditions of the study area *Alchornea lojaensis* exhibits seasonal growth rhythms becoming visible in distinct growth boundaries (tangential bands of thickened and flattened libriform fibres).

Vessels and Rays

For detailed quantitative analyses we applied a high resolution x-ray micro tomography (Phoenix nanotom m, General Electric Company) like it is commonly used for medical investigations. This time saving method enables us to create virtual cross-sectional images (voxel size 1.9 µm) of any direction, without cutting or injuring the wood sample (**Figure 17**).

Apart from the opportunities of a complete 3D volume rendering, a segmentation of individual parts of the sample, e.g. vessels or rays, is applicable (**Figure 18**) using the data visualisation software AMIRA (Visualization Sciences Group). All virtual cross sectional images can be exported to the WinCELL software (Regent Instruments Inc.) for computing vessel diameter, vessel area, or vessel frequency of different layers within the sample.

The expected results shall provide the basis for a better understanding of the water balance within the trees and will enable us to evaluate the influence of environmental factors on the wood anatomical properties.

Acknowledgement
We are indebted to Dr. Bernhard Ruthensteiner (Bavarian State Collection of Zoology) for using the "x ray micro tomography Phoenix nanotom m" and his scientific support.

References

[1] Secco R (2008): *Alchornea lojaensis*, a new species of Euphorbiaceae for the Flora of Ecuador. In: *Kew Bulletin* Vol. 63: 511 –513; DOI http://dx.doi.org/10.1007/s12225-008-9043-9
[2] Etzold H (2002): Simultanfärbung von Pflanzenschnitten mit Fuchsin, Chrysoidin und Astrablau. In: *Mikrokosmos* 91 (5): 316-318
[3] Gärtner H and Schweingruber F (2013): Microscopic Preparation Techniques for plant analysis. *Kessel Verlag*. Remagen-Oberwinter. 78S.

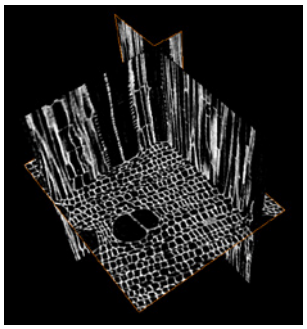

Figure 17: Virtual cross-sectional images along different axis alignments of *Alchornea lojaensis*. Image: Susanne Spannl

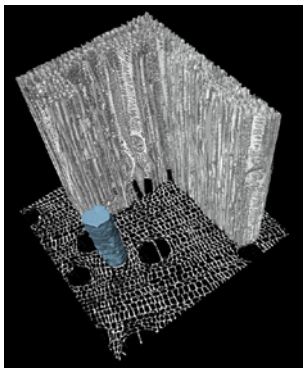

Figure 18: 3D-Volume rendering of a small branch piece of *Alchornea lojaensis* (approx. 0,5mm). A single vessel segmentation is illustrated in light blue. Image: Susanne Spannl

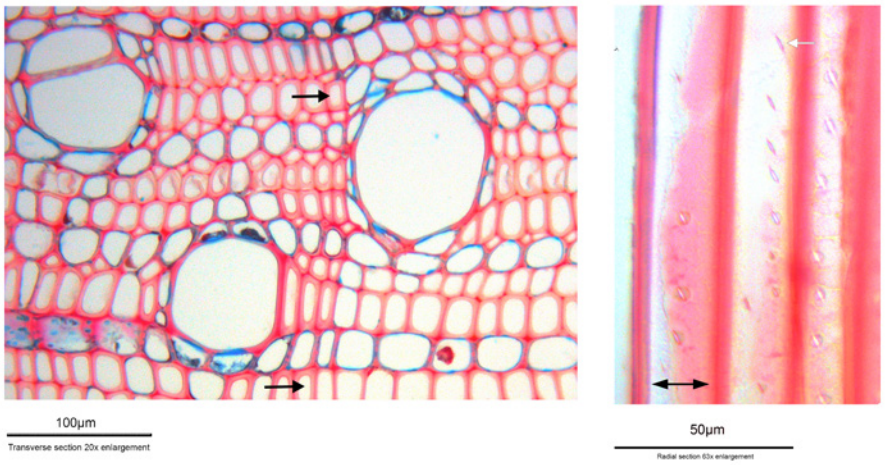

Figure 16: Distinctly thickened and flattened libriform fibres (arrows) marking the growth boundaries of individual years in *Alchornea lojaensis*. **Right**: Close-up view of thick-walled libriform fibres with piceoid pits. Images: Susanne Spannl

doi: 10.5678/lcrs/pak823-825.cit.1260

Fate of Phosphorus in Tropical Montane Forest Ecosystems

Karla Dietrich and Yvonne Oelmann
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We aim to disentangle biological and geochemical processes controlling phosphorus retention along the altitudinal gradient of the nutrient manipulation experiment. First results reveal that fertilized phosphorus is not only retained in aboveground biomass and the organic layer - as previously reported by Homeier et al. - but also enters the mineral soil.

Tropical forests suffer from continuously high atmospheric Nitrogen (N) and Phosphorus (P) deposition. Elevated N and P inputs affect terrestrial and aquatic ecosystems since the productivity of plant communities is mostly limited by N or P, or both, and tropical forests are likely to respond sensitively to these changes. The size and direction of these responses are unclear and they might be related even to the climate changes for this region which predicted increasing temperatures and decreased moisture.

Previous experiments showed that the main proportion of P added to forests to simulate atmospheric deposition was retained in the organic compartment (plant biomass, organic layer on top of the mineral soil, Homeier et al. [1]). While total P pools in soil respond slowly to low P addition rates, the biological and geochemical processes underlying retention in the organic layer or in soil are expected to react faster. **Project A7** investigates the relationship between biological and geochemical mechanisms underlying P retention and if this relationship changes with altitude. In addition, we want to test if N and P fertilization modify the relationship between both types of control.

Phosphate saturation index Z

$$Z = \frac{[P_{ox}]}{0.5([Al_{ox}]+[Fe_{ox}])}$$

calculated as the proportion of sorbed phosphate ions ($[P_{ox}]$ = oxalate-extractable phosphate concentrations) relative to the potentially available sorption sites ($[Al_{ox}]$ + $[Fe_{ox}]$ = oxalate-extractable aluminum and iron concentrations)

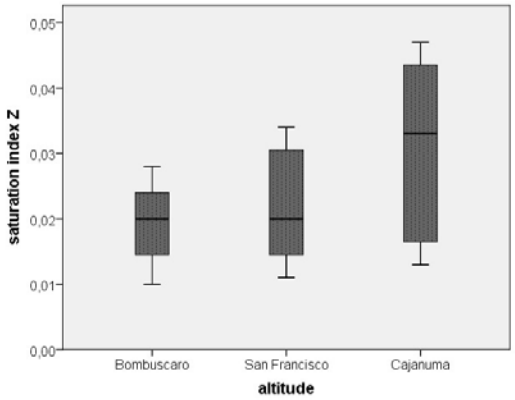

Figure 19: The phosphate saturation index Z (see box) at different altitudes (Bombuscaro = 1000 m, San Francisco = 2000 m, Cajanuma = 3000 m a. s. l.). Graph: Karla Dietrich

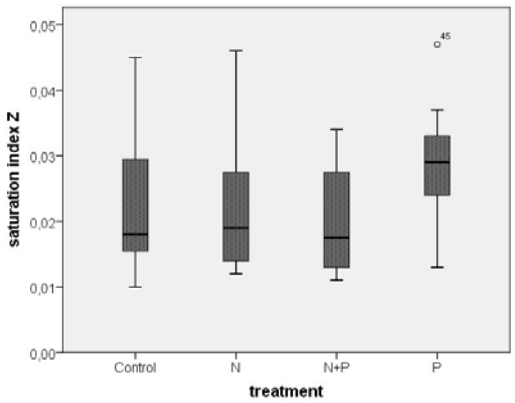

Figure 20: The phosphate saturation index Z (see box) of different treatments in the NUMEX experiment. Control = no fertilizer added; N, P, and N+P = addition of the respective nutritional elements and a combination of both. Graph: Karla Dietrich

We aim at disentangling biological and geochemical processes (immobilization/release rates by microorganisms, sorption/desorption, precipitation/dissolution) controlling P retention along the nutrient manipulation experiment (NUMEX-X) altitudinal gradient (1000, 2000, 3000 m a.s.l.). We will assess P fractions and use a combination of radioactive isotope tracer studies (^{33}P) and incubation of the organic layer and mineral soil.

First results indicate that the P-saturation index increased with increasing altitude (**Figure 19**). Up to now, we lack an explanation and further corroborating data (e.g. pH, mineralisation) are yet to be measured. We found an increased P-saturation index if P fertilizer is added (**Figure 20**) highlighting that (i) excess P is leached to the mineral soil and (ii) retention of P not only applies to the organic compartment (living biomass and organic layer) but also to the mineral soil.

Reference

[1] Homeier J, Hertel D, Camenzind T, Cumbicus NL, Maraun M, Martinson GO, Nohemy Poma L, Rillig MC, Sandmann D, Scheu S, Veldkamp E, Wilcke W, Wullaert H, Leuschner C (2012): Tropical Andean Forests Are Highly Susceptible to Nutrient Inputs-Rapid Effects of Experimental N and P Addition to an Ecuadorian Montane Forest. *Plos One*, 7, e47128, doi: http://dx.doi.org/10.1371/journal.pone.0047128.

doi: 10.5678/lcrs/pak823-825.cit.1260

Sap Flow Measurements Started in the Natural Forest of the RBSF

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A major step towards the joined measurements of evaporation and water consumption of trees has been made. First results reveal inter- and intraspecific variation. After building the two observation towers, sap flow sensors are now working on 15 trees.

After finishing the two observation towers on the plot of the jointly working projects C5 and C6 in the natural forest of the Reserva Biológica San Francisco (RBSF), sap flow sensors were installed end of March 2014 for measuring water consumption of the trees on the stretch between the two towers (**Figure 21**). So far 15 of 21 trees are equipped with 3 Granier-type sensors each, including 7 species (*Graffenrieda emarginata, Vismia tomentosa, Spirotheka rosea, Tapirira cf. guianensis, Alzatea verticillata, Podocarpus oleifolia*, and some yet to identify representatives of Lauraceae).

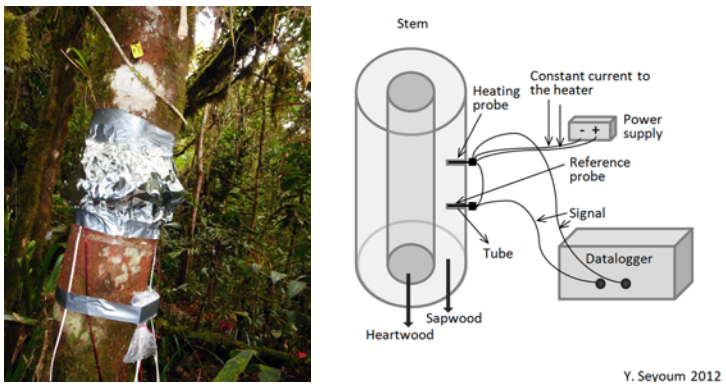

Figure 21: Sap flow measurement on the trunk of a *Vismia tomentosa* (left) and principle of the measurement (right). Photo: Simone Strobl, illustration modified after [1]

First results show that sap flow density is varying interspecifically and naturally within a species with the diameter (dbh) of the trees (**Figure 22**). In all trees, sap flow started at 8 o'clock in the morning and reached highest values between 0.1 and 0.3 g cm^{-2} min^{-1} around noon. Smaller trees stopped sap flow at sunset while the bigger trees (*Alzatea* and *Tapirira*) continued water flow in the evening hours for refilling stem reservoirs.

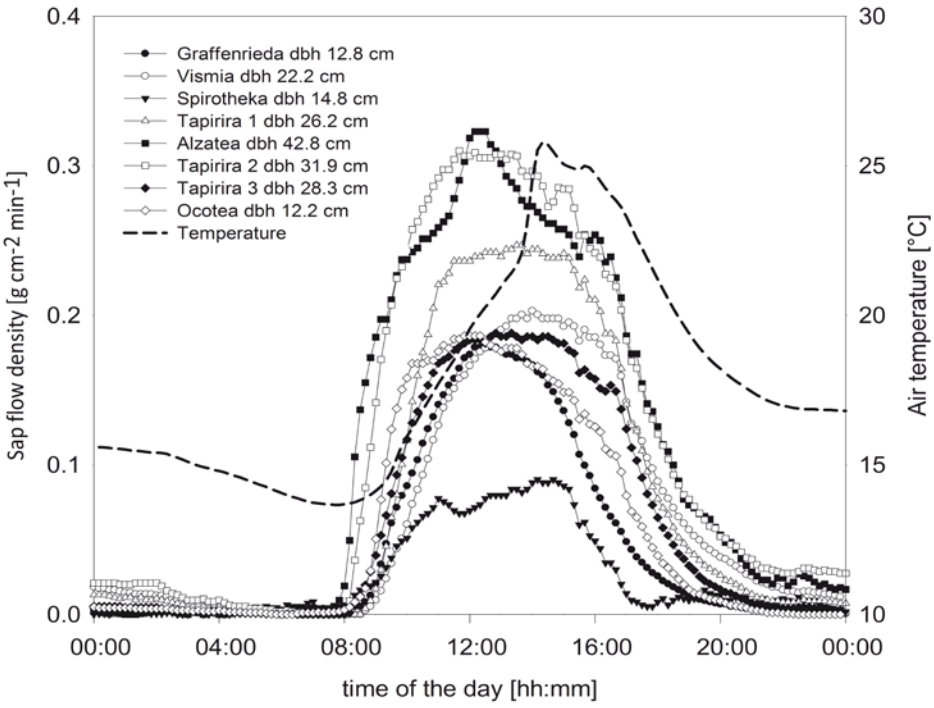

Figure 22: Sap flow density [g cm^{-2} conducting stem tissue min^{-1}] of 8 different trees of 6 species on March 31st in the RBSF. Graph: Simone Strobl

Figure 23: Glimpse into the canopy of the RBSF forest from the eastern tower at a hight of 9 meters. Photo: Simone Strobl

Parallel measurements of phenology, leaf live span and stem increment on up to 40 trees will start in May and will be conducted from our Ecuadorian partner from the NCI, Ing. Eduardo Cueva. For those measurements, already 40 trees are equipped with dendrometers, and monitoring of the tree phenology will benefit a lot from crown access by the above mentioned observation towers (**Figure 23**; see also **Figure 12**).

To get the link between whole tree water consumption and transpiration of leaves, parallel measurements of sap flow and transpiration of the leaves (with the portable photosynthesis system LI-6400XT) will start at the beginning of October, hopefully during drier weather conditions. Together with the scintillometer measurements of project C6, the results of these measurements will help up-scaling water consumption from the tree to the landscape level.

Reference

[1] Seyoum Y (2012): Foliage dynamics, water and carbon relations of three coexisting functional types of indigenous trees in the Munessa natural forest. *PhD Thesis*, Addis Abeba University

doi: 10.5678/lcrs/pak823-825.cit.1260

The RendezWUE: A New Approach to Simultaneously Measure Canopy Evapotranspiration and Leaf Photosynthesis

Brenner Silva[1], Simone Strobl[2], Jörg Bendix[1], Erwin Beck[2]
[1]University of Marburg, Germany – members of the DFG-PAK Research Consortium
[2]University of Bayreuth, Germany – members of the DFG-PAK Research Consortium

In the RendezWUE approach, a laser scintillometer and a porometer system to measure photosynthesis provide a functional link between leaf and landscape scale water relations. This novel technology is now ready to operate above the canopy of the tropical mountain rain forest.

We've successfully tested a new approach in **projects C5 and C6** which combines two techniques to measure evapotranspiration and photosynthesis at leaf and landscape scales. The name RendezWUE reminds a space maneuver ("Rendezvous") and is used here to refer to the simultaneous use of two state-of-the art instruments: a laser scintillometer (SLS40, Scintec, AG) and a portable photosynthesis system (LI6400XT, Licor, Inc.). We used these instruments to monitor canopy evapotranspiration, leaf transpiration and photosynthesis (**Figure 24**).

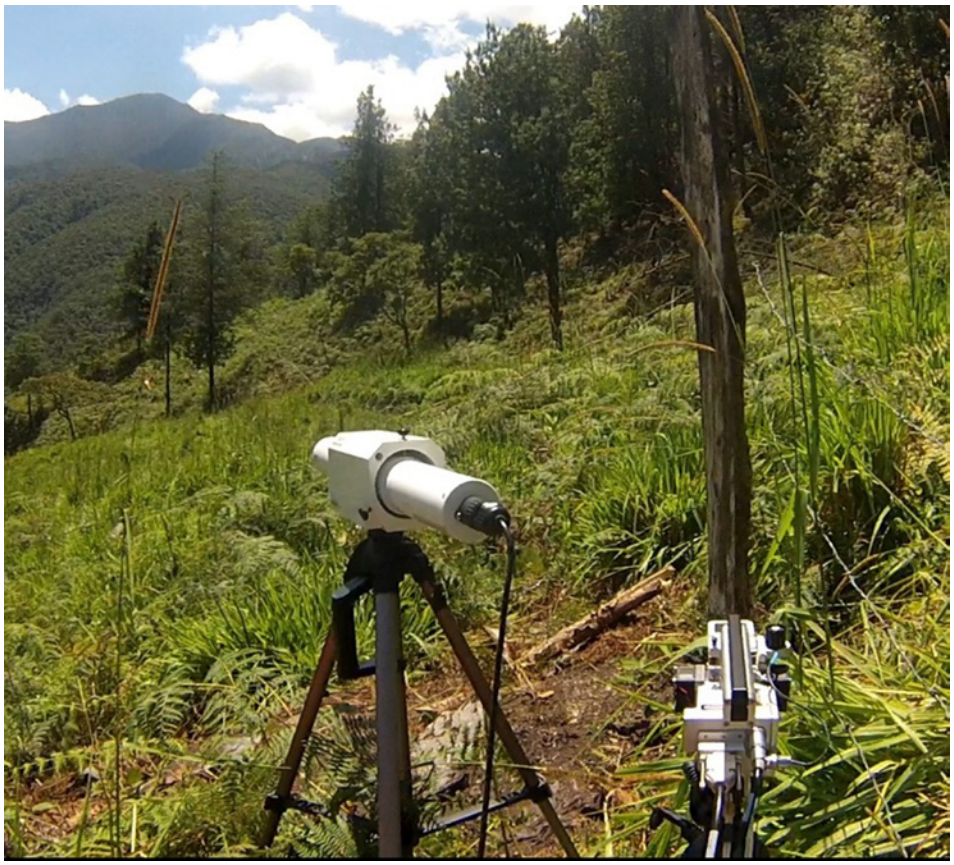

Figure 24: Laser scintillometer and portable photosynthesis system at the pasture site. Photo: Brenner Silva

First Results

In the valley of the San Francisco River we carried out one week of measurements on a pasture site, which was not intensively used. The results revealed average water use efficiency (WUE) of 5.53, which oscillated according to changing weather conditions (**Figure 25**): Highest WUE was observed on a cloudy and very humid day (WUE = 8.85) while it significantly dropped on a sunny day (WUE = 3.10). Daily courses of WUE could also be observed, revealing for instance morning and late evening events of extremely high values.

Evaluation of Method

Since leaf transpiration correlates well with canopy evapotranspiration (r2 > 0.8) the link between both scales (leaf and canopy) and also the suitability of the approach could be confirmed. The ratio of canopy to leaf transpiration is proportional to the green and photosynthetic active leaf area. This ratio can also be used to upscale photosynthesis and to calculate WUE on the landscape level, based on remotely sensed data. The RendezWUE approach will now be explored in the natural forest, for which two observation towers have been built.

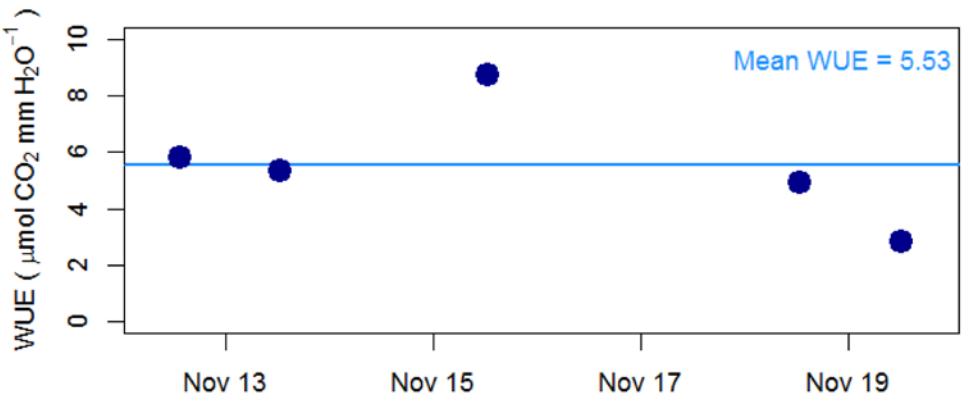

Figure 25: Water use efficiency (WUE) during the experiment week at the pasture site. Graph: Brenner Silva

doi: 10.5678/lcrs/pak823-825.cit.1260

Dynamic Discharge yet Dawdling Waters

Edison Timbe[1], David Windhorst[1], Patricio Crespo[2], Lutz Breuer[1]
[1]Justus Liebig University Giessen, Germany – members of the DFG-PAK Research Consortium
[2]Universidad de Cuenca, Ecuador – member of the SENESCYT Research Consortium

Time series of stable isotopes of water were used to infer mean transit times and transit time distributions functions of diverse hydrological compartments of an Andean tropical montane catchment. Analysis of results was based on the efficiencies and uncertainties of the predictions provided by seven lumped-parameter models. Large mean transit times for stream and spring waters (≥ 2 years) indicate a rapid exchange of surface waters with deeper soil horizons. Besides, intercomparison between soil waters suggests a possible influence of land use in the magnitude of their residence time."

Introduction

Discharge in the San Francisco, an Andean tropical montane forest catchment, is highly dynamic. Yet, observations from previous studies indicated somewhat contradictory results with a high significance of event water and hence short transit times of water in small headwaters [1] with – at the same time – a high contribution of baseflow and thus old water at larger scales [2, 3]. We therefore analyzed possible transit time distribution functions (TTD) and their respective mean transit times (MTT) using a nested catchment approach. Results of this study (**project C7**) have been published very recently [4].

Methods

The research is based on stable water isotopes ($\delta^{18}O$ and $\delta^{2}H$) sampled on a weekly basis in diverse hydrologic compartments (rainfall, streams, subsurface flows and soil water) and event based sampling of precipitation collected close to the research station ECSF during a two years period. The altitudinal correction factor from Windhorst et al. [5] was used to derive an area wide representation of the incoming precipitation signal necessary to drive the selected models. For the fitting of TTD, we used seven well known lumped models representing different flow patterns. For every sampled site, inter-comparison of predictions from these models was performed to account for the uncertainty of each TTD. Results yield interesting insights of the hydrologic functioning of the catchment: under baseflow conditions long MTTs for stream water ≥ 2 years (yrs) were detected, a phenomenon also observed for the main tributaries and shallow springs. Considering the findings of Goller et al. [1] and the highly dynamic and rapid response of discharge to rainfall as observed in hydrographs we expected something different.

Results and Discussion

For baseflow conditions, which are dominant in the catchment, stream water at the main outlet and five tributaries yielded similar MTT estimations, ranging from 1.8 to 2.5 yrs, while the MTT estimation for the remaining two tributaries were between 3.5 to 4.4 yrs (see **Figure 26**). Small creeks and springs described even longer MTT, between 2 to 5 yrs. Shorter MTT (from 2 to 9 weeks) of water were found in the top soil layer, indicating a rapid exchange of surface waters with deeper soil horizons. These latter observations fit well with the observations of Goller et al. [1] as these soil water likely contribute to discharge in the uppermost headwaters. Overall, we conclude that there is a functional difference in rainfall runoff generation across scales. For instance, although with high uncertainties, at the larger scale the Two Parallel Linear Reservoirs model (TPLR), a three-parameter function that combines two parallel reservoirs each one represented by a single exponential distribution, showed the best performance while on the smaller scale

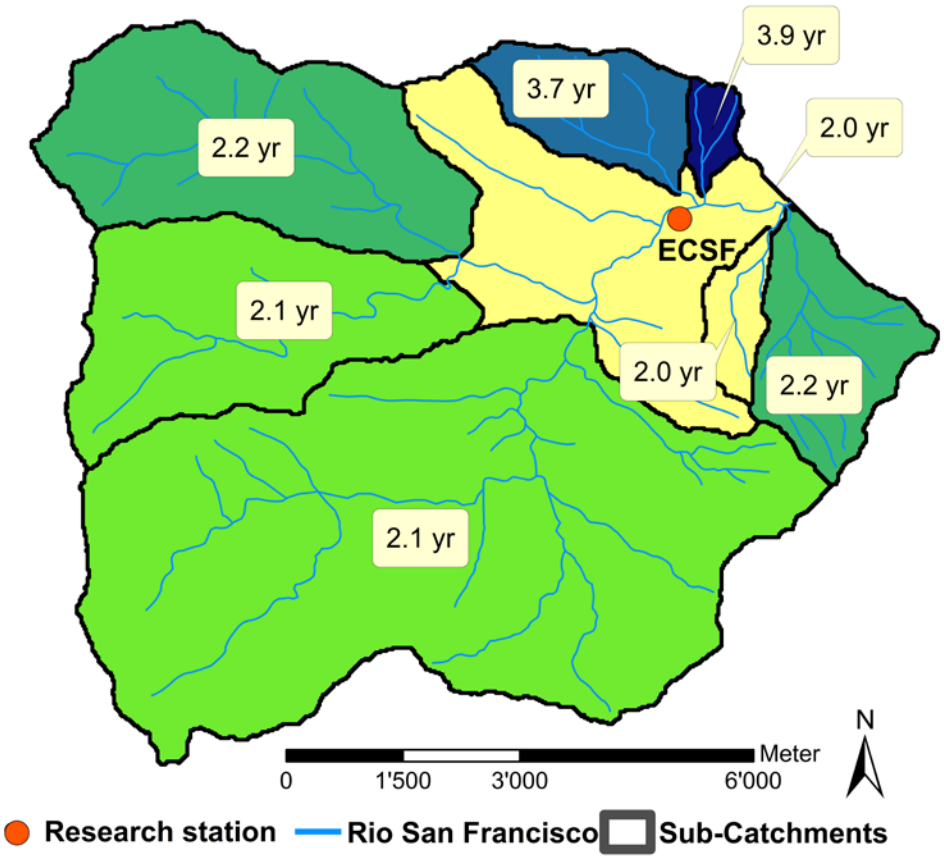

Figure 26: Average mean transit times for the monitored sub-catchments and the main outlet of the Rio San Francisco in years [yr]. Graph: David Windhorst

doi: 10.5678/lcrs/pak823-825.cit.1260

no clear favorite could be identified, yet these latter predictions showed less uncertainties and better efficiencies. Soil water under different land cover was sampled at different depths. Results showed that pastures areas have shorter residence times (2.3 to 6.3 weeks) than forested ones (3.7 to 9.2 weeks). Considering the characteristics of the sampling sites, results suggest a possible regulatory effect of land use on water movement. Besides, these findings point out the potential of environmental tracer methods for estimating the effects of changes in vegetation, a task usually difficult to accomplish by conventional hydrometric methods.

Our research revealed that looking for the best TTD and its derived MTT is not only matter of accounting for the best fit to a predefined objective function, instead, it is recommended to at least: include in the analysis several potential TTD models, assess the suitability of each model to represent the prevailing flow conditions and to account the uncertainty range of predictions due to the model selection. The diversity of sampling sites and uncertainty analysis, based on the best fits to the Nash Sutcliffe Efficiency and the identifiability of the parameters of the convolution equations of seven conceptual models, allowed defining the ranges of variation of the mean transit times and the probable distributions functions for the main hydrological compartments of the San Francisco catchment.

References

[1] Goller R, Wilcke W, Leng M, Tobschall HJ, Wagner K, Valarezo C, Zech W (2005): Tracing water paths through small catchments under a tropical montane rain forest in south Ecuador by an oxygen isotope approach. *J. Hydrol.*, 308, 67–80, doi: http://dx.doi.org/10.1016/j.jhydrol.2004.10.022

[2] Bücker A, Crespo P, Frede H-G, et al. (2010): Identifying controls on water chemistry of tropical cloud forest catchments: combining descriptive approaches and multivariate analysis. *Aquatic Geochemistry* 16: 127–149.

[3] Crespo P, Bücker A, Feyen J, et al. (2012): Preliminary evaluation of the runoff processes in a remote montane cloud forest basin using Mixing Model Analysis and Mean Transit Time. *Hydrological Processes* 26: 3896–3910.

[4] Timbe E, Windhorst D, Crespo P, Frede H-G, Feyen J, Breuer L (2014): Understanding uncertainties when inferring mean transit times of water trough tracer-based lumped-parameter models in Andean tropical montane cloud forest catchments. *Hydrol Earth Syst Sci*, 18(4), 1503–1523, doi: http://dx.doi.org/10.5194/hess-18-1503-2014

[5] Windhorst D, Waltz T, Timbe E, et al. (2013): Impact of elevation and weather patterns on the isotopic composition of precipitation in a tropical montane rainforest. *Hydrol Earth Syst Sci*, 17: 409–419. doi: http://dx.doi.org/10.5194/hess-17-409-2013

Towards a Guideline for Digital Soil Mapping in South Ecuador

Mareike Ließ
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We develop models and a guideline for digital soil mapping which are a prerequisite for policy makers to plan and structure land use planning decisions. They also serve to calculate risk zones as well as to estimate carbon stocks and soil fertility.

Tropical mountain areas pose severe problems to traditional soil mapping approaches, due to their heterogeneity and complex terrain. Digital soil mapping (DSM) provides an effective means and a solution to this dilemma.

Models for Maps

Since long, soils are understood as a function of their genetic factors: parent material, relief, climate, organisms and time. The complex interaction of these factors activate particular soil forming processes, which in dependence of their intensity and duration, lead to a characteristic distribution of soil properties in space. The development of quantitative spatial models relating soil properties to their genetic factors – which do not only make the spatial prediction of continuous soil properties possible, but include model uncertainty as a must – is described by the term “digital soil mapping” (DSM). Soil maps form the basis for land use planning. They provide a useful tool for policy makers and municipalities.

Research Areas

In **project C9**, research and experience in DSM shall be extended and deepened in two further research areas (the dry forest in the Laipuna Reserve and the high mountain areas in Cajas National Park) in order to develop a guideline for DSM in Ecuador.

Objectives

The DSM guideline will give an overview:

- about the DSM approach,
- the different sampling designs developed according to the area size, accessibility and terrain complexity,
- the various methods from the field of supervised machine learning to develop digital soil maps, and
- the implementation with open source software.

The soil-landscapes of the investigation areas are analyzed and soil-landscape models are developed by supervised machine learning techniques, in order to spatially predict soil properties from point data based on environmental prediction parameters. By using the digital soil maps as principal input which were developed in such a way, a functional soil-landscape analysis will be carried out to determine landslide, erosion or anthropogenic disturbance risk zones as well as to estimate soil organic carbon stocks and soil fertility.

doi: 10.5678/lcrs/pak823-825.cit.1260

Effects of Land Surface Models on the Occurrence and Intensity of Precipitation

Katja Trachte and Jörg Bendix
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First results of numerical simulations demonstrate the importance of accurate representation of land surface characteristics in this highly diverse and complex area. The models shall be developed to generate a high resolved climate indicator system (hrCIS) for south Ecuador.

In the framework of the **project C12** a highly resolved climate indicator system (hrCIS) is generated using the Weather Research and Forecasting (WRF) model [1] to derive ecologically relevant climate indicators affecting the ecosystems of the study area. WRF is applied to establish a 30-year climate normal period (1981-2010) of indicators such as air temperature and precipitation (hrCISpr). This is realized by a multi-nested domain set-up consisting of 36 km, 12 km and 4 km horizontal resolution to adequately consider the three ecosystems of the Platform: rain forest (RBSF), dry forest (Laipuna) and Páramo (Cajas). To gain the most suitable hrCISpr, a sensitivity study with an ensemble of 33 numerical experiments has been performed on each domain size. Since the local climate is governed by both, the terrain and the land surface characteristics, the horizontal resolution, as well as the surface models are of particular interest.

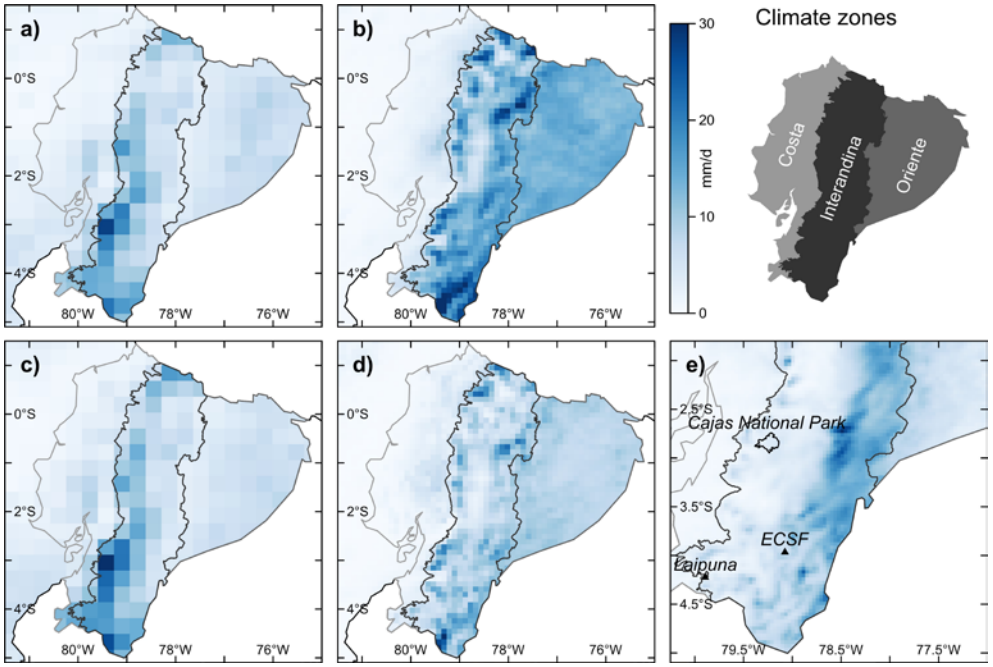

Figure 27: Mean precipitation [mm/d] for DJF 2001 of WRF-LSM (a, b) and WRF-CLM (c, d, e) with 36 km (a, c), 12 km (b, d) and 4 km (e) horizontal resolution. Graphs: Katja Trachte

The effects of both features are demonstrated in **Figure 27** on the basis of the mean precipitation amount for each grid size (a, c: 36 km; b, d: 12 km; e: 4 km) and two land surface models (a, b: Noah Land Surface Model LSM [2, 3]; c, d, e: Community Land Model CLM, [4, 5]).

With respect to the land surface model each simulation result show comparable rainfall occurrences on the 36 km domain, but clearly differ on 12 km. Although, the spatial patterns are improved in both simulations, the rainfall considerably increases in WRF-LSM pointing to an overestimation. In contrast, WRF-CLM reveals a significant improvement of the precipitation patterns regarding the occurrences as well as the frequencies. The main reason is attributed to a more precise representation of the land surface processes in CLM. The diabatic heating is calculated in more detail, and thus, the heat energy budget driving the specific local circulation regimes. However, these enhancements are only effective on an appropriate horizontal resolution as demonstrated by the domain nests.

Based on these findings it can be stressed that an accurate development of local climate indicators highly depends on the proper resolution and the accurate description of the shape of the terrain as well as on the surface fluxes.

References

[1] Skamarock, W C, Klemp J B, Dudhia J, Gill DO, Barker DM, Duda M, Huang XY, Wang W, Powers JG (2008): A description of the advanced research WRF version 3. *NCAR technical note*, NCAR/TN\u2013475+SRT, 123 pp, doi: http://dx.doi.org/10.5065/D68S4MVH

[2] Chen F and Dudhia J (2001): Coupling an advanced land-surface / hydrology model with the Penn State/NCAR MM5 modeling system. Part I: model description and implementation. *Mon. Wea. Rev* 129: 569-585, doi: http://dx.doi.org/10.1175/1520-0493(2001)129<0587:CAALSH>2.0.CO;2

[3] Tewari M, Chen F, Wang W, Dudhia J, LeMone M A, Mitchell K, Ek M, Gayno G, Wegiel J, Cuenca R H (2004): Implementation and verification of the unified NOAH land surface model in the WRF model. *20th conference on weather analysis and forecasting/16th conference on numerical weather prediction*, pp. 11–15, http://nldr.library.ucar.edu/repository/collections/OSGC-000-000-008-560

[4] Oleson, KW, Lawrence, DM, Bonan GB, et al. (2010): Technical description of version 4 of the Community Land Model (CLM). *NCAR Tech. Note* NCAR/TN–478+STR. 266 pp, doi: http://dx.doi.org/10.5065/D6FB50WZ

[5] Lawrence DM, Oleson, KW, Flanner MG et al. (2011): Parameterization improvements and functional and structural advances in Version 4 of the Community Land Model. *J. Adv. Model. Earth Syst.*, 3, M03001, http://onlinelibrary.wiley.com/doi/10.1029/2011MS00045/full

doi: 10.5678/lcrs/pak823-825.cit.1260

Transfer News

Second of Three Weather Radars Installed in Southern Ecuador

Andreas Fries (Local coordinator Radar Net Sur) and Jörg Bendix
Philipps-Universität Marburg, Germany – members of the DFG funded Transfer Research Projects

The data generation of the second wether radar GUAXX and its operation procedure are explained as well as how it supplements the first radar.

The DFG Transfer Project (BE 1780/31-1): "Operational rainfall monitoring in southern Ecuador" has installed the second weather radar at the Cerro Guachaurco mountain peak (3100 m a.s.l.; radar GUAXX) in the Ecuadorian province of Loja, canton Paltas. The Cerro Guachaurco mountain peak is the highest mountain in the western part of the province of Loja and offers an almost undisturbed view for the radar in all directions (**Figure 28**). The fenced infrastructure at the Cerro Guachaurco consists of a radar-house and a 12 m radar-tower. The radar "RainScanner120" (RS120) from SELEX-Gematronic was installed at the top of the tower in March 2014 and is under calibration at the moment. The radar will be operated by technicians of the provincial government of Loja (Gobierno Provincial de Loja, GPL).

The RS120 is a X-band weather radar (wavelength: 9.4 GHz) and is able to generate various user-defined images for different time scales (10 seconds to 1 hour) with different ranges (up to 100 km = radius) and resolutions (100 m x 100 m to 1 km x 1 km per pixel). Due to its large range, the RS120 covers almost completely the South-Ecuadorian provinces of Loja and El Oro. The RS120 consists of a 1.2 m parabolic antenna and a motor, which rotates the antenna 12 times per minute, inside a 2 m x 2 m radar dome. The motor is controlled by an Interface Unit, which also is connected to the Signal Processor PC, where the raw images can be displayed and operating parameters of the radar set. The Interface Unit, the Signal Processor PC and an additional computer for image processing are installed inside the radar-house.

In contrast to the Dansk Hydrolosk Institut (DHI) Local Area Weather Radar (LAWR), installed at the Cerro El Tiro mountain peak (2800 m a.s.l.; radar LOXX) and operated by the Universidad Técnica Particular de Loja (UTPL) since April 2013, the software package of the RS120 includes the clutter-subtraction and other necessary functions (e.g. atmospheric attenuation of the radar beam, beam blockage effects etc.) to correct the raw images. Furthermore, the RS120 software permits the calculation of rain rate (R) directly by means of the relation between radar reflectivity (Z) and R (formula: $R = a \cdot Z^b$). As a next step of research, the parameters "a" and "b" are adjusted to the rainfall types of Southern Ecuador. Also, a real time calibration with rain gauge data is integrated in the package. However, to date the majority of the climate stations in Southern Ecuador do not dispose real-time data transmission, but an actualization of the existing stations and an extension of the station network by the national meteorological agency of Ecuador (Instituto Nacional de Meteorología y Hidrología, INAMHI) and the South Ecuadorian Water Fund (Fondo Regional del Agua, FORAGUA) is intended.

The two weather radars LOXX and GUAXX cover major parts of the three provinces in Southern Ecuador (El Oro, Loja and Zamora-Chinchipe) and range from the Pacific coast, over the Andean Highland to the Amazon Basin (see **Figure 28**). The corrected images are real-time transmitted to a server in the GPL, where they are uploaded to an internet portal. The website is available for all people around the world (www.radarnetsur.gob.ec and displays the precipitation distribution and intensities during the last 3 hours). To date solely LOXX-images are visible due to the absent internet connection at the Cerro Guachaurco mountain peak, which will be installed within the next weeks. Another ongoing research now is the intercalibration of both technically different radars.

During the next month the third radar will be installed in the National Park of Cajas, Cuenca (4440 m a.s.l.; radar CAXX). The infrastructure is under construction and should be ready by July 2014. The CAXX is a RS120, too, thus the coverage of the radar network will be enhanced to 5 provinces in Southern Ecuador: Cañar, Azuay, El Oro, Loja and Zamora-Chinchipe.

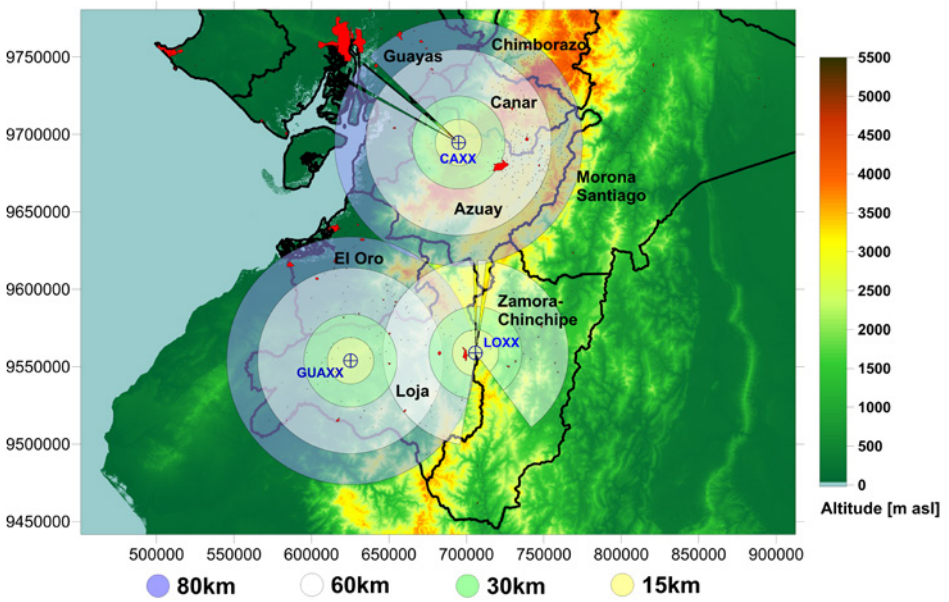

Figure 28: Radar locations and ranges with calculated areas of beam blockage of the transfer project funded by the DFG. LOXX: first installed weather radar at the Cerro El Tiro mountain peak, GUAXX: second weather radar at the Cerro Guachaurco mountain peak and future CAXX weather radar in the National Park of Cajas, Cuenca. Graph: Andreas Fries.

doi: 10.5678/lcrs/pak823-825.cit.1260

SENESCYT Bundle Projects

Five research projects are being funded by the Ecuadorian National Secretariat for Higher Education, Science and Technology (Secretaria Nacional de Educación Superior, Ciencia, Tecnología y Innovación, SENESCYT) for the next years (Table 2). Four of them introduce their research questions and goals in this section.

Table 2: Ecuadorian Bundle Projects

Working package 1: Monitoring Biodiversity and Ecosystem Functions	**Investigators**
PIC-13-ETAPA-002 Use of bioacoustics to develop innovative indicators of diversity in communities of amphibians and bats along altitude and disturbance gradients	David **Siddons**, Andrea Jara, Carlos Nivelo, Juan Carlos Sanchez
PIC-13-ETAPA-003 Network topology of epiphytic orchid-mycobiont and epiphytic orchid-phorophyte interactions	Juan Pablo **Suarez**, Lorena Riofrío, Carlos Naranjo
PIC-13-ETAPA-004 Spatial-temporal responses of bird and bat communities to altitudes and disturbance in three different habitats	Carlos Iván **Espinosa**, Boris Tinoco, Andrea Jara
PIC-13-ETAPA-005 Morpho-functional adaptations along a climatic stress gradient and its influence on plant community assembly	Elizabeth **Gusmán**, Diego Vélez, Carlos Iván Espinosa
Working package 2: Water and Element Fluxes	**Investigators**
PIC-13-ETAPA-001 Development of functional hydrological indicators for evaluating the impact of global change in Andean ecosystems	Patricio **Crespo**, Rolando Célleri, Fernando Oñate

Use of Bioacoustics to Develop Innovative Indicators of Diversity in Communities of Amphibians and Bats Along Altitude and Disturbance Gradients

David Siddons[1], Andrea Jara[2], Carlos Nivelo[1] and Juan Carlos Sanchez[1]
[1]Universidad del Azuay, [2]Universidad Técnica Particular de Loja, Ecuador – members of the SENESCYT Research Consortium

We want to invent a novel and inexpensive technique to monitor cryptic species in dense forest ecosystems.

Ecuador is a megadiverse country with a large variety of ecosystems and an even larger number of species. The study of amphibians and bats is a challenge since many species are cryptic and there are only a few experts in this field. Another challenge is the underrepresentation of certain species when techniques such as mist-netting are used.

How to Monitor Cryptic Species

This study (**project PIC-13-ETAPA-002**) arose from the wish to include monitoring of these cryptic species in the most cost-effective way, without becoming expert taxonomists. The overall goal of this project is to facilitate others to be able to identify species by the creation of an automated call recognition system and recording protocol for amphibians and bats. This also includes testing whether certain species are suitable as indicator species.

Research Questions

We want to know:

1. How altitudinal and disturbance gradients affect the community of amphibians.
2. Whether automatic bioacoustics recorders can provide adequate data to estimate richness and abundance of amphibian and bat species.
3. Whether these methods can provide a cost-effective alternative to more expensive and intensive biodiversity field investigations.

Methods and Study Area

The study areas will be in the montane forests in and around Cajas National Park and the dry forests of Laipuna and Arenillas. Rather simply put, bats and amphibians will be caught and recorded to provide baseline calls of the species found in the areas under investigation. Automatic recorders will also be set up to record wild sounds in the study areas. An automatic recognition programme will be callibrated using baseline calls to scan recordings and identify calls. These data will then be used to calculate species richness and abundance.

doi: 10.5678/lcrs/pak823-825.cit.1260

Network Topology of Epiphytic Orchid-Mycobiont and Epiphytic Orchid-Phorophyte Interactions

Juan Pablo Suárez, Lorena Riofrío and Carlos Naranjo
Universidad Técnica Particular de Loja – members of the SENESCYT Research Consortium

We analyse how the architecture of interaction networks of the symbioses between orchids, their hosts and their symbiontic partners are influenced by the altitudinal gradient in the tropical mountain forest.

Changes in structure and composition of plant communities as consequence of biotic and abiotic factors have been studied extensively. Rare species are more susceptible to environmental gradients than frequent ones, but the significance of this species turnover is difficult to interpret. A more integrative view is provided by the concept of "interaction networks".

Objective

The main goal of **project PIC-13-ETA-PA-003** will be to assess the architecture of interaction networks, phorophyte-orchid and orchid-mycobiont, against an altitudinal gradient.

Research Questions

The research questions are:

1. How robust are the interaction networks against either loss of keystone (multi-linked) or rare species of phorophytes and orchid mycobionts?
2. Do the networks display changes in the architecture (shape) as a response to an altitudinal gradient?
3. Is the orchid´s population genetic structure affected by the altitudinal gradient and/or by the identity of the interacting phorophytes and mycobionts?

Methods and Research Areas

The study will be carried out in the mountain forest areas of Reserva Biológica San Francisco (RBSF) and Cajas National Park. Populations of five epiphytic orchid species (**Figure 29**) will be sampled in two altitudinal levels. Trees hosting epiphytic orchids (phorophytes) and orchids will be morphologically identified. Orchid mycobiont will be identified by direct polymerase chain reaction amplification (PCR) from roots and DNA barcoding of internal transcribed spacer region including 5.8S (nrITS-5.8S). The orchid's population genetic structure will be assessed. Finally nestedness and modularity in the network structure of phorophyte-orchid and orchid-mycobiont will be calculated.

Figure 29: The epiphytic orchid *Stelis sp.* from Cajas National Park will also be part of the planned analyses. Photo: Juan Pablo Suárez

doi: 10.5678/lcrs/pak823-825.cit.1260

Spatial-Temporal Responses of Bird and Bat Communities to Altitudes and Disturbance in Three Different Habitats

Carlos Iván Espinosa[1], Boris Tinoco[2], Andrea Jara[1]
[1]Universidad Técnica Particular de Loja, [2]Universidad del Azuay – members of the SENESCYT Research Consortium

How animal species in mixed or single-species flocks adapt to ecological parameters such as food and climate will be analyzed in two different ecosystems.

Figure 30: The Blue-crowned Motmot (*Momotus momota*) inhabits the Neotropical dry forests. As omnivorous species it feeds on fruits, insects and other small animals. Our study analyzes how the Motmot and other bird as well as bat species modify their abundance when food resources change. Individuals are collected in order to band them and take morphometric measurements that we can analyze their loyalty to the territory. Photo: Santiago Erazo

Several studies have shown that human disturbance and altitudinal gradients modify the structure and composition of bird and bat communities. Quantifying the biodiversity change patterns and the mechanisms responsible for these changes in the tropics is essential for understanding ecological responses of organisms. The findings can also be used to generate and guide management actions and conservation issues for biodiversity.

The bird and bat community fluctuations may be caused by local movements within and among habitats at the same elevation or among habitats at different elevations or levels of disturbance. These movements in bird communities occur in response to changes in local and regional climate conditions and the availability of resources (**Figure 30**). In Neotropical ecosystems, only a few sites have been evaluated about the influence of resource variation on abundance and movement patterns of birds. The limited research that has been conducted in tropical ecosystems generally quantifies the abundance and richness patterns; however, abundance of a given species may be similar among sites but individual birds may vary in condition or site fidelity. Species interactions are often ignored, yet can have an important impact in the ecosystem functionality. In bird communities positive-positive interactions are measured as mixed species associations and are common across many taxa, including insects, mammals, fish and birds. In the tropics, one of the most ubiquitous interspecific interactions occurs in mixed species foraging flocks of birds.

Objectives

Our main goal in p**roject PIC-13-ETAPA-004** is to quantify how species abundance, indirect fitness measures (i.e. fluctuating asymmetry, parasite loads, fat, etc.) and species interactions vary across disturbance and altitudinal gradients, and how these changes respond to resources availability. The evaluation of these parameters alone and in combination across altitudinal gradients and habitat types will provide unique information about mechanisms influencing population regulation and community structure.

Research Questions

In the present project we are interested in the following specific questions:

1. How do richness, composition and guild structure of bats and birds vary across gradients and seasons?

2. Are shifts in bird and bat composition a function of resource variability?

3. How do richness, composition and characteristics of mixed species flocks vary across gradients?

Methods and Ecosystems

This research will be carried out in two ecosystems: the mountain forest in Cajas National Park and the dry forest in Laipuna Reserve. We will use three methods to survey birds across the gradients: mist-nets, point-counts and mixed flock observations. The survey of bats will be evaluated using mist nets, to gather data about the relative abundance of bats, population health and resource use.

doi: 10.5678/lcrs/pak823-825.cit.1260

Morpho-Functional Adaptations Along a Climatic Stress Gradient and its Control over the Communities Assembly

Elizabeth Gusmán M., Diego Vélez M. and Carlos Iván Espinosa
Universidad Técnica Particular de Loja – Researchers are members of the SENESCYT Research Consortium

To be able to identify biodiversity management strategies we analyze six vegetative and six reproductive traits which are important for plant survival, growth and reproduction.

Ecosystem Functions

The composition, structure and functioning of ecosystems are being modified by climate change. Ecologists are trying to develop functional classifications of plant species to assess the impact of climate change on ecosystem function. The functional plant traits are related to the survival, growth and reproduction of species. Understanding the relationships among plant traits in natural ecosystems and their role in composition, structure, biotic interactions and abiotic factors are keys to improve the comment knowledge about function and dynamics of ecosystems.

How Assemblies Adapt to Stressors

The aim of this study (**project PIC-13-ETAPA-005**) is to examine how dry (**Figure 31**) and montane forests communities assembly are filtered by the morpho-functional traits, and how these traits allow the species adaptation to climate stress by modifying leafs, maximum height, wood density or seed mass.

Figure 31: Our study analyzes the relationships among plant traits in the natural ecosystem of the dry forest and their role in composition, structure, biotic interactions and abiotic factors. Photo: Elizabeth Gusmán Montalván

Research Questions

To achieve our goal, we will address the following questions:

1. Is there any evidence of a restricted range or even spacing of functional trait values within in dry forest and montane forest?
2. Which environmental factors are related to functional trait variation in dry forest and montane forest?
3. Does the relative importance of assembly processes regarding different traits change across an ecological gradient?

Traits to be Analyzed

Six vegetative traits will be analyzed: plant height, leaf area, specified leaf area, wood density, nitrogen content of leaves and growth form. In addition, six reproductive traits will be analyzed: sexual system, pollination syndrome, dispersion syndrome, amount of nectar, sugar level in the nectar, seed dry mass, size and weight of fruit and seed. These traits were selected upon their feasibility to be measured by simple methods and for being strongly related to important functions in plants.

Perspective

The results will allow the establishment of biodiversity management strategies for sensitive areas to global change to mitigate the effects of climate change.

doi: 10.5678/lcrs/pak823-825.cit.1260

Data Warehouse News

German Alert and Booking Systems, International Cooperation, and Data Transfer Automatization

Rütger Rollenbeck (Data Manager) and Maik Dobbermann (Developer and Webmaster)
Philipps University Marburg, Germany – Data Manager, Developer and Webmaster of the DFG-PAK Research Consortium

The control tool of available funds for each research team and the new booking tool are introduced. The status of the collaboration between German and Ecuadorian data teams and the automatic transfer of climate data are reported.

With the implementation of the new German Research Consortium PAK 823-825, the data base and especially the website had to undergo some major changes. The transition is now completed and the new website is online since February 2014. The new organisational structure and all new projects are now visible for the public. The structure of the former Research Unit (FOR816) is still researchable in a submenu. In accordance with an agreement of the FOR816 member assembly, all research data of the finished FOR816 is now available to the public and accessible worldwide via the website [1]. We hope to stimulate ongoing analyses of the data and to stimulate further research efforts in the scientific community with this step.

The organisational structure has been largely improved by integrating several new administrative tools on the website.

Alert System for Available Funds

All financial issues can now be handled in a very transparent way and each subproject as well as the centralized administration of the Platform have means of a constant monitoring of their financial status. This is realized in the form of graphical interfaces, which provide rapid information (**Figure 32**). The graphical interface includes an alert system, showing several warning thresholds, when certain fractions of the available funds have already been spent. The columns turn yellow, when more than 60% of the available funds are spent and turn red, when 90% are released. Now, all projects can conveniently plan and calculate their research activities.

Station Booking Tools

The research infrastructure of the Platform has been extended with the new research station in Laipuna and an interims research base in Cuenca. The latter one will hopefully soon be upgraded to the full-fledged research station in the Cajas National Park.

To reflect these extensions, the booking tool for stays in the field has been replicated and allows easy booking via the web interface for the users. At the same

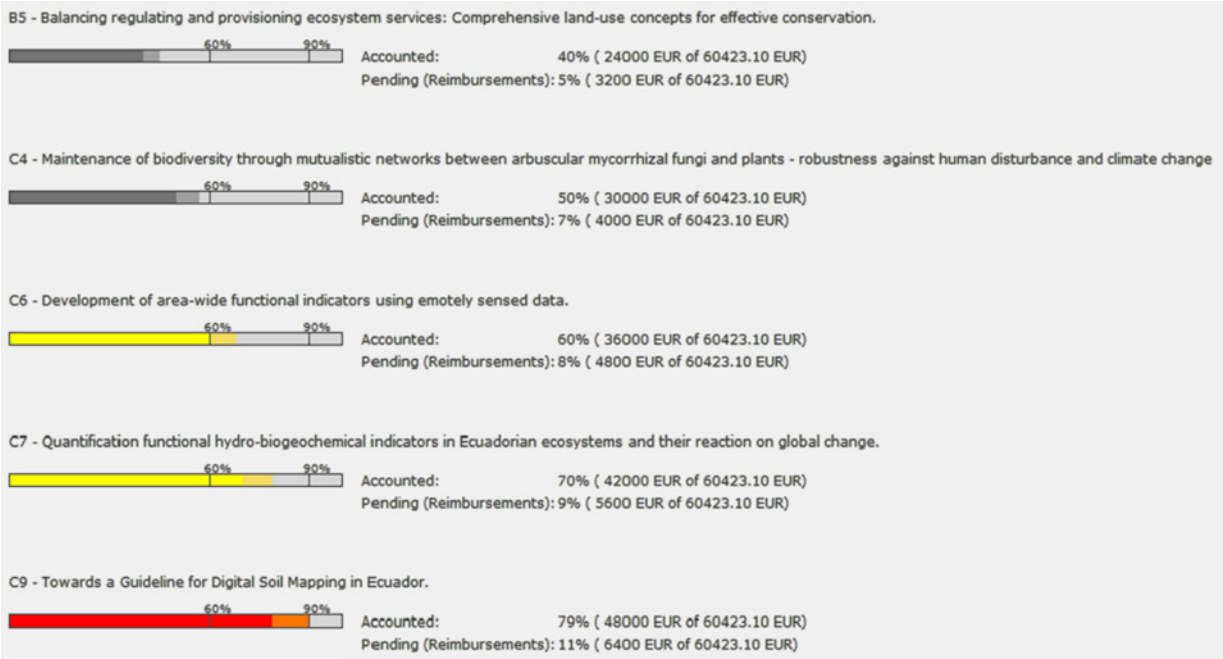

Figure 32: Graphical interface showing the financial status of subprojects (fictional data). Graph: Rütger Rollenbeck

doi: 10.5678/lcrs/pak823-825.cit.1260

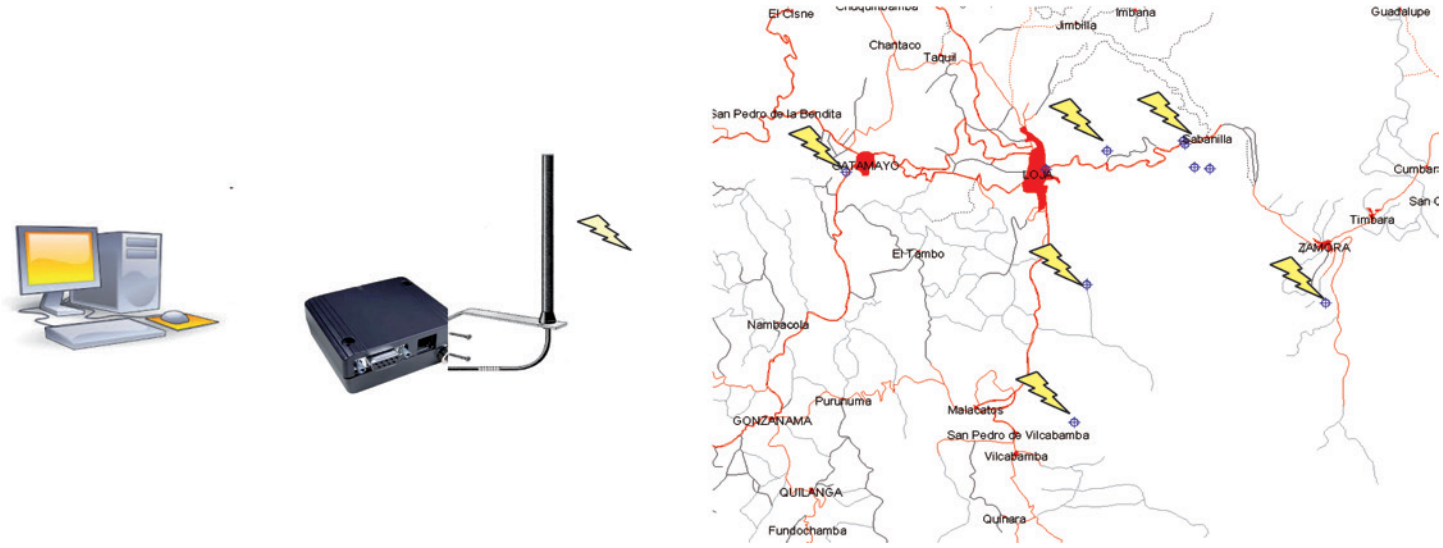

Figure 33: Central server (**left**) contacts solar powered GSM-Modem at each climate station (**right**) and downloads most recent data. Graphs: Rütger Rollenbeck

time the respective station managers obtain quick and comprehensive information about the usage of the stations and the required management activities. The booking tools will be handed over to the Ecuadorian partners soon.

Cooperation of the Data Warehouse Teams

The data-warehouse team has initiated a cooperation with the Ecuadorian counterparts at the Universidad del Azuay in Cuenca (UDA) and the Universidad Técnica Particular de Loja (UTPL). As a first step, the Ecuadorian counterparts have been granted access to the research data base to stimulate Ecuadorian research activities. The next step is the replication of the data warehouse system at the UDA, where a proprietary server will be installed and the scientific data of the Ecuadorian projects will be hosted. A new web interface accessing both data bases will be implemented and maintained by the UTPL and hopefully is the impulse for a long term storage of native knowledge for wide spread activities of the national scientific community in Ecuador.

Once, the new system is up and running, the data flow scheme agreed upon between German and Ecuadorian projects will be implemented and support an efficient exchange of knowledge between all parties involved.

Automatic Transfer of Climate Data

The communication and transport infrastructure in Ecuador has strongly improved during the last years. However, the complex terrain and technical issues still pose a major challenge for scientific research as well as the transfer and application of this knowledge for the benefit of the local and national community in the country.

To improve this situation, modern technologies of telemetric data collection will be implemented. The first step is to connect all existing climate stations of the German PAK Research Consortium to a central server and enable a continuous climate monitoring in the region.

Technologically, each climate station will be equipped with a solar powered GSM-Modem. A central server than calls each station in regular intervals to download the most recent data collected by the data logger (**Figure 33**). This setup not only enables a permanent situational awareness of the climatic situation in the region, but also facilitates alerts and warnings, when critical conditions occur. For the scientists, the operation of the stations is much easier: Potential loss of data is minimized and maintenance requirements can be detected much faster. Overall, the system is a large step towards improved data quality and availability. The system also works hand in hand with the new radar network currently being installed in South Ecuador. Only together with real time calibration information, quantitative precipitation data can be derived from the three radars of the Radar Net Sur. This integrated approach will be made operational within the year 2014. Later, the telemetric system will be adapted to other climate station networks operated by local authorities.

As a service oriented team, we hope we could help all those who have used the Data Warehouse and like to motivate all the others to give it a try on www.tropicalmountainforest.org.

References

[1] Data of the preceding Research Unit (FOR816) are available via: http://137.248.191.82/content_projects.do;jsessionid=7361331BE6F32644ACB9E3181EAED9EA?phase=2&subpage=intro

doi: 10.5678/lcrs/pak823-825.cit.1260

News from Infrastructure Providers[1)]

Laipuna Research Station Awaits Scientists

NCI introduces the features of the new building which just has been completed and the equipment of the whole station.

Figure 34: The buildings of the Laipuna Research Station are now restored. Photo: NCI

After several months of construction and modifications to the original building (**Figure 34**) the infrastructure at the Research Station Laipuna is ready to welcome and accommodate researchers from the recently approved projects of the German-Ecuadorian Platform for Biodiversity and Ecosystem Monitoring and Research in South Ecuador. The station is located in the Laipuna Natural Reserve (see map in the TMF Newsletter issue no 17, page 9, doi: 10.5678/lcrs/for816.cit.1132). The Reserve harbors plant and animal species both from the dry and the humid upper forests. Nature and Culture International (NCI) who acquired the area eleven years ago fenced it to prevent cattle grasing in this very biodiverse region. NCI who owns and runs the research station at Laipuna is looking forward to the first scientists to arrive in the Catamayo valley (**Figure 35**).

At this stage the Station has the capacity to accommodate 14 researchers in five rooms (**Figure 36**). The building includes a kitchen and dining room, storage room, bathrooms, and confortable work places for the researchers. The social areas and rooms are fully furnished (**Figure 37**). A new water system was built and a satellite telephone line is available. Internet access is now being negotiated and will be ready for use within the next weeks. Also the main paths have been repaired. NCI would like to improve the station in the near future based on the requirements of the research projects and the establishment of the research plots.

[1)] In this section infrastructure providers inform about news around the Research Platform. This time Bruno Paladines from Nature and Culture International (NCI) informs about the opening of the rebuilt Research Station.

Figure 35: The Laipuna Research Station is situated in the valley of the Catamayo river. The picture was taken during the season when the deciduous trees of the dry forest shed their leaves. Photo: NCI

Figure 36: Sleepting places at the Research Station. Photo: NCI

Figure 37: The entrance hall of the Research Station provides room for meetings. Photo: NCI

doi: 10.5678/lcrs/pak823-825.cit.1260

Miscellaneous

Mycorrhiza Seminary at the UTPL

Ingeborg Haug[1], Ingrid Kottke[1], Juan Pablo Suárez[2]
[1]University of Tübingen, Germany – members of the DFG-PAK Research Consortium
[2]Technical University of Loja, Ecuador – member of the SENECYT Research Consortium

The Universidad Técnica Particular de Loja (UTPL) invited Ingrid Kottke and Ingeborg Haug from **project A4** to perform a one-week seminary on mycorrhizae for students. During March 11-14, 2014, lectures under the title "Mycorrhiza: Root-Fungus Symbiosis - Current scientific approach" were performed and accomplished by presentations of the current research in the group of Dr. Juan Pablo Suárez from the Departamento de Ciencias Naturales of UTPL. In total 20 attendants participated in the seminary (**Figure 38**).

Ingrid Kottke opened the morning sessions with plenary talks about network and evolutionary approach, functionality of mycorrhizas and an overview of knowledge and open questions on orchid mycorrhizas. Ingeborg Haug focused on ectomycorrhizas in the tropics and her arbuscular mycorrhizal research in Southern Ecuador. PhD candidates presented their results and ongoing studies: Paulo Herrera about epiphytic orchid mycobionts in the RBSF and Cajas National Park, Micaela Mafla about ectomycorrhizas in the Yasuni National Park, Paul Lojan about arbuscular mycorrhizas and bacteria for potato growth in the VALORAM project [1] and Dario Cruz about Tulasnellaceae species delimitation.

Juan Pablo Suárez showed new own results on specialists and generalists among orchids and their mycobionts. During the afternoons results and manuscripts of the PhD candidates were discussed and some advise given to the students laboratory work. We thank all participants for this fruitful meeting and the UTPL for the invitation.

Following the workshop an excursion (**Figure 39**) was carried out together with some of the participants to visit the investigated sites in Cajas National Park and to undertake a further sampling for the orchid **project PIC-13-ETAPA-003** "Network topology of epiphytic orchid-mycobiont and epiphytic orchid-phorophyte interactions".

Figure 38: Members of the course discussed current approches to Mycorrhiza and the Root-Fungus Symbiosis. Photo: Ingeborg Haug

Figure 39: Follwoing the workshop an excursion led some of the participants to the research sites at the Cajas National Park. Photo: Byron Moreno (self-timer)

Reference

[1] More information about the VALORAM project (*VALORising Andean Microbial diversity through sustainable intensification of potato-based farming systems*): http://www.ucc.ie/en/valoram

doi: 10.5678/lcrs/pak823-825.cit.1260

Event Calendar

Status Symposium

The Annual Status Symposium of the German and the Ecuadorian Consortia will take place at the Universidad del Azuay (UDA) in Cuenca, Ecuador, on October 2nd and 3rd 2014.

gtö Conference

The next international conference of the Society for Tropical Ecology (gtö) will take place at the Eidgenössische Technische Hochschule (ETH) in Zurich, Switzerland, from 7th - 10th April 2015. It will focus on "Resilience of Tropical Ecosystems: Future challenges and opportunities". According to their website the conference provides an exciting and friendly atmosphere for tropical ecologists at all levels of their career: http://www.gtoe-conference.de

Deadline

The editorial deadline for the forthcoming German issue of the MRp|SE Newsletter is:

23rd October 2014.

Please send your ideas, manuscripts and images to Esther Schwarz-Weig at the editorial office. Please feel free to contact her if you have any questions concerning the Newsletter. E-mail: esw@sci-stories.com

People and Staff

Avarded Scientists

Photo: Gerhard Kost

Roman Link (University of Göttingen, right) received the second of the three Sibylla Merian Awards for best posters at the conference of the Society of Tropical Ecology (Gesellschaft für Tropenökologie, gtö) for his contribution "Small-scale spatial distribution of Piperaceae and Rubiaceae in a tropical mountain ecosystem in southern Ecuador". The results of his Master Thesis are provided in the "Science News" section. Roman who is member of the DFG-PAK Research Consortium and working on **project A1** received the price from Prof. Eckhard Heymann (left) from the Adivsory Board of the gtö, in Freising, Germany, on 28th February 2014.

Photo: Gerhard Kost

Brenner Silva (right), member of the DFG-PAK Consortium and working on **project C6**, received the third "Maria Sibylla Merian Award" of the Society of Tropical Ecology (Gesellschaft für Tropenökologie, gtö) in the category "best poster" at the annual conference 2014 in Freising, Germany. The poster was entitled "RendezWUE: Canopy evapotranspiration meets water use efficiency of leaves" (results provided in the "Science News" section). See website of the gtö: http://gtoe.de/merian-awards-2014

Photo: private

Víctor Brito Gómez started his PhD work in **project C9** "Towards a guideline for digital soil mapping in Ecuador" in October 2013. After his preceeding studies in Agricultural Engineering and the M.Sc. "Management and Preservation of Water and Soil" at the University of Cuenca, Gómez had gained experience in soil survey and land use planning.

Mareike Ließ

Johanna Orellana started her work as PhD student in the working group of Rolando Célleri (University of Cuenca) together with the group of Jörg Bendix (DFG Transfer-Project BE 1780/31-1). At Catholic University of Leuven, Belgium, Orellana earned her M.Sc. in artificial intelligence (major subject: Engineering and Computer Science). Her PhD research will focus on calibration of the radars of the Network "RadarNetSur" located in the cantons Loja and Cuenca. She will also implement applications for the investigators of the Research Platform "Biodiversity and Ecosystem Monitoring and Research in South Ecuador" using the radar data.

Andreas Fries

Photo: private

In 2013, **Prof. Dr. Yvonne Oelmann** joined the research Platform in Ecuador as a new project leader of **project A7** ("The fate of phosphorus in forest and treeline ecosystems in Ecuador"). Prof. Oelmann has been head of the Geoecology work group at the University of Tuebingen since 2011. Her research focuses on the effect of biodiversity on element cycles in grassland and forest ecosystems – amongst others using isotope tracer approaches to identify the processes elements undergo in ecosystems. Until now, Prof. Oelmann has published 39 papers in peer-reviewed international journals. For more information visit her website: www.geo.uni-tuebingen.de/geoecology

Photo: private

Diplom biolologist **Karla Dietrich** is a member of the Geoecology working group of professor Oelmann at the University of Tuebingen. She started to work as PhD student in the group of project A7 in autumn 2013. She will focus on biochemical and geochemical controls of phosphorus (P) cycling and the effect of nutrient addition on P cycling. In particular, P storage and availability in soils and the organic layer of the nutrient manipulation experiment (NUMEX) sites will be assessed. The biologically mediated P release and immobilization rates will be measured based on a ^{33}P isotope approach. The geochemical control will be studied by determining P release and retention of the mineral soil.

doi: 10.5678/lcrs/pak823-825.cit.1260

David Siddons the principal investigator of the Ecuadorian bundle **project PIC-13-ETAPA-002** has been working for the University of Azuay for about five years as a lecturer. Only recently he works as an investigator as well. His main interests and lines of investigations are bioacoustics and population distribution modelling. He currently is collaborating to build a Biodiversity Information System.

Andrea Jara the sub-director of the Ecuadorian bundle **project PIC-13-ETAPA-002** has been working at the Universidad Técnica Particular de Loja since 2005 as both lecturer and investigator. Her main focus are seed dispersal processes. She also analyses spatial patterns, seed rain and interactions, plant-animal interactions, and community dynamics to investigate seed dispersal processes and their possible effects on the community structure of tropical dry forests. *David Siddons*

Photo: Eike-Lena Neuschulz

PhD students **Vinicio Santillán** and **Marta Quitían** (above) have recently arrived at the Estación Científica San Francisco (ECSF) to start fieldwork. They are interested in bird communities and their ecosystem functions, particularly in plant-frugivore interactions. In **project C3** they will study the diversity of birds and mutualistic seed dispersal interactions among frugivorous birds and fruiting plants across altitudinal and land use gradients. In particular they seek to investigate whether artificial fruits can be used as functional indicators to monitor the ecosystem function avian seed dispersal. They will conduct their studies in the Podocarpus National Park as part of the project “Development and validation of functional indicators for avian seed dispersal”, supervised by Katrin Böhning-Gaese, Eike Lena Neuschulz and Matthias Schleuning from the Biodiversity and Climate Research Centre, Frankfurt (BiK-F). They will also be co-supervised by Edwin Zaraté (UDA) and Carlos Iván Espinosa (UTPL). *Eike-Lena Neuschulz*

Photo: private

Paulina Álava started her work as PhD student in the working group of Prof. Jörg Bendix (**project C6** in the DFG-PAK group, funded by a scholarship of KAAD (German Catholic Academic Exchange Service) in April 2014. At Wageningen University, Netherlands, Álava earned her M.Sc. in Climate Studies – Earth System Science. Her PhD research will focus on evapotranspiration and remote sensing in the Reserva Biológica San Francisco. Using data from the observation towers (sincillometry and spectrometry) Álava will work with satellite data at tree and landscape scales and investigate evapotranspiration as a landscape indicator of environmental change.

Photo: private

Recently **Galo Carrillo** started his work as PhD student, funded by a SENECSYT PhD scholarship, in the working groups of Prof. Jörg Bendix (**project C6** in the DFG-PAK group, funded) and Prof. Rolando Célleri (UC). At University of Cuenca, Ecuador, Carrilo earned his M.Sc. of environmental management for production and services industries. His PhD research will focus on a regional comparison of evapotranspiration and primary productivity across the three study sites of the MRp|SE: the dry forest at Laipuna, the mountain forest in the Rio San Francisco valley, and the Páramo in Cajas. Carrillo will mainly work with eddy covariance and weather stations to calibrate satellite data at landscape and regional levels. *Brenner Silva*

About Us

Monitoring and Research Platform | South Ecuador

The platform for biodiversity, ecosystem monitoring and research in South Ecuador (MRp|SE) is a German-Ecuadorian joint venture of interdisciplinary research and knowledge transfer. Investigating three ecosystems in South Ecuador, the teams aim to understand impacts of global change (mainly atmospheric nutrient deposition related to land use changes) on processes, functions and services of the megadiverse ecosystems of the Andean mountain rainforest, the dry forest and the Páramo. Regarding knowledge transfer the program aims on implementing and further testing options for sustainable land use. At the same time, research has been started towards a novel functional monitoring system indicating impacts of environmental changes on ecosystem functions in the sense of an early warning system. The prototype indicator system under development shall be implemented on a broad scale in cooperation with non-university partners for use by relevant stakeholders in policy and development planning.

Research and knowledge transfer is funded by two national research foundations, the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) and its Ecuadorian partner organization Secretaría Nacional de Educación Superior, Ciencia, Tecnología e Innovación (SENESCYT), as well as by four Ecuadorian non-university partners (NCI, FORAGUA, ETAPA and Gestión Ambiental Zamora).

In research funding, the platform marks a new and advanced step of cooperation as all involved organizations are funding joint German-Ecuadorian projects for the first time in parallel and on a larger scale. The MRp|SE was inaugurated in Cuenca on 16 October 2014 based on more than 17 years of intensive research into biodiversity and ecology of the South Ecuadorian Andes. In 1997, a small

doi: 10.5678/lcrs/pak823-825.cit.1260

group of German researchers funded by the DFG began to investigate the biodiversity-rich mountain rain forests. From 2001 the first DFG Research Unit (FOR402) operated with a significantly larger consortium. A second Research Unit (FOR816) continued from 2007 to 2013. Over the years, cooperation with Ecuadorian partners has gradually been intensified including the Universidad Técnica Particular de Loja, the Universidad Nacional de Loja, the Universidad del Azuay, the Universidad de Cuenca, the Pontificia Universidad Católica de Quito, the foundation Nature and Culture International (NCI), the city enterprise of Cuenca (ETAPA EP), the regional water fund FORAGUA, and the environmental department of the city of Zamora. Two more knowledge transfer projects funded by DFG are closely linked to the platform: The program "Nuevos Bosques para Ecuador" and "Radar Net Sur" which are cooperating with the government of the province Loja (GPL) and private land owners.

Credits and Contact

DFG PAK 823-825 Research Consortium

More information about the Research Cosortium (DFG PAK) is available at:
www.tropicalmountainforest.org

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Citation

DFG Research PAK 823-825 (2014): MRp|SE Newsletter, Issue 1, Laboratory for Climatology and Remote Sensing (LCRS), University of Marburg, Marburg, Germany.
DOI: 10.5678/lcrs/pak823-825.cit.1260

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doi: 10.5678/lcrs/pak823-825.cit.1260