Tabebuia Bulletin

Platform for Biodiversity and Ecosystem Monitoring and Research in South Ecuador

formerly MRp|SE NewsLetter

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RadarNet Sur has installed the third and last weather radar of the project at Cerro Paraguillas mountain peak (4450 m a.s.l., ridge top left). This radar is the highest radar location inside the project and the highest operating weather radar worldwide. Photo: Andreas Fries

In this Issue

Coordinators' Corner

News Since November 2014

Jörg Bendix[1], Erwin Beck[2], Juan Pablo Suárez[3], Alfredo Martínez[4]

[1]Universities of Marburg and [2]Bayreuth, Germany – Coordinator and Deputy Coordinator of the DFG-PAK Research Consortium

[3]Universidad Técnica Particular de Loja, [4]University of Cuenca, Ecuador – Coordinator and Deputy Coordinator of the SENESCYT Research Consortium

The Coordinators describe why this publication has received a new name. They summarize the state of the German and the Ecuadorian Research programs, the latest developments in the knowledge transfer working group, the decisions taken at the member assembly in March as well as the inauguration of the third radar which completes the RararNet Sur.

Holding the third newsletter of our platform in your hands you may notice that we have changed its name after intensive discussions with all PAK members and the scientific advisory board to "Tabebuia Bulletin". The first agreed title "Vistazo" could not be used because it is already the name of a well known magazine in Ecuador. Thus, the scientific advisory board (SAB) decided to search for a name referring to a charismatic species which is characteristic of our research area and well known in the Neotropics (**Figure 1**). As a result, the majority of the SAB members voted for the name given to this (and the following) issue(s).

The new name of our newsletter just uncovers some internal changes (as the new editorial board) which will develop the newsletter step by step into a format more similar to a scientific publication outlet.

Figure 1: Flowering *Tabebuia chrysantha* trees are highly visible in the landscape like this one at the ECSF research station, thus leaving a lasting mark on any observer. Photo: Jörg Bendix

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State of PAK 823-825 Research Consortium

After a running time of 1.5 years most of the projects (including the administrative projects) have reached the midpoint of the program. This means that we now have to start uploading data to the central data warehouse, to publish our results, and to develop the deliverables of the knowledge transfer projects of our program. Finally, we have reached our eventual structure with 16 funded projects and two associated PIs (Peters & Wilcke), with the last pending proposal (citizenship by Bogner) again rejected by the reviewers.

Fortunately, the new accounting control system (so called “traffic light system”) could now be activated on the website after all contracts were signed and all accounts arrived in the PAK office. There is no way out from facing financial problems with the rising exchange rate of the US $, particularly in the first forwarding contract that covers the infrastructure costs. But also travelling costs (second forwarding contract) in the country are increasing so that some projects already have reached their limit and now have to apply to the SAB for additional travel funds as decided by the PAK member assembly. **Figure 2** also points to the need to apply for a follow-up program in which the format should be a Research Unit. In its last meeting, the SAB found the topic multifunctionality with regard to ecosystem services, in particular production most promising. The development of a pre-proposal on this topic should be now discussed and pursued.

State of the SENECSYT Research Program

Unfortunately, the SENESCYT (Ecuadorian National Secretariat for Higher Education, Science and Technology) funds are not yet delivered to our Ecuadorian partner universities. However, an agreement between our partner ETAPA and SENESCYT about the money transfer was contracted in the beginning of 2015. The plan is to forward the money directly from ETAPA to the new lead partner, the University of Cuenca (UC). UC’s law department has already elaborated legal procedures how to transfer the money also to our partners from the private universities Universidad Técnica Particular de Loja (UTPL) and Universidad del Azuay (UDA) in Cuenca. Despite the pending funds, the bundle partners have undertaken initial work based on the limited university funds.

Developments in the Knowledge Transfer Working Group 4

On his trip to Loja and Cuenca, the deputy coordinator Erwin Beck, also member of Working Group (WG) 4, has discussed with our non-university partner Nature and Culture International (NCI) which elements of our program are most important for a knowledge transfer to the stakeholders. Land restoration has become one of the top goals of the Ecuadorian government. The topics are nature regeneration, revegetation with natural species, establishment of corridors for joining areas with natural vegetation, and sustainable use of ecosystems, e.g. coffee plantations shaded by indigenous tree species. The respective ministries shall pay between 400 and 800 $/ha for three years for measures taken in the above listed activities. The money shall be transferred to the Juntra Parrochiales for planning the measures and supporting the land owners. The general problem is lack of knowledge of methods and protocols.

Thus, it is obvious that the objectives of subprogram B on the development of sustainable land use options has priority importance for a knowledge transfer. NCI is planning a workshop to bring actors from the ministries (agriculture and environment), the Parrochiales and scientists together to spread the knowledge and modalities about the new development plan for Ecuador. The first of these workshops shall take place still prior to the school holidays in Ecuador. Another workshop focusing on knowledge transfer to technicians and landowners shall be organized in connection with our Status Symposium in October in Loja. At the moment project B2 is preparing an instruction brochure for pasture regeneration and potentially participates

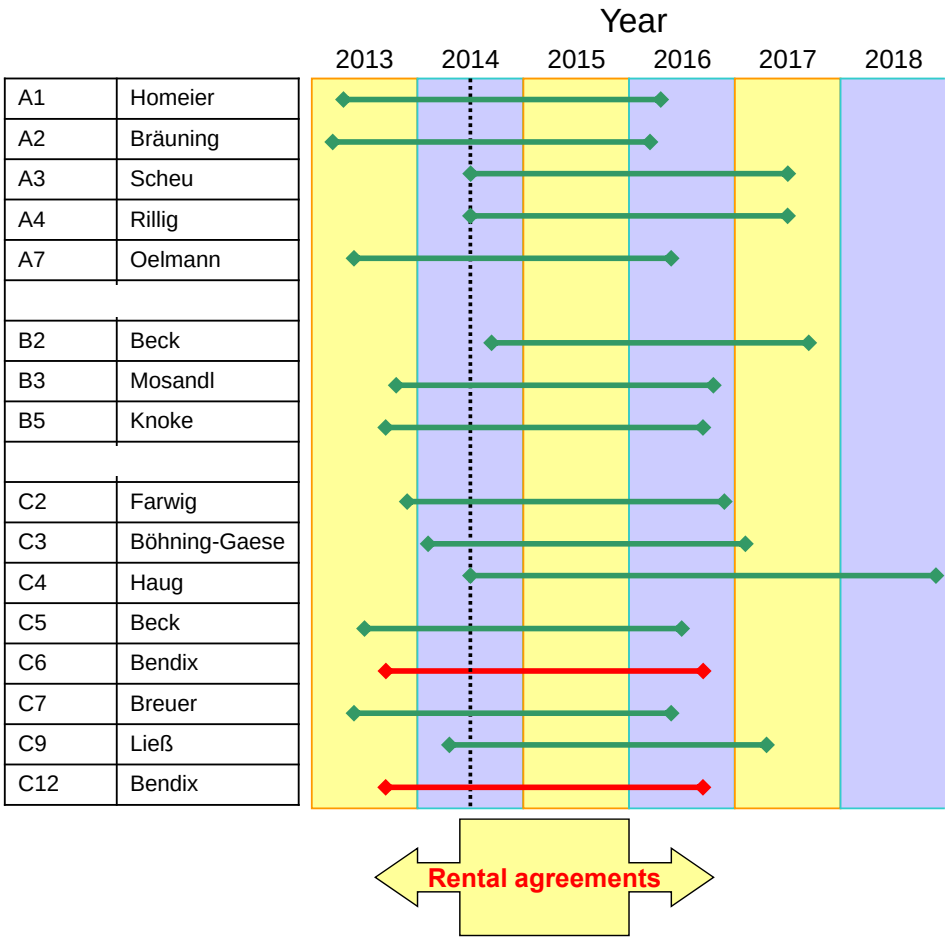

Figure 2: Final structure of PAK 823-825 Research Consortium and duration of single projects (in red projects with administrative components). Graph: Jörg Bendix

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Figure 3: Inauguration ceremony for the third radar in Cuenca with Erwin Beck (speaking) and Andreas Fries introducing the program (standing, left of Beck). The following persons honored the inauguration ceremony with their attendance: Econimista Claudio Patiño (Miembro del Directorio de ETAPA EP), Arquitecto Pablo Abad (Miembro del Directorio de ETAPA EP), Dr. Cristian Zamora (Miembro del Directorio de ETAPA EP), Ing. Iván Palacios (Gerente General ETAPA EP), Ing. Marcelo Cabrera (Alcalde Cuenca), CPA Ruth Caldas (Vicealcaldesa de Cuenca), Economista Jorge Zárate (Prefectura de Loja). Photo: Felix Matt

in the first workshop. Recently, the state of Ecuador is on the way to develop an indicator system for monitoring of biodiversity and ecosystem services and thus, also the development of indicators by our subprogram C and the projects of our Ecuadorian partners will gain increasing importance. Therefore a second workshop shall take place for knowledge transfer from our indicator prototypes; we plan this workshop also in the vicinity of our status symposium.

On that occasion we would like to remind our readers of the deadline for manuscripts for the second volume of the famous Booklet by Kiss and Bräuming, edited by Franz Xaver Bogner, Jörg Bendix and Erwin Beck. The deadline has been extended to May 31st.

Meeting at the gtö Conference in Zurich

As in the years before, the platform members were a main pillar of the annual conference of the Society for Tropical Ecology (gtö) in Zurich entitled “Resilience of Tropical Ecosystems: Future challenges and opportunities”. Starting with the member assembly on 7th April 2015, the coordinator and the deputy coordinator of PAK chaired the biggest session of that conference on “Modern methods in monitoring tropical ecosystems” with 19 talks of which five talks were contributed by PAK members. In a second session (“Tropical montane elevation transects”) jointly chaired by Jürgen Homeier (PAK member), Gregory R. Goldsmith and Yadvinder Malhi (both from the University of Oxford), results from the current PAK Research Consortium and the foregoing Research Unit RU816 explaining the altitudinal transect in the San Francisco valley were confronted and compared with the results of the “Andes Biodiversity Research Group” [1] lead by the University of Oxford, of a comparable altitudinal research transect along the eastern slopes of the Peruvian Andes around 13°S latitude. PAK and RU816 members contributed to this session with 7 out of 15 talks. PAK members were also involved in other sessions and furthermore provided a bunch of interesting presentations to the poster session. We are very proud that a member of PAK, in succession of the last gtö conference 2014 in Freising, could again win a Merian poster award. Our congratulations go to Julia Adams (**Figure 4**) for her winning poster ”Implementing the success: From abandoned sites to valuable pasture land” with coauthors Kristin Roos and Erwin Beck (their results are presented in the Science News section, page 9).

Knowledge Transfer: Inauguration of the Third Weather Radar in Cajas at Cuenca

The associated knowledge transfer project Radarnet Sur [2] proudly announces the commissioning of the third and final station of the rain radar network south Ecuador in the Cajas páramo (see Transfer News section, page 14). With this, the development of a prototype radar network is finished from the technical point of view. To improve operational use, inter-calibration and application procedures have to be developed and implemented as a next step. The political importance of the network was underlined by a formal inauguration ceremony in Cuenca where the project was represented by the deputy speaker of PAK, Erwin Beck, and the project coordinator Andreas Fries (**Figure 3**). Information on the radar network was recently posted in a video on YouTube by our partner Prefectura de Loja [3], highlighting the excellent acceptance of the project in the environment of southern Ecuador.

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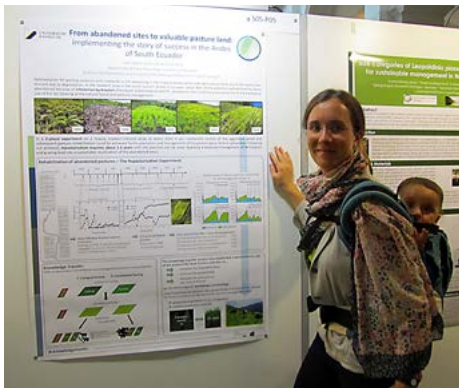

Figure 4: Julia Adams (University of Bayreuth) received the third of the three Sibylla Merian Awards for best posters at the conference of the Society of Tropical Ecology (Gesellschaft für Tropenökologie, gtö). Adams, member of the DFG-PAK Research Consortium and working on **project B2**, received the award in Zurich, Switzerland in March 2015. She is carrying her daughter Norina who also accompanies her when she is working in the field. Photo: Erwin Beck

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News from the Research Sites and from Ecuador

Landslide in the RBSF Impacts Research Plots

Felix Matt
Philipps-Universität Marburg, Germany – member of Local advisory board of the DFG-PAK Research Consortium

Figure 1: The view from the opposite slope of the Rio San Francisco Valley shows the primary landslide (red arrow 1), its way downhill (blue dashed line) and the transect Q2 (orange). The construction of the channel in Q2 broke and the water poured into the small drain channel where it caused a secondary landslide (red arrow 2) which enlarged a slide already existing. The place of the twin towers used for research are marked (green arrows). Photo: Felix Matt, modified by esw

On 26th April 2015 a landslide occurred on the eastern slope of the upper Q2 (near T2) in the research area near the ECSF research station (**Figure 1**). The material was largely blocked on its way down from the concrete construction of the aboveground running water channel (camino canal x camino Q2). The channel construction resisted only partially (**Figure 2**). Its bottom broke several meters in length, so that the water poured into the trough of water catchment (quebrada) Q2, which entailed another landslide and induced erosion. This caused a bed several meters wide and deep. The material was transported to the Rio San Francisco passing the already existing landslide at camino rio which was formerly surmounted by wooden stairs and which now is significantly larger than it was before.

Influence on Research

The installations of the cooperative project X2 (Wolfgang Wilcke et al.) in the area were totally destroyed (**Figure 2, bottom**). The electricity company EERSSA will repair the channel. Access for machinery and construction material to their research site in the tropical mountain forest of the Reserva Biológica San Francisco (RBSF) is currently being discussed with our partner Nature and Culture International (NCI) and the local coordinators.

Figure 2: View on the intact water channel (top). Debris from the landslide was blocked by the channel which finally broke (second). The water from the channel scraped a wide riverbed on its way downhill (third). It not only destroyed the main access route to the plots of project X2 but also destroyed its weirs (bottom), water gauges, rain totalisators as well as all data loggers which once were situated beneath the channel. Photos: Felix Matt (2), Andre Velescu (2).

Changes in Parcel Mails and Courier Services

Jörg Zeilinger
Philipps-Universität Marburg, Germany – member of Local advisory board of the DFG-PAK Research Consortium

As reported at the member assembly at the gtoe conference in March in Zurich, Switzerland, customs regulations in Ecuador are changing. Due to these new regulations we advise you to coordinate with local board members well in advance before sending parcels with scientific equipment via parcel mails or courier services. Otherwise the complete loss of your parcel is even possible.

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Science News

Comparing Two Tropical Montane Elevation Transects

Jürgen Homeier[1] and Jörg Bendix[2]
[1] Universities of Göttingen and [2]Marburg, Germany – members of the DFG-PAK Research Consortium

At the conference of the Society for Tropical Ecology (gtö) in Zurich in March a symposium on tropical elevation transects was organized by Gregory Goldsmith (Paul Scherrer Institute, CH), Jürgen Homeier and Yadvinder Malhi (University of Oxford, UK) to explore and contrast results from two well-studied Andean elevation transects: our study area in the Southeast of Ecuador (7 talks) and a transect in the Southeast of Peru (6 talks). The oral session was completed by two talks from other sites (Papua New Guinea and Philippines).

The major aim of the session was a comparison of the effects of changing environments on forest structure and ecology along the two Andean transects. Both transects are located on the eastern slopes of the Andes covering an altitudinal range between 3.3 km a.s.l. and the foothills in the western Amazon (**Figure 1**). The Ecuadorian transect is characterized by a greater complexity of topography and is located in the region of the Andean depression where the Andes hardly exceed 3.6 km a.s.l. of altitude. In contrary, the Peruvian transect is situated in an area were the Andes are well developed, blocking airstreams from the Pacific due to altitudes partly exceeding 5 km a.s.l. in peak areas (**Figure 1, right**).

Presented data from the Ecuadorian transect relied on all research programs, FOR402, FOR816 and DFG-PAK823-825. The results from the Peru transect were mainly gained by the Andes Biodiversity and Ecosystem Research Group [1].

Comparing the presented results we saw that environmental settings (climate, soils) and ecosystem responses are partly different, although both transects are located on the eastern slope of the Andes. This leads to the conclusion that still more effort is needed to derive general patterns on the responses of tropical forests to environmental drivers, and how these responses may be altered in the future.

Temperature has long been recognized as a main driver of changing forest structure and species composition with elevation. That makes tropical mountains ideal systems to explore the effects of temperature on ecosystem processes, especially in the view of global warming. Facing the projected increase of temperature in tropical montane forests, it is of urgent need to identify knowledge gaps and research priorities for these ecosystems. A synthesis of the existing knowledge is essential to define key indicator parameters and standardized protocols for a better understanding of tropical montane elevation gradients.

Reference

[1] Andes Biodiversity and Ecosystem Research Group: www.andesconservation.org

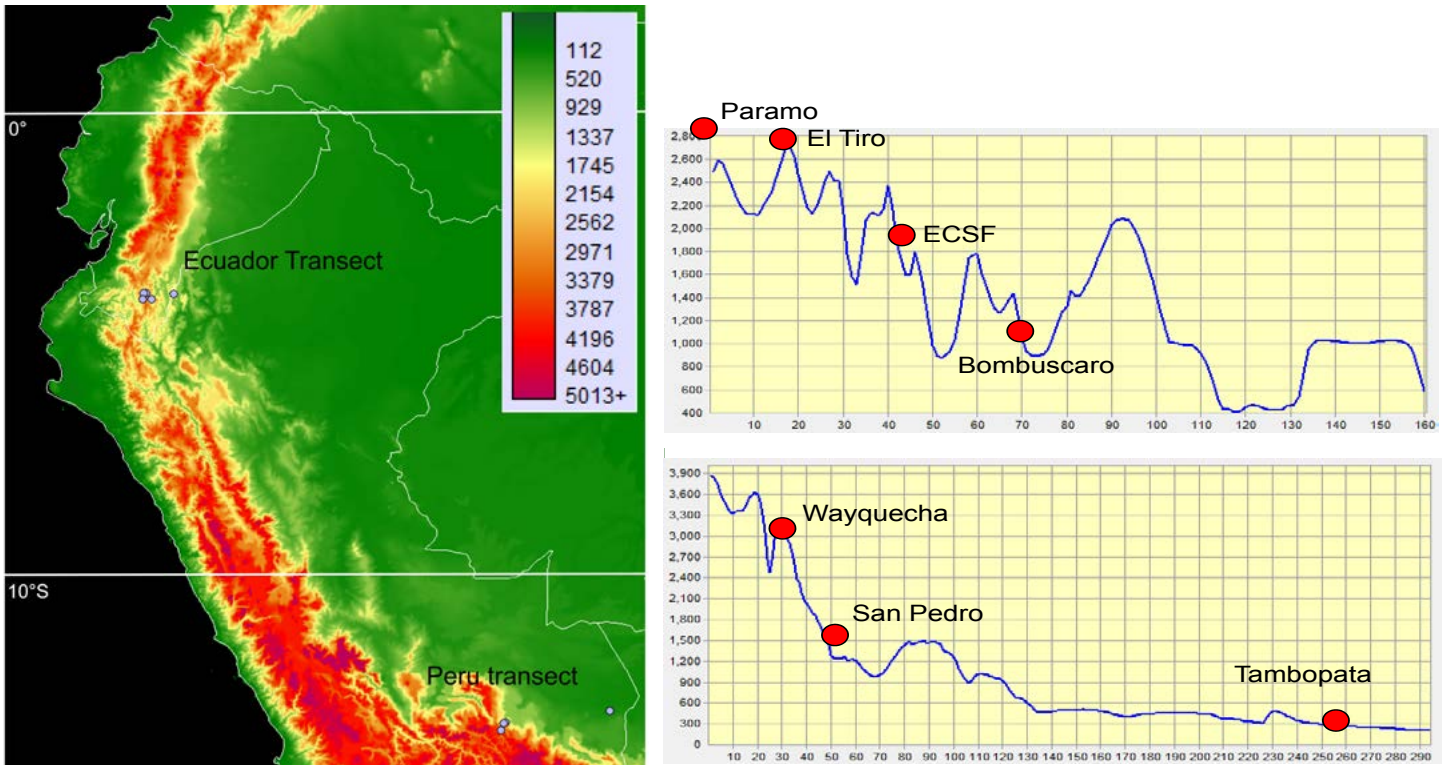

Figure 1: Location, elevation (left), and elevation profiles (right) of the two compared transects in Ecuador (top) and in Peru (bottom). ECSF = Estación Científica San Francisco. Graphics: Jörg Bendix

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Litter Mixture Effects on Microarthropod Colonization and Microbial Biomass in the Litter Layer of a Tropical Montane Rain Forests in Southern Ecuador

Laura M. Sánchez Galindo, Olaf Butenschön, Franca Marian, Dorothee Sandmann, Valentyna Krashevska, Mark Maraun, Stefan Scheu
Georg August University Göttingen, Germany –– members of the DFG-PAK Research Consortium

We investigated the effects of leaf litter mixtures on microarthropod colonization, microbial biomass and activity, since it is not clear whether the effect of litter mixture on nutrient mineralization is additive, non-additive or idiosyncratic. We show first results that decomposer communities in the litter layer are influenced by the leaf litter type.

Since is not clear how leaf litter mixtures affect the decomposition process members of **project A3** carried out a litterbag study to investigate its effect on microarthropod colonization, microbial biomass and activity in a tropical montane rain forest in southern Ecuador.

Methods

We collected freshly fallen leaves from four dominant tree species in the area of the Reserva Biológica San Francisco at 2000 m a.s.l. (**Figure 1**). Eleven Litterbags were filled with each individual litter species and all possible two and four leaf litter combinations. A randomize block design was employed using four blocks. Three replicates of each litterbag were randomly assigned to each block, resulting in a total number of 132 experimental litterbags. Subsequently, they were placed on the soil surface, and one replicate was harvested after 6, 12 and 24 months, respectively. Microbial biomass and activity in the litter were measured, and oribatid mites were determined to species level.

Results

The relationship between the oribatid mite communities and environmental factors was analyzed using a redundancy analysis (RDA) (**Figure 2**). The results suggest that resource limitation favors sexual reproduction to exploit the existing resources more efficiently. On the other hand, a high amount of resources favors parthenogenetic reproduction, which allows faster resource exploitation.

We then performed a non-metric multidimensional scaling (NMDS) followed by MANOVA using the same dataset as above. We found that the community structure of oribatid mites was affected by the presence of *C. andina*, a litter species with high content of nitrogen. We conclude that the community structure was affected by the quality of the litter and not by its diversity.

Regarding to the microbial biomass and activity, we found that when *G. emarginata* was present both strongly differed in the

Figure 1: Leaf litter species: *Graffenrieda emarginata*, *Cecropia andina*, *Clusia* spp., and *Myrcia* sp. nov. (clockwise starting top left). Photos: Laura M. Sánchez Galindo

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single litter and diverse litter treatments after 12 months (**Figure 3**). This indicates that not all litter types provide sufficient amounts of nutrients for microbial growth. Furthermore, not all decomposer communities were affected by the presence of the same litter type.

Conclusion

Taken together, our results indicate that decomposer communities in the litter layer were influenced by leaf litter type and not by the amount of different leaves present in the litterbags.

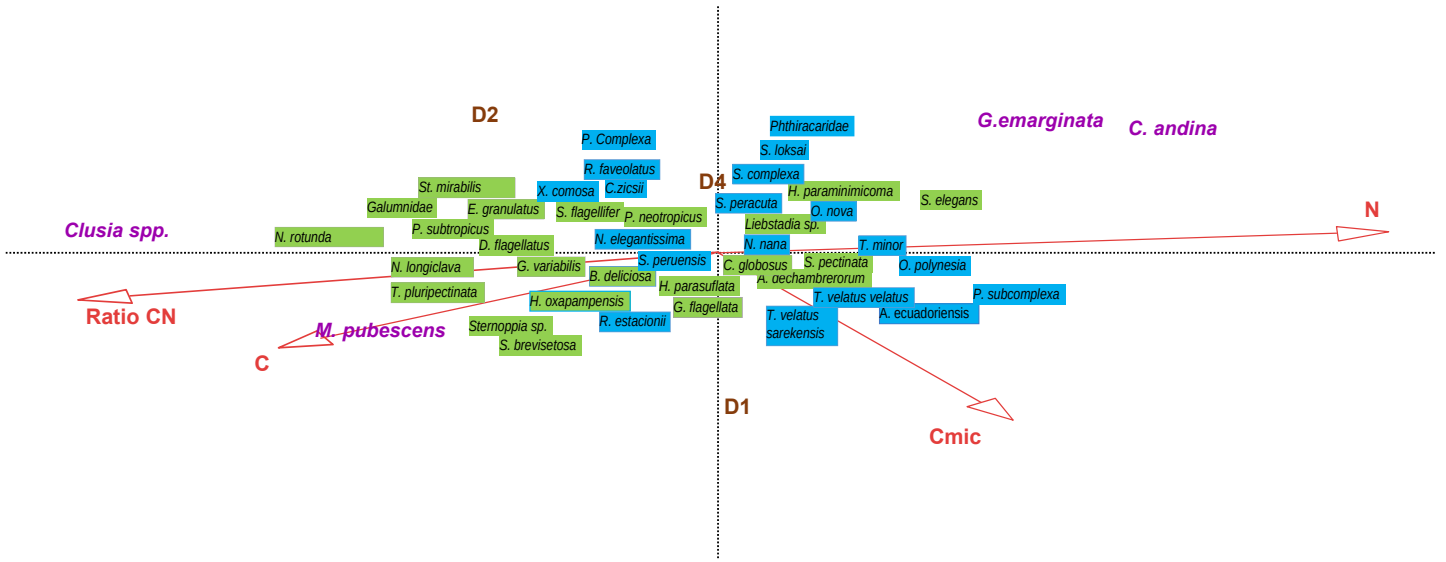

Figure 2: Redundancy analysis for oribatid community structure. Environmental factors: nitrogen (N), carbon (C), microbial carbon (Cmic) and C/N ratios. Sexual oribatid species (green boxes), which are often fungal feeders, clustered with the litter with high concentration of carbon, as well as high C/N ratios. Parthenogenetic species (blue boxes), which are often primary decomposers, clustered with litter with high concentration of nitrogen. Graph: Laura M. Sánchez Galindo

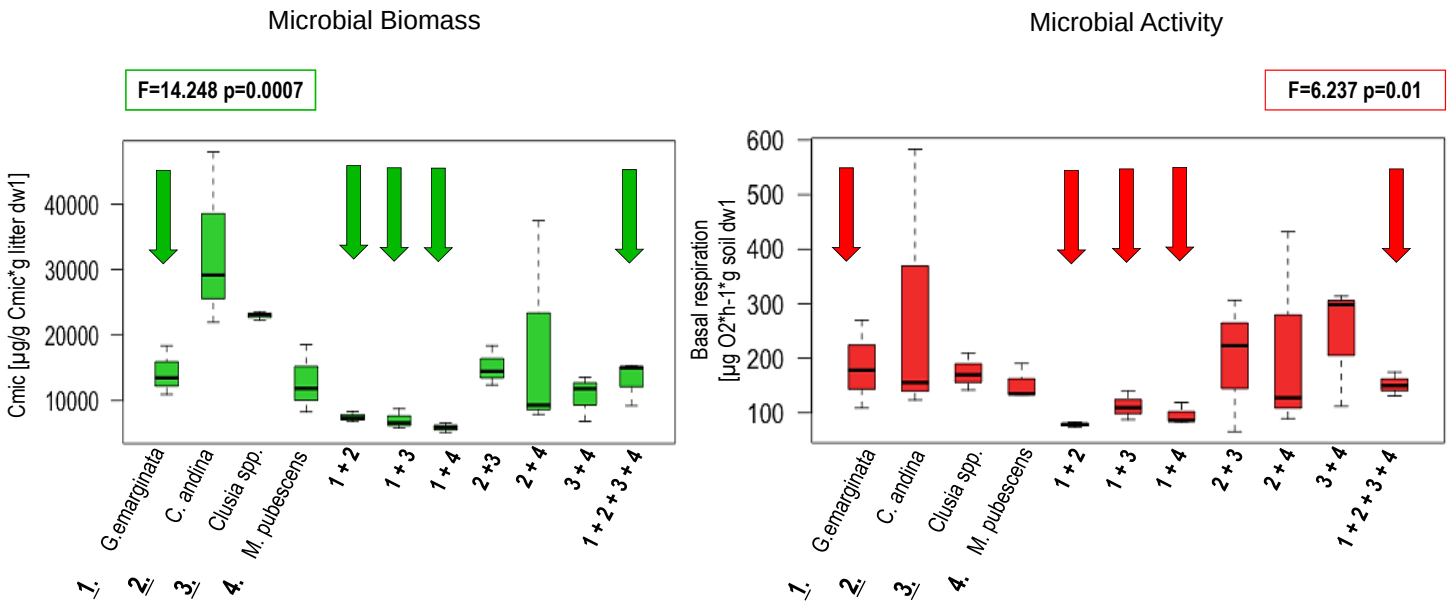

Figure 3: Analysis of the effect of litter type on microbial biomass (left) and activity (right) after 12 months by ANOVA. A significant decrease in microbial carbon and basal respiration was found only when G. emarginata was present (arrows). This suggests that the major decomposition processes of this litter type carried out by microorganisms took place within the first six months of the experiment. Graph: Laura M. Sánchez Galindo

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Altitude and Nutrient Addition Effects on Bioavailable Phosphorus Concentrations in Soils in a Montane Rain Forest in South Ecuador

Karla Dietrich, Emmanuel Münch, Yvonne Oelmann
University of Tuebingen, Germany – members of the DFG-PAK Research Consortium

Our results show that nutrient application in the framework of the nutrient manipulation experiment (NUMEX) resulted in increased bioavailable phosphorus (P) concentrations mainly in the organic layer and if P only was added.

In tropical rainforests, biogeochemical cycles are affected by increasing atmospheric input of nitrogen (N) [1]. Members of **project A7** tested the effect of (i) altitude, and (ii) moderate nutrient addition (N, P, N+P) on bioavailable P concentrations in two organic layers (Oe, Oa), and in mineral soil (A). The NUMEX experiment comprises three altitudes (1000 m, 2000 m, and 3000 m a.s.l.) and at each altitude, three treatments (P addition equivalent to 10 kg P ha^{-1} yr^{-1}, N addition equivalent to 50 kg N ha^{-1} yr^{-1}, and a combination of N and P addition, respectively) as well as non-fertilized control plots. In October 2014, after seven years of fertilization we sampled the organic layer and the mineral soil in triplicates per plot combined to a composite sample resulting in n = 4 per treatment at each altitude. We assessed bioavailable P concentrations by extraction with Bray-1 solution [2] and subsequent photometric determination by means of a continuous flow analyzer.

Bioavailable P concentrations of the control plots were highest in the upper organic horizon (Oe) at 2000 m a.s.l. (**Figure 1**, same pattern for lower organic horizon Oa; no difference among altitudes for the mineral soil (A); data not shown). This can be explained by P deficiency at high altitudes [3] which goes along with decreasing mineralization rates [4]. Whereas at the lowest site, nutrient uptake is increased due to better growth conditions [3]. Nitrogen addition did not influence bioavailable P concentrations (**Figure 2**, same pattern for Oa and A, data not shown). As could be expected, P addition significantly increased bioavailable P amounts in the Oe horizon, most pronounced at 2000 m and 3000 m (**Figure 2**, same pattern for Oa; no treatment effects for A, data not shown). The rapid decomposition and plant uptake of additional nutrients at 1000 m obscures the detection of effects. Even though higher elevations provide less favorable conditions for mineralization and plant growth, our results indicate that organisms' benefit of additional nutrient input might be limited by other factors than N and P supply.

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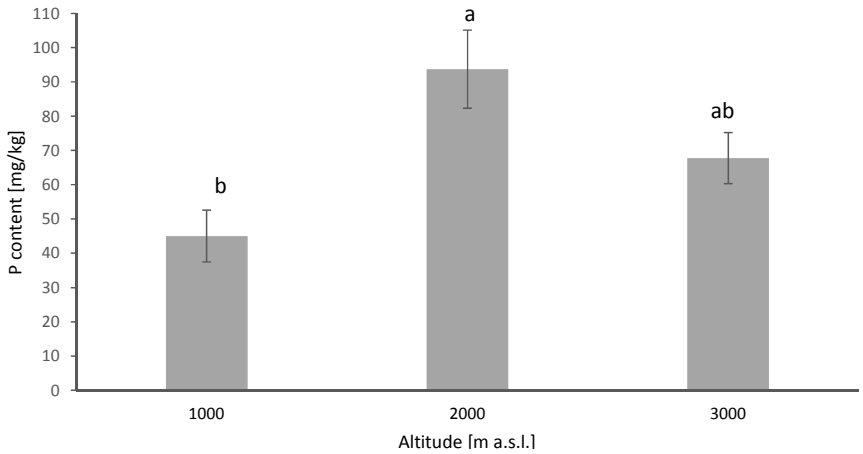

Figure 1: Bioavailable P concentrations in the Oe horizon of control plots at the three altitudes. Error bars indicate plus and minus one standard error. Different lower-case letters indicate significant differences in P concentrations among altitudes. Graph: Emmanuel Münch

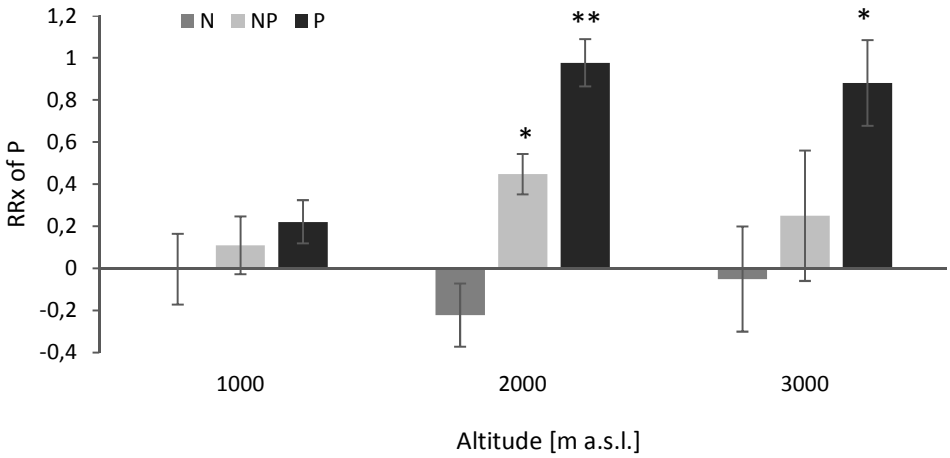

Figure 2: Effects of experimental nutrient addition on bioavailable P concentrations in the Oe horizon at three altitudes. Effects are expressed as natural-log response ratios (RRx; treatment value is divided by the value of the control plot). Positive RRx values indicate an increased P concentration whereas negative values indicate a decreased P concentration as compared to the respective control plot. Error bars indicate plus and minus one standard error. Asterisks depict mean RRx significantly deviating from zero (* $p \leq 0.05$, ** $p \leq 0.01$). Graph: Emmanuel Münch

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From Abandoned Sites to Valuable Pasture Land: Spreading the Story of Success

Julia Adams, Kristin Roos, Erwin Beck
University of Bayreuth, Germany – members of the DFG-PAK Research Consortium

Since 2005 various bracken control strategies, productivity of the pasture grass *Setaria sphacelata* and the effect of adapted management strategies with variations of the fertilization and grazing intensity were monitored at our study and demonstration site "Llashipa". Based on our long lasting experience we created a protocol that is now, in the current transfer phase of the project, passed on to local farmers in terms of management recommendations.

The Problem

Deforestation for gaining pastures and croplands is still advancing in the tropical Andes while vast agricultural areas are at the same time disused due to degradation. In the research area in the south-eastern Andes of Ecuador about 40 % of the potential pastureland has been abandoned because of infestation by bracken (*Pteridium* spp.). This rhizomatous plant is one of the most aggressive weeds worldwide. Infestation by bracken fern and shrubs is a consequence of the traditional use of fire for clearing of the natural forest and pasture management. Growth of both, bracken and woody weeds, is even fostered by recurrent burning. Although eradication of bracken has been reported as almost impossible, we nevertheless were able to demonstrate in our repasturisation experiment extending over ten years that rehabilitation of sites which were completely covered by bracken is possible (**Figure 1**).

Methods and Procedures

On our study site "Llashipa" located at 2000 m a.s.l. we applied a three-step strategy in **project B2** consisting of

1. combating bracken by intensive mechanical or chemical treatment followed by
2. replanting a highly competitive pasture grass [1] and
3. the application of an adapted pasture management.

In the first step, the efficacy of 13 bracken control treatments was examined. Two of the measures proved to be successful, namely periodical cutting of the weed with a machete or repeated spraying of the locally available herbicide "Combo" (a mixture of metsulfuron methyl and picloram). In the second step, the commonly used pasture grass *Setaria sphacelata* was planted which by its fast and ample growth could compete against the fern. Following our protocol, repasturisation requires about 2.5 years until the pastures can be used. After this two-step treatment of the abandoned areas an experiment was started simulating pasture farming with low financial input or, alternatively with intense management. Our results reveal that a balanced management of fertilization and grazing can lead into a sustainable reutilization of the abandoned areas.

Since 2014, we investigate the effects of a longer fallow period in order to examine the sustainability of our repasturisation protocol. Furthermore we are currently investigating the secondary compounds of the pasture grass *Setaria sphacelata*, to precise our management recommendations. Although this commonly used pasture grass exhibits a number of advantages (high competitive strength, adaptable to a wide range of soils, frost and water logging tolerant etc.), and can therefore compete well with the bracken fern, it also shows a serious disadvantage. The high levels of

Figure 1: The photographic series shows the development of the experimental area "Llashipa" since 2005. In 2008, the pasture grass *Setaria sphacelata* was planted on the former bracken infested site. Since 2010 various management strategies were examined. The first photo from 2015 illustrates the situation after the fallow year and the second the situation after the resumption of the management strategies. Figure: Julia Adams

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Figure 2: An impression of the greenhouse experiment at the Universidad Técnica Particular de Loja (UTPL). The experiment is carried out in order to analyze the secondary components of *Setaria sphacelata* to refine our management protocol. Photo: Julia Adams.

soluble oxalate can cause a serious animal disease (like milk fever – Hypocalcaemia, lameness). Thus for an optimization of the pasture management we started a greenhouse experiment in collaboration with the group of Juan Ignacio Burneo at the Universidad Técnica Particular de Loja (UTPL, **Figure 2**). The results obtained will continue to lead to an adjustment of the protocol.

Transfer and Adjustment of Recommendations

In the current phase of the transfer project, our recommendations for the management procedure shall be scaled-up to farm level and the altitudinal range of repasturisation shall be extended from 1000 m to 2400 m altitude. To that end local farmers are instructed and trained directly in the management process. Additionally a workshop is planned for better implementation and a possible financial assistance where politicians as well as farmers have the opportunity to present their expectations and contributions to the transfer project. For though our protocol already achieves very good results, it is essential to include the local conditions on the test farms (e.g. soil, climate etc.) as well as the demands of the local population into the management plan. Finally we aim to present an adapted management plan to the local population, in order to revitalize the degraded land and thus to alleviate the pressure on the natural forests.

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Image Textures as a Surrogate for Functional Biodiversity: the Case of Tree Diversity

Christine Wallis[1], Yvonne Tiede[1], Jürgen Homeier[2], Birgit Ziegenhagen[1], Roland Brandl[1], Nina Farwig[1], Jörg Bendix[1]
[1]Philipps-University Marburg, Germany – Members of the DFG-PAK Research Consortium
[2]Georg-August-Universität Göttingen, Germany – Member of the DFG-PAK Research Consortium

We studied the potential of remotely sensed image textures in modeling different measures of tree diversity: Shannon, phylodiversity and community. Our results suggest that phylodiversity is more related to remotely sensed metrics than Shannon. Best predictions were found for the community level.

Mountain rainforest ecosystems of southern Ecuador enclose different kinds of forest habitats along elevation and land use gradients. In this study (**project C2**) we investigated remotely sensed metrics as a surrogate for the mountain forest habitat structure to model tree diversity at a landscape scale. We assessed a high-dimensional dataset of 100 image textures derived from Sigtierras high-resolution orthoimages [1] to predict field data on tree diversity. We used three diversity measures: Shannon index for species diversity, phylogenetic diversity to relate to functional diversity, and tree community to account for the compositional complementary among study sites. To overcome high-dimensionality of predictors we chose partial least squares regressions (PLSR). Our results showed significant high predictions for the tree community (**Figure 1**) supporting similar patterns in bird diversity models where bird communities were best predicted by remote sensing [2, 3]. Meanwhile, we found low predictions for the Shannon index explaining approx. 17 % of variance in species diversity and slightly higher R^2 values for phylodiversity (up to 22 % variance).

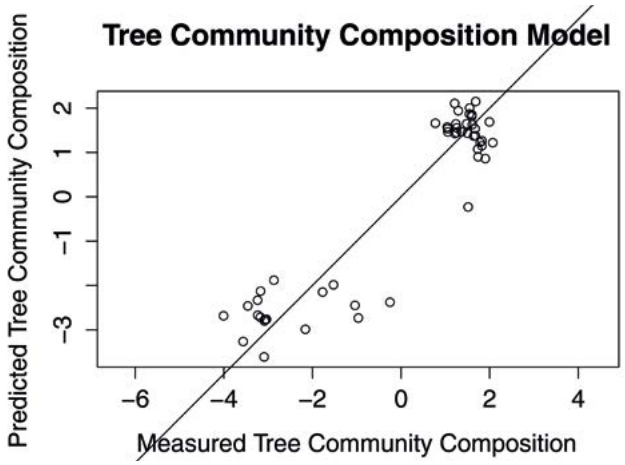

Figure 1: Partial least squares regressions model for tree community composition. Validated R^2 = 0.9; n = 49. Graph: Christine Wallis

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Background: What are Image Textures?

Image textural approaches incorporate the recalculation of each pixel of optical remote sensing data – either raw bands or indices – by assessing first-order or second-order occurrence statistics within a specified neighborhood [4]. The neighborhood is defined by a moving or fixed window and relates to the scale of species' environment. Thus, textural metrics explain different aspects of habitat heterogeneity.

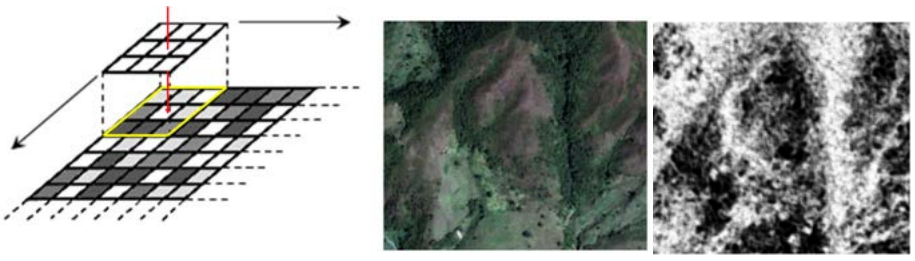

Figure 2 (left): Image textural approach: Recalculation of the centered pixel (red arrow) within a defined neighborhood in a 3 * 3 pixel window (yellow area). Black arrows define the movement in two directions; textures will be calculated for each shift. True-color image of a pasture and forest sites (**middle**) and a texture image (**right**) where the entropy of the near-infrared band was calculated within a 10 * 10 pixel moving window. Light areas define high heterogeneity and dark areas more homogeneous regions. Graph (left): Jörg Bendix; (middle and right): Christine Wallis

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Increased Nitrogen and Phosphorus Availability Stimulates the Mineralization of Dissolved Organic Matter in the Tropical Montane Forest of South Ecuador

Andre Velescu and Wolfgang Wilcke
Karlsruhe Institute of Technology, Germany – cooperating members of the DFG-PAK Research Consortium

We studied the response of dissolved organic matter (DOM) to moderate nutrient additions and observed that availability of phosphorus (P) is essential for the mineralization of DOM in the organic layer. Added nitrogen (N) can be efficiently used by the microbial community only if phosphorous availability is improved.

The tropical montane forest on the Amazonian exposed slopes of the southern Ecuadorian Andes has experienced a strong increase in N deposition during the past 15 years, which is mainly attributed to biomass burning resulting from the conversion of natural forests to agricultural land in the Amazonian Basin [1]. At the same time, increasingly unevenly distributed rainfall has allowed for longer dry spells in the study area, thus leading to a reduction of the water content in the organic layer [2]. This likely favors mineralization of DOM by microorganisms and hence increases nutrient release from the organic layer.

Figure 1: Arthur Broadbent filters freshly collected samples in our laboratory at the San Francisco Research Station (ECSF). Photo: Andre Velescu

Methods

To understand the response of the ecosystem to increased nutrient input, **project A6** of the preceding Research Unit has been sampling all relevant solutions of the water cycle since 2007, as part of the interdisciplinary nutrient manipulation experiment (NUMEX, **Figure 1**). Since 2008, we have applied 50 kg ha^{-1} a^{-1} of N, 10 kg ha^{-1} a^{-1} of P, 50 kg + 10 kg ha^{-1} a^{-1} of N and P in a fourfold replicated block design in the Reserva Biológica San Francisco at 2000 m a.s.l. In the cooperating **project X2** of the current Research Consortium we tested the hypothesis that DOM concentrations in litter leachate would decrease in response to N additions, either because of soil acidification or because of an increased mineralization resulting from the stimulation of the microbial activity.

Results

After seven years, we found no acidification of the NUMEX plots. In the litter leachate of the unfertilized control plots, mean concentrations of total organic carbon (TOC) and dissolved organic nitrogen (DON) showed high seasonal variability but no temporal trends, while they decreased significantly in the P and NP treatments (**Figure 2**, next page). Interestingly, they showed no reaction if N alone was added. At constant pH values, we conclude that increased N availability stimulates the mineralization of DOM only if P is also added, which means that availability of P plays a key role in the mineralization of DOM in the organic layer.

We also observed a much higher nitrate leaching after 2010 in the plots with separate N additions, but less leaching in the combined NP treatment (**Figure 3**, next page). N seems to accumulate at the beginning of the experiment and later it is increasingly leached as nitrate. This further supports our view that added N can be efficiently used by the microbial community only if P availability is simultaneously improved. We consider this a strong indication that the microbial activity is co-limited by N and P.

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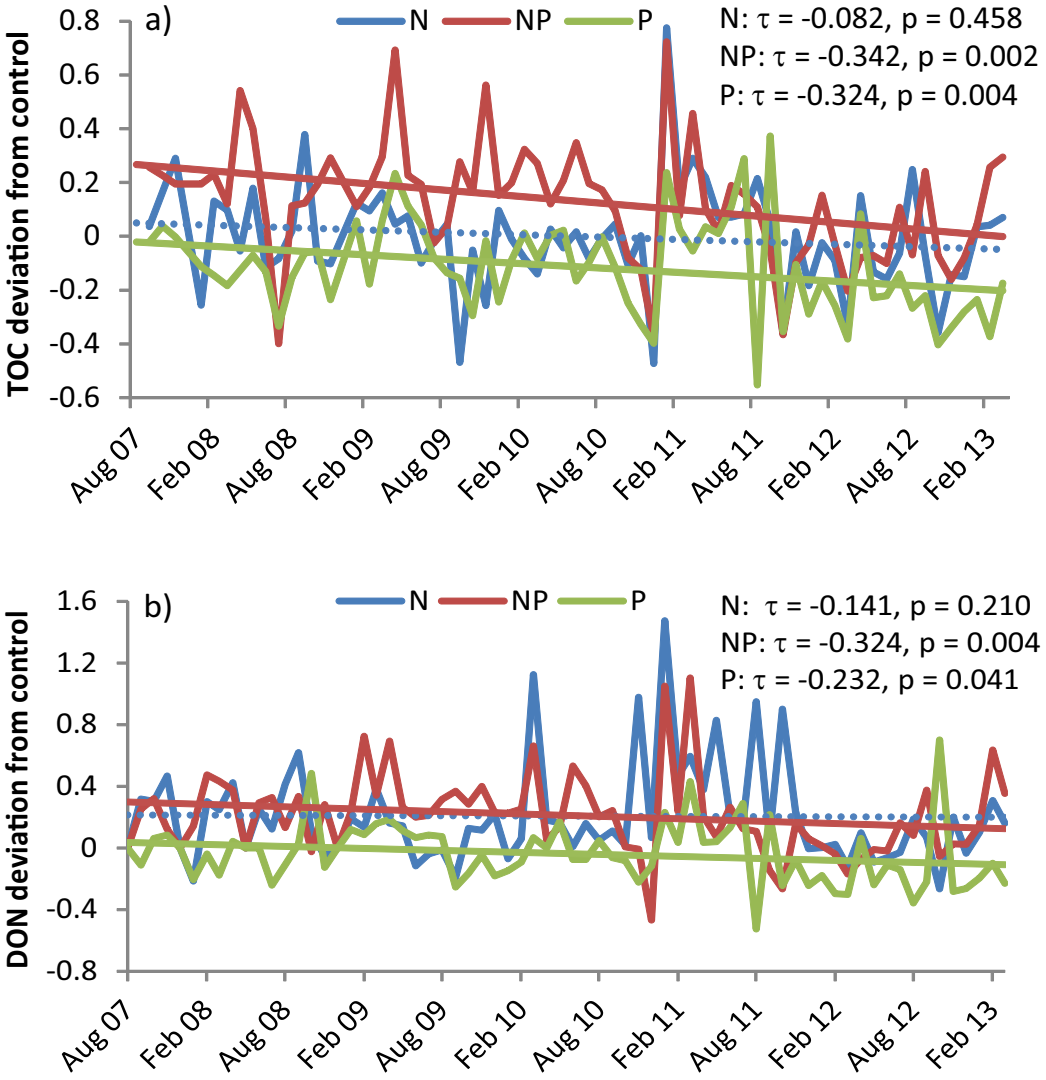

Figure 2: Differences in **(a)** total organic carbon (TOC) and **(b)** dissolved organic nitrogen (DON) concentrations in litter leachate between the respective treatment and the control plots of the NUtrient Manipulation EXperiment (NUMEX). Trends were tested using the seasonal Mann-Kendall-Test. Graphs: Andre Velescu

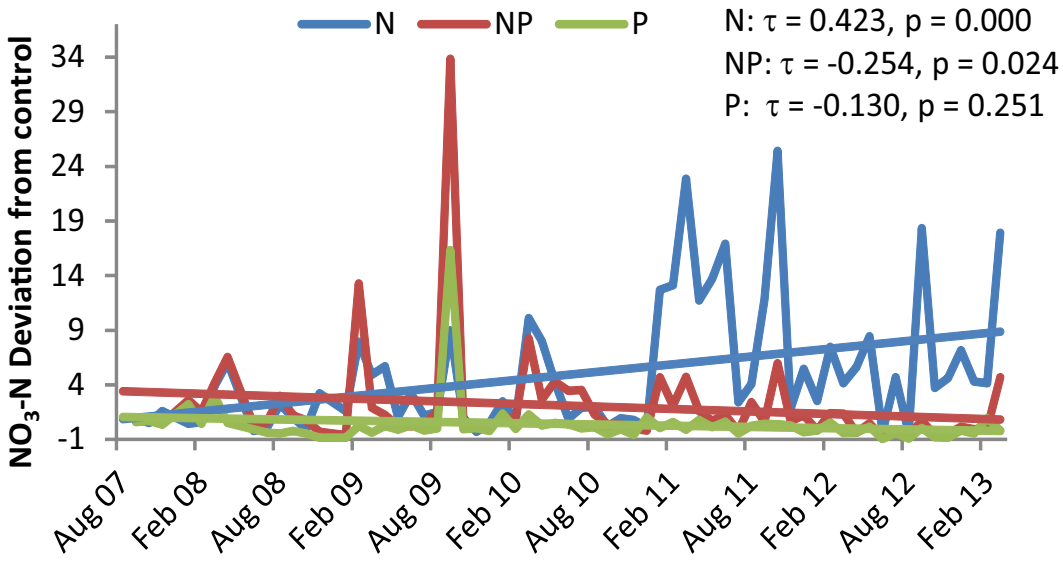

Figure 3: Differences in nitrate (NO_3-N) fluxes with litter leachate between the respective treatment and the control plots of NUMEX. Trends were tested using the seasonal Mann-Kendall-Test. Graphs: Andre Velescu

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Transfer News

RadarNet Sur is Operating

Andreas Fries and Jörg Bendix
University of Marburg – members of the DFG funded Transfer Research Project

RadarNet Sur has installed the third and last weather radar of the project at the Cerro Paraguillas mountain peak (4450 m a.s.l.; radar CAXX) in the Ecuadorian province of Azuay, canton Cuenca. The CAXX radar is the highest radar location inside the project and the highest weather radar operating worldwide. The Transfer Projekt (BE 1780/31-1) entitled "Operational rainfall monitoring in southern Ecuador" is funded by the German Research Foundation (DFG) in cooperation with Gobierno Provincial de Loja (GPL), Universidad Técnica Particular de Loja (UTPL) and Empresa de Telecomunicaciones, Agua Potable y Alcantarillado de Cuenca (ETAPA).

With the installation of the third weather radar in the South of Ecuador, the planned radar network is operating. The "RadarNet Sur" radar network covers almost completely five provinces in South Ecuador (Azuay, Cañar, El Oro, Loja and Zamora-Chinchipe; **Figure 1**). Now, it is possible to detect the distribution and intensity of the rainfall in real time and generate high resolution precipitation maps for the whole region. The network consists of two different X-band weather radar types (wavelength: 9.4 GHz), operated by the local partners.

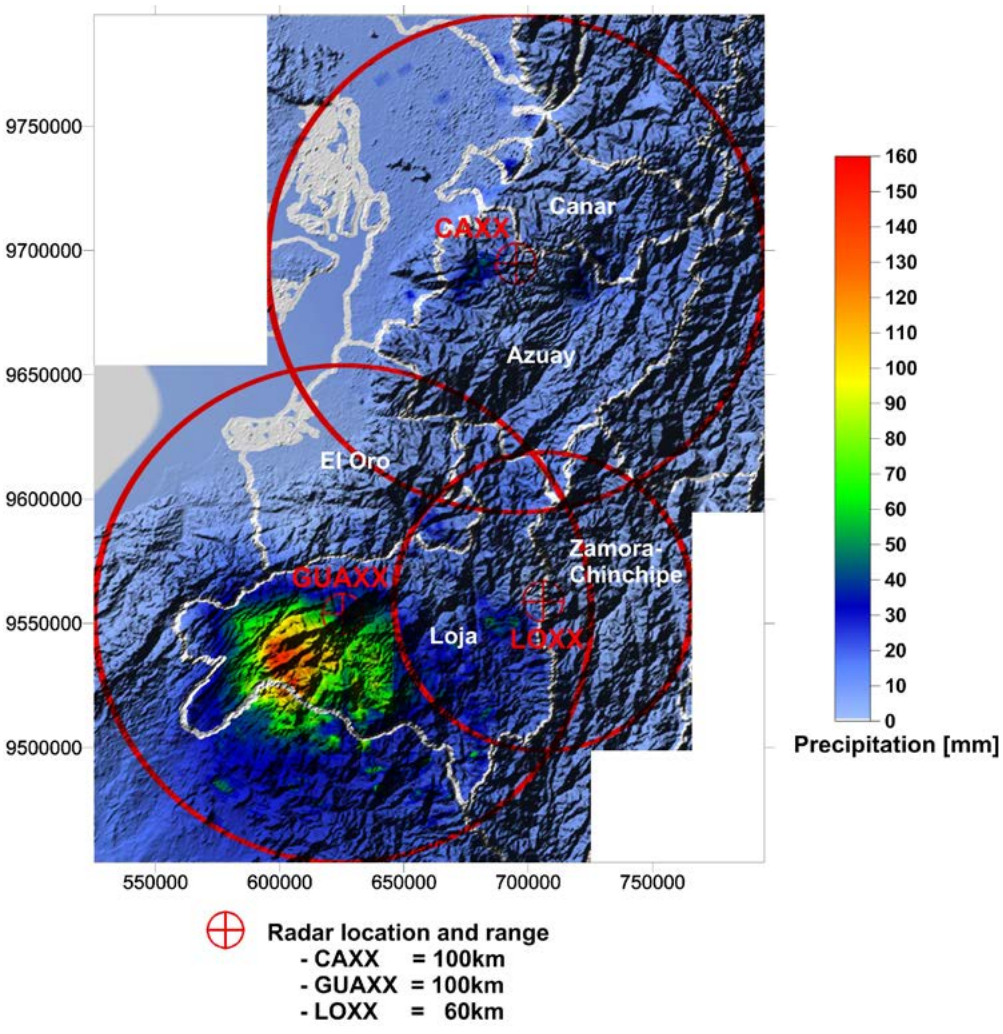

Figure 1: Quantitative precipitation maps of the three radars CAXX, GUAXX and LOXX on the 25th of March 2015. Graph: Andreas Fries

The radar LOXX from DHI (Dansk Hydrolosk Institut) is a Local Area Weather Radar (LAWR), installed at the Cerro El Tiro mountain peak (2800 m a.s.l.) and operated by the UTPL since April 2013. The LOXX generates automatically three images every five minutes with different resolutions (500 m, 250 m and 100 m) and ranges (60 km, 30 km and 15 km).

The radar GUAXX from SELEX-Gematronic is a "RainScanner120" (RS120), installed at the Cerro Guachaurco mountain peak (3100 m a.s.l.) and operated by the GPL since April 2014. The RS120 is programmed to store three images every five minutes, too, with different resolutions (500 m, 250 m and 100 m) and ranges (100 km, 60 km and 20 km).

In March 2015 the CAXX-radar, also a RS120 from SELEX-Gematronic, was installed at the Cerro Paraguillas mountain peak (4450 m a.s.l.; **Figure 2**) and is operated by ETAPA. The radar inauguration took place in the city of Cuenca the 25th March 2015, where the mayor of Cuenca officially started the radar (**Figure 3**). Several media reported about the inauguration.

Real Time Transmission and Public Images

The 5-minute images of all three radars are real time transmitted to a server inside the GPL, where they are uploaded to the project website [1] and provide images for the public. The public images show the

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Figure 2: Radar CAXX at the Cerro Paraguillas (4450 m a.s.l.). During the next month the radar will be calibrated by means of data from two disdrometers, installed in the National Park Cajas and in the city of Cuenca. Photo: Andreas Fries

rainfall intensity and its distribution over the last three hours in the south of Ecuador. For more details about the technical radar specifications and parameters, please refer to the MRp|SE Newsletter [2].

To generate quantitative precipitation maps, the individual radar images has to be calibrated by mean of rain gauge data at surface. In order to access the totality of the existing surface data for the generation of realistic precipitation maps, a convention between "RadarNet-Sur" and INAMHI (Instituto Nacional de Meteorología y Hidrología), the Ecuadorian Weather service, and GPZ (Gobierno Provincial de Zamora-Chinchipe) was signed on 23rd April 2015. On one hand INAMHI and GPZ will make accessible all their meteorological station data for radar image calibration; on the other hand the project will provide the corrected and calibrated radar images to INAMHI for weather forecasting to improve the regional early warning systems; the GPZ, supported by the German Research Consortium, use the precipitation maps for agricultural, climatic, ecological and hydrological applications. An example for a calibrated quantitative precipitation map based on the radar images for the whole region is given in **Figure 1**.

Figure 3: Inauguration of the CAXX radar. Photo: Felix Matt

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Data Warehouse News

Data Quality and Usability

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

Use of the Data Warehouse has continued on a high level, although some potential for improvements has been identified by the Data Warehouse team. Publications from all members of the DFG-PAK Research Consortium are up to date, but the publication of data sets has lagged behind this development. Consequently, improvements to the user interface and the upload procedure are proposed and will soon be implemented. The integration of real-time data transfer from Ecuadorian climate stations has been postponed, because the existing measurement infrastructure needs to be updated first. Those activities and further data ware house workshops will take place from June to October 2015.

Publication and Data Upload

The "library" of the Research Consortium has constantly grown: In 2014 more than 30 new publications were added and 2015 has already seen seven new contributions until March. With regard to newly obtained data sets, 39 attributes and 19 new data sets have been added. In 2015, this pace has slowed down a bit, with four attributes in two new data sets have been uploaded. The Data Warehouse manager took the opportunity of the last member assembly at the Congress of the Society for Tropical Ecology (gtö) in Zürich, to conduct a small opinion poll and the results indicate the necessity of some improvements. First, concerns about the correct use of data sets

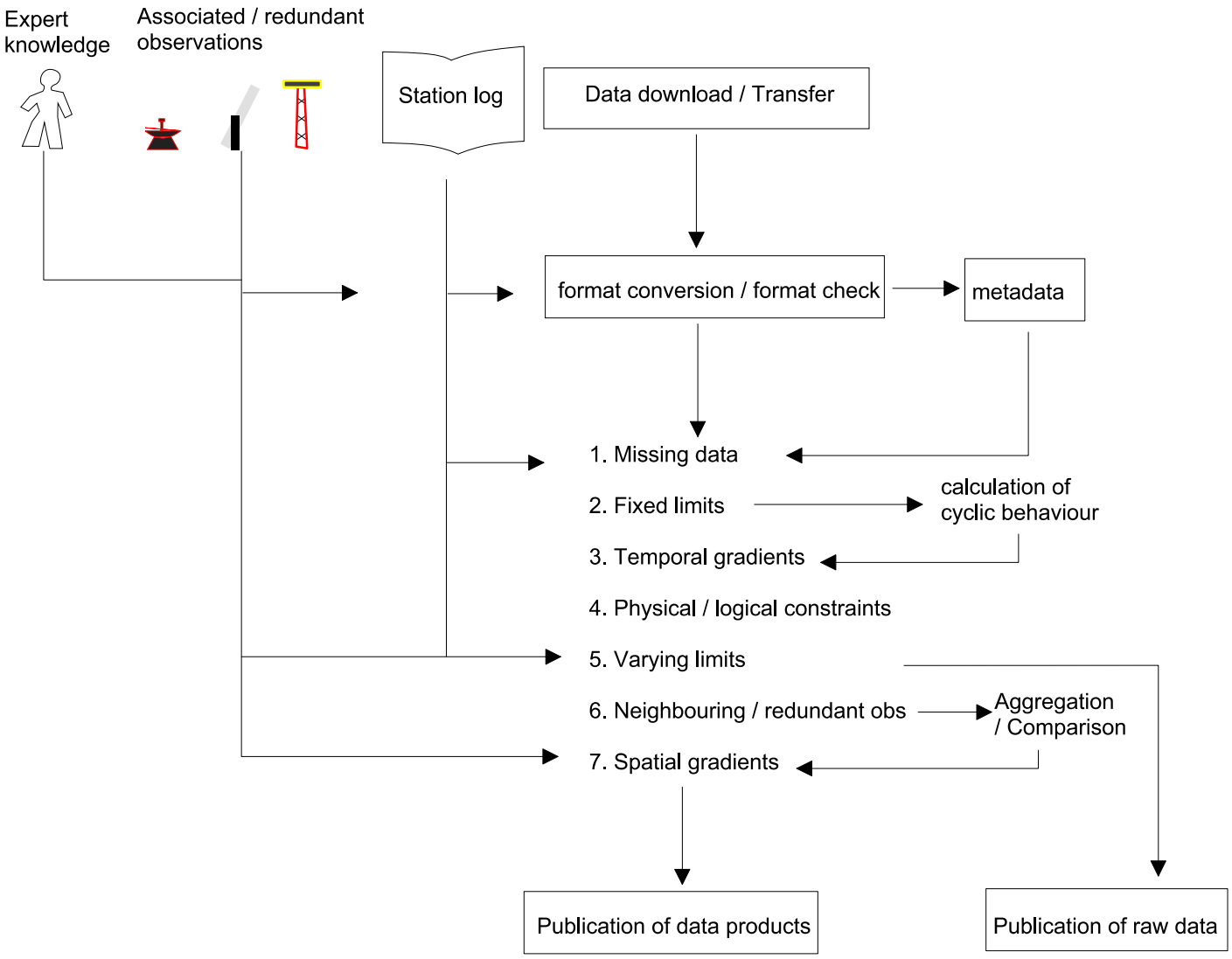

Figure 1: Processing scheme to detect erroneous observations in time series data. Graph: Rütger Rollenbeck

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have to be addressed. It turns out, that many users are unsure about the handling of data by other users and also there are some worries about the management of intellectual property rights.

These points will be discussed during the next Data Warehouse workshop. The handling of data can largely be controlled, if and when the data creator provides uncertainty assessments of the data sets. The Data Warehouse manager has developed a large array of algorithms for this purpose and will supply those to the users and give assistance with their application (**Figure 1**). Examples are shown in the next section.

Regarding the concerns about the intellectual rights, the update of the procedures in place seems indicated, because they are well designed, but somehow less known to the users.

Another issue stated by the users in the opinion poll is the design of the user interface. The administrative area of the website is well accepted, but the data search and upload pages apparently require an update, given the fact, that they have been unchanged now for more than six years. The intended new design has been presented in the member assembly and will be programmed within the next weeks. The upload procedure itself will be condensed and many default values will be set without the explicit need for user input, because they rarely change.

As a further aid, the Data Warehouse manager has supplied templates for common software in use by the scientists, like common office software, the R-statistics package and/or scripting systems like Python. Those templates will enhance and simplify the data preparation for the upload and take away some workload of the data creator. They will be supplied via the website and modified according to the feedback from user's experiences (**Figure 2**).

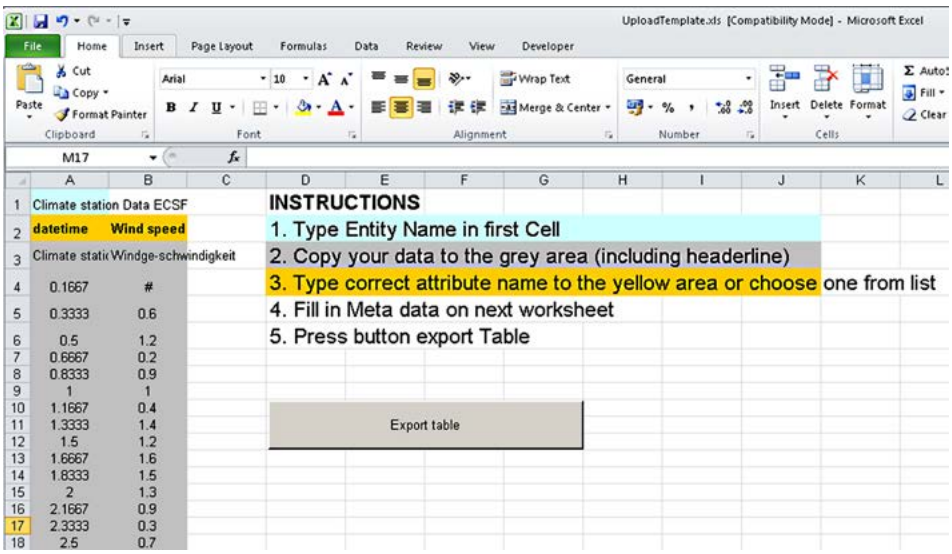

Figure 2: Example of an upload template requiring five simple steps to produce a data set ready for upload. Screenshot: Rütger Rollenbeck

Book Review

Summary of 15 Years of Ecosystem Research

Prof. Dr. Roland Gerstmeier recommends the book "Ecosystem Services, Biodiversity and Environmental Change in a Tropical Mountain Ecosystem of South Ecuador" for its "top-class quality" in his German book review about the Ecological Studies Volume written from members of the preceding German Research Unit [1]. He states that the book fills a gap since research of ecosystem services in hotspot areas are largely missing so far. The present Ecuador project is one of the few exceptions.

This is the second review about the book after the first review by Sandra Luque who recommends the book since it is "an extraordinary, well-written, and well-produced synthesis of interdisciplinary work" [2].

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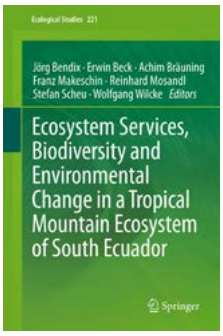

Bendix J, Beck E, Bräuning A, Makeschin F, Mosandl R, Scheu S, Wilcke W (2013): Ecosystem Services, Biodiversity and Environmental Change in a Tropical Mountain Ecosystem of South Ecuador. Ecological Studies, Springer, Berlin, Volume 221, 438 pp.

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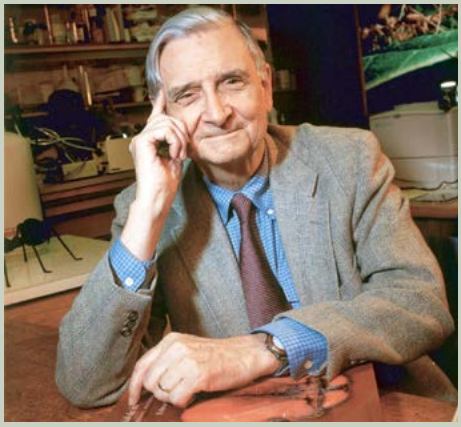
News from Infrastructure Providers and Non-University Partners[1)]

Renowned Biologist Edward O. Wilson Joins NCI's Board of Directors

We are excited to announce that noted biologist, author and Harvard professor Edward O. Wilson has joined Nature and Culture International's (NCI) Board of Directors. A longtime advocate of NCI's work to conserve the endangered tropical forests of Latin America, Wilson officially joined NCI's Board of Directors last March.

"The program of NCI is powerful because it is grounded in two fundamentals: conservation is achieved acre by acre, and it is most effective and sustainable when it enhances not just the economic, but also the spiritual needs of those who inhabit the land," stated Wilson regarding NCI's extensive conservation programs, which work with local communities and governments to build solutions from the ground up.

Wilson, a University Research Professor Emeritus at Harvard University, is considered the world's foremost expert on myrmecology, or the study of ants. Among his many scientific achievements, he is also a two-time Pulitzer Prize winning author renowned for his books ranging from biology to environmental advocacy and his secular-humanist ideas on the interplay between religion, ethics and conservation. "Eduard Wilson is an icon in the field of biology, and a staunch supporter of conserving tropical forests for both their biological and aesthetic values," said Byron Swift, President of NCI. "We are proud and honored to have him on our Board of Directors."



Edward Osborne Wilson. Photo: Wikimedia commons from February 2003 is licensed under CC BY 2.5

Having directly supported the creation of 6.5 million acres of protected areas to date, NCI is now expanding to Bolivia and Colombia where it is working with local partners to protect highly threatened ecosystems such as the Andean cloud forest and Chocó dry forest. NCI's focus on preserving biodiversity through the creation of protected areas dovetails with Wilson's own organization, the E.O. Wilson Biodiversity Foundation, which is increasing global awareness of biodiversity and the critical role species play in sustaining our planet.

Protecting Rainforests in Collaboration with Ecuador's Indigenous Achuar

Home to some of the most pristine rainforests on the planet, Ecuador is on the frontlines of conservation. Since 2008, NCI has been working with local communities to protect their land through the government's Socio Bosque program (see also TMF Newsletter of the DFG Research Unit 816, 2011, Issue 14, pages 7 and 8, doi: 10.5678/lcrs/for816.cit.1031), an innovative "payment for conservation" program that combines forest conservation with enhancing social welfare.

As official partners of Socio Bosque, NCI has assisted 28 communities in joining Socio Bosque, 16 of which are indigenous, including the Shuar, Achuar, Zápara and Kichwa. These efforts have protected more than 500,000 acres of biodiverse forests and numerous threatened species, as well as generated over $1 million Dollars in funds for health care, education and infrastructure for these communities.

We underline the last experience with the indigenous Achuar Indigenous groupo, who joined Socio Bosque for the first time. Clemente Santi, an Achuar member of the Capahuari community, spoke to us about the changes they are seeing. "We care for our forests. Before we were in the habit of knocking down the trees, but now we want to save our forest."

Since he was a child, Clemente has seen troubling changes in his forest – a trend of deforestation that is now being reversed by Socio Bosque. "People used to destroy our forest for pastures. Now, we are planting trees near our homes. We are giving our children something that they will take care of, that will be planted for their future."

Representative of the Achuar Nationality in the Morona Santiago Province at a community meeting in the preparation of the Socio Bosque process. Photo: J. Anhalzer, NCI

[1)] In this section infrastructure providers and non-university partners present news around the Research Platform. This time Bruno Paladines from the NGO Nature and Culture International (NCI) reports about latest devepolments.

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Knowledge Transfer

Workshops: Terrain Analysis with Geographical Information System SAGA

Mareike Ließ
University of Bayreuth, Germany – member of the DFG-PAK Research Consortium

SAGA [1] is a very powerful open source software from the field of geographical information systems (GIS). It is used by platform **project C9** "Towards a guideline for digital soil mapping in Ecuador" to analyze three-dimensional landscape models, so called digital terrain models (DTM) in the context of digital soil mapping. The various terrain parameters which can be calculated from these DTMs, may serve as predictors for many ecological, pedological or hydrological parameters. Often these parameters can only be measured at certain points, but not continuously throughout a landscape or plot. Through the fitting of regression models, these parameters can then be spatially predicted to obtain a map.

As part of the knowledge transfer aspect, two courses were given in October and November 2014 to provide practical training on terrain analysis with the GIS software SAGA. One of the courses was held at the Estación Científica San Francisco close to Loja, while the other course was organized in cooperation with the "Empresa Pública Municipal de Telecomunicaciones, Agua Potable, Alcantarillado y Saneamiento" (ETAPA) at the "Central de Totoracocha de ETAPA-EP" in Cuenca. Being primarily thought to join hands with people from all cooperation partners of the monitoring platform as well as interested students, the course was open to GIS experts as well as newcomers.

The course started with a general introduction into GIS and guidance how to install the SAGA software. Participants first got to know SAGA with some basics such as data import and export, the handling of different data types, and finally created their own DTM in raster format from a contour lines shapefile. This DTM was used throughout the course to get to know the software's manifold modules. Various geomorphological and hydrological terrain parameters were calculated. These included rather simple parameters such as slope and aspect as well as rather complex parameters such as the topographic wetness index and the upslope contributing catchment area. Finally, the participants learned to extract terrain parameters at point locations to create a simple file with available soil data as well as terrain data, which may then be used to adapt a regression model to spatially predict soil properties.

The course was interactive and participants were also given the chance to present problems from their own working environment, which were addressed within the SAGA software environment. Similar courses are planned in the near future.

Figure 1: SAGA course at the Central de Totoracocha de ETAPA-EP in Cuenca given by Dr. Mareike Ließ. Participants included members of ETAPA, Nature and Culture International, Ministerio del Ambiente (Loja) and the Secretaria de Gestión de Riesgos (Guayaquil) as well as employees of the Universidad de Cuenca, PhD students and technicians of several platform projects. Photo: Victor M. Brito Gómez

References

[1] SAGA Software: www.saga-gis.org

Awarded Scientists

Photo: Eike-Lena Neuschulz

The President of the Society of Tropical Ecology (gtö) congratulated the Merian Award prize winners in Zurich, Switzerland, in March 2015 (f.l.t.r.): Julia Adams (poster rank 3), Delphine Zemp (poster rank 1), Tom Van der Stocken (oral presentation rank 2), Manfred Niekisch (President of the Society of Tropical Ecology, gtö), Bea Maas (oral presentation rank 3), Graham Prescott (oral presentation rank 1).

Event Calendar

Status Symposium

The next Status Symposium will take place on 7th and 8th October 2015. It will be organized in the same manner like its predecessors starting with several English sessions and offering Spanish sessions on the second day. In connection with the Symposium workshops for knowledge transfer are planned (see page 2).

Deadline

The editorial deadline for the forthcoming German issue of the Tabebuia Bulletin is:

26th October 2015.

Please send ideas, manuscripts and images to executive editor Dr. Esther Schwarz-Weig. Please feel free to contact her if you have any questions concerning the Bulletin. E-mail: esw@sci-stories.com

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People and Staff

Photo: Jennifer Cohen

PhD student **Giova Mosquera** started his field research in the Quinuas River catchment (Cajas National Park) in April 2015 supporting hydrometric, hydrogeochemical, and sediment measurements in the framework of the **project C7** (Quantification of functional hydro-biogeochemical indicators in Ecuadorian ecosystems and their reaction on global change). He is student in an international research cooperation between the department of Landscape, Water and Biogeochemical Cycles at the University of Giessen and the Department of Water Resources and Environmental Sciences at the University of Cuenca.

David Windhorst

Photo: Andre Velescu

Ing. **Jimmy Alexander Villalta** started as full-time technician at the ECSF research station in January 2015. He supports **project X2** and performs the weekly sampling of rainfall, throughfall, litter leachate, soil solution and litterfall in the Reserva Biológica San Francisco. He is also in charge of the readout and maintenance of several data loggers of **project A6**. After the landslide (see page 4) he immediately repaired the damaged equipment where this was possible and replaced the destroyed sample collectors, so that the long term ecosystem monitoring in Q2 can be continued with only a minor disturbance.

Andre Velescu

About Us

Monitoring and Research Platform | South Ecuador

The Platform for Biodiversity and 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. In the Tabebuia Bulletin scientists and partners inform about their progress and latest research results. It is named after the Tabebuia tree which generates charismatic yellow blossoms and is home to the Neotropics.

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 2013 based on more than 16 years of intensive research into biodiversity and ecology of the South Ecuadorian Andes. In 1997, a small group of German researchers funded by the DFG began to investigate the biodiversity-rich mountain rain forests. From 2001 the first DFG Research Unit (FOR 402) operated with a significantly larger consortium. A second Research Unit (FOR 816) 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.

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Credits and Contact

DFG PAK 823-825 Research Consortium

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

Coordinator of the German Group

Prof. Dr. Jörg Bendix,
Fachbereich Geographie der Philipps-Universität Marburg,
Deutschhausstraße 10,
D-35032 Marburg, Germany,
phone: ++49 (0)6421-2824266.
e-mail: bendix@staff.uni-marburg.de

Coordinating Office

Mrs. Birgit Kühne-Bialozyt,
Fachbereich Geographie der Philipps-Universität Marburg,
Deutschhausstraße 10,
D-35032 Marburg, Germany,
phone ++49 (0)6421- 2826543,
e-mail:
kuehnebi@staff.uni-marburg.de

Coordinator of the Ecuadorian Group

Dr. Juan Pablo Suárez,
Universidad Técnica Particular de Loja, Departamento de Ciencias Naturales, San Cayetano Alto s/n, C. P. 1101608 Loja, Ecuador,
phone: 593-7-2570275
e-mail: jpsuarez@utpl.edu.ec

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Executive and Managing Editor

Dr. Esther Schwarz-Weig (esw),
www.Sci-Stories.com,
e-mail: esw@sci-stories.com

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