



**Universität für Bodenkultur Wien**

Department für Wald- und Bodenwissenschaften

## 2. Student Conference

Department of Forest and Soil Sciences, 2017  
Book of Abstracts



24. May 2017

The student conference comprises the following BOKU courses (2017S)

Bachelorseminar 910110,

Masterseminar 910301, and

Dissertantenseminar 910400

Printed version: 23. May 2017

Please be aware that slight modification of the program are possible. Please pay attention to the latest versions of the program (BOKU learn, BOKU online) and the bulletin board at the day of conference.

**ISBN 978-3-900932-50-3**

**Universität für Bodenkultur Wien**

**2. Student Conference, Department of Forest and Soil Sciences, 2017 – Book of Abstracts / B. Rewald (Ed.). University of Natural Resources and Life Sciences, Vienna. 66 p.**

Cite contributions as: AUTHOR NAME(S) (2017) PRESENTATION TITLE. In: Rewald, B. (Ed.), 2. *Student Conference, Department of Forest and Soil Sciences, 2017 – Book of Abstracts*. University of Natural Resources and Life Sciences, Vienna, Austria.

## Program overview

The meeting will take at May 24<sup>th</sup>, 2017 at the **Schwackhöfer-Haus** (“Glass building”), Peter-Jordan-Straße 82, 1190 Vienna – Ground floor (Erdgeschoss / Aula). Oral presentations will start at **9.00 am** without delay.

Time	Seminar room 1 (Schw-SR 06)	Seminar room 2 (Schw-SR 09)	Aula Schwackhöfer
8	Conference desk (Registry etc.)		
9-10.30	Session 1	Session 2	Poster
10.30-11	Open poster session & Coffee break		
11-12.00	Session 1 (continue)	Session 2 (continue)	Poster
12.00-14	Poster session, thesis market & Lunch buffet		
14.00	Poster award		

The **conference desk** is open from 8 am, please do not hesitate to ask if you have any **questions**.

All actively presenting **students** are kindly asked to **sign** the **attendance sheets** (Anwesenheitslisten) for the Bachelor, Master- and PhD students’ seminars respectively at the conference desk. Please note that it is mandatory to participate until the end (9-14.15).

For **oral contributions**, all presenters are kindly asked to up-load their presentations to the provided computers (PC, Windows 7, PowerPoint or pdf only) by USB, not less than **15 min before** the start of the session/during coffee break. Please note that oral presentations are 12 min long PLUS 3 min for questions. Try to keep the time limits please!

Please place your **posters** (A1-A0, portrait format) BEFORE 9 AM at the board with the *corresponding number* (above your abstract, this book). Overall, please stay next to you poster during the poster session if questions arise. There will be 2 **best poster awards**, separately for Bachelor students and Master/PhD students! Established scientists (>Doctorate) at the Department: please pick up the ballot paper for voting at the conference desk and return them until 13.30 pm. Please join the award ceremony (**14.00 pm**).

## Table of contents

<b>Program overview</b> .....	3
<b>Oral presentations – Time schedule</b> .....	5
Session 1 – Soil Science in a nutshell (9.00-10.30 and 11.00-12.00 o'clock, SCHW-SR 06) .....	5
Session 2 – Plants, their friends and foe (9.00-10.30 and 11.00-12.00 o'clock, SCHW-SR 09).....	6
<b>Oral presentations – Abstracts</b> .....	7
Session 1 – Soil Science in a nutshell .....	7
Session 2 – Plants, their friends and foe .....	16
<b>Poster presentations – Master and PhD students</b> .....	25
Section Soil Research .....	25
Section Forest Entomology, Forest Pathology and Forest Protection .....	38
Section Silviculture.....	41
Section Forest Ecology .....	46
Section Forest Growth .....	52
Section Forest Engineering .....	53
<b>Poster presentations – Bachelor students</b> .....	54
Index of contributors .....	65

## Oral presentations – Time schedule

### Session 1 – Soil Science in a nutshell (9.00-10.30 and 11.00-12.00 o'clock, [SCHW-SR 06](#))

Conveners: Prof. Dr. Walter W. Wenzel, Priv.-Doz. Dr. Markus Puschenreiter

<i>Time</i>	<i>Presenter</i>	<i>Title</i>
9.00-9.15	<b>Olivier Duboc</b>	Recycling fertilizers from wastewater: potentials and limitations for organic agriculture
9.15-9.30	<b>Merle Gerding</b>	Interactive global change effects on soil nitrous oxide fluxes in managed grassland
9.30-9.45	<b>Stefan Wagner</b>	Arsenic speciation in the rhizosphere of hyperaccumulator plants
9.45-10.00	<b>Christoph Noller</b>	Evaluating the relation between soil chemical and microbiological characteristics and nickel accumulation in the hyperaccumulator <i>Noccaea goesingensis</i>
10.00-10.15	<b>Enrico Porotti</b>	Implementation of methods and related analytical approaches for silicon extraction/digestion in soil
10.15-10.30	<b>Dorothea Summer</b>	Combination of chemical and biological PCE degradation to increase the efficiency of <i>in-situ</i> groundwater remediation
		<i>Open poster session &amp; Coffee break</i>
11.00-11.15	<b>Simon Leitner</b>	Characteristics of stable carbon isotope fractionation of chlorinated ethenes during bacterial degradation
11.15-11.30	<b>Owen Bradley</b>	The effect of land use on carbon storage in the Gaurishankar conservation area - baseline calculation of carbon stocks for the BOKU carbon offset project Nepal
11.30-11.45	<b>David Keßler</b>	Effects of ungulate herbivores on post disturbance forest soil carbon dynamics in the Northern Calcareous Alps
11.45-12.00		<i>Open discussion</i>

Please visit the posters and stay until the poster award ceremony (14 o'clock). Enjoy lunch (from 13 o'clock).

## Session 2 – Plants, their friends and foe (9.00-10.30 and 11.00-12.00 o'clock, [SCHW-SR 09](#))

Conveners: Dr. Tim Ritter, Dr. Viktor Bruckman

<i>Time</i>	<i>Presenter</i>	<i>Title</i>
9.00-9.15	<b>Georg Marchart</b>	The effect of shelterwood felling in old-growth stands on the diameter increment and the growing stock in lower Austria
9.15-9.30	<b>Karin Oberaigner</b>	Einfluss von Schadholzaufarbeitung auf die Verjüngungsdynamik im National Park Kalkalpen
9.30-9.45	<b>Matthias Höckner &amp; Lukas Röck</b>	Einheitshöhenkurven im Forstrevier Lend und Taxenbach
9.45-10.00	<b>Jiangsan Zhao</b>	Application of principal component analysis facilitates unraveling the effects of AMF and beneficial bacteria on <i>Pisum sativum</i> nutrient status
10.00-10.15	<b>Hannes Raffl</b>	Historic translocation of <i>Larix decidua</i> in the Carpathians revisited: A molecular analysis
10.15-10.30	<b>Christoph Rosinger</b>	Revealing patterns in biodiversity and ecosystem functioning in ectomycorrhizal communities in European forests
		<i>Open poster session &amp; Coffee break</i>
11.00-11.15	<b>Gerline Weizer</b>	Influence of photoperiod and changing temperature conditions on the development and overwintering behaviour of the Larch Bark Beetle, <i>Ips cembrae</i> Heer. (Col., Scolytinae)
11.15-11.30	<b>Bernhard Schmieder</b>	Constitutive defences and induced wound responses of spruce after a sawfly infestation in the Waldviertel, Lower Austria
11.30-11.45	<b>Roland Paumann</b>	Untersuchungen zum Ausbreitungsverhalten des Buchdruckers (Col., Scolytinae) im Wildnisgebiet Dürrenstein
11.45-12.00		<i>Open discussion</i>

Please visit the posters and stay until the poster award ceremony (14 o'clock). Enjoy lunch (from 13 o'clock).

# Oral presentations – Abstracts

## Session 1 – Soil Science in a nutshell

*Oral presentation - Session 1*

### **RECYCLING FERTILIZERS FROM WASTEWATER: POTENTIALS AND LIMITATIONS FOR ORGANIC AGRICULTURE**

Olivier Duboc<sup>1\*</sup>, Jakob Santner<sup>1,2</sup>, Franz Zehetner<sup>3</sup>, Walter W. Wenzel<sup>1</sup>

<sup>1</sup>Department of Forest and Soil Sciences, Institute of Soil Research, University of Natural Resources and Life Sciences, Vienna (BOKU), Konrad-Lorenz-Strasse 24, A-3430, Tulln, Austria. \*olivier.duboc@boku.ac.at

<sup>2</sup>Department of Crop Sciences, Division of Agronomy, University of Natural Resources and Life Sciences, Vienna (BOKU), Konrad-Lorenz-Strasse 24, A-3430, Tulln, Austria.

<sup>3</sup>Department of Forest and Soil Sciences, Institute of Soil Research, University of Natural Resources and Life Sciences, Vienna (BOKU), Peter Jordan Straße, A-1180, Vienna, Austria.

Organic agriculture (OA) started in the early 20<sup>th</sup> century deemed as a more sustainable alternative to conventional practices. It is a growing sector, and recently OA has set itself the objective to “warrant sustainable agriculture and nutrition beyond the niche”. To come closer to that goal, the use of nutrients recycled from wastewater is considered as one of the solutions, but guaranteeing the safe use of such products is a major prerequisite. To that end, technologies exist and / or are being developed to produce recycling fertilizers that are free from pathogens, organic and inorganic pollutants.

In the past decade a strong focus has been given on the recovery of Phosphorus (P). Struvite and other products already have been considered appropriate for OA. A number of technologies also exist that produce fertilizers with contrasting P bioavailability. Our previous work has shown that methods of P fertilizer testing based on ion sinks could help characterize and predict P bioavailability from highly heterogeneous recycling fertilizers. These tools provide more detailed description of solubility vs. availability and could be used to identify their suitability for OA, since in this sector sparingly soluble but effective fertilizers are preferred.

In contrast, less attention has been given to Nitrogen (N) recovery, which is commonly removed by denitrification in wastewater treatment plants. Struvite is not suitable for N recovery due to the mismatch of N:P stoichiometry with the effluent. Ammonium sulfate produced by acid washing of NH<sub>3</sub> in wastewater treatment plants may be an option but authorization in OA would require that it is used in a way that is compatible with the principles of OA, e.g. as nutrient complementation in legume-based crop rotations. Microalgae can stoichiometrically recover N, P and other nutrients, but must be investigated regarding their safe use.

## **INTERACTIVE GLOBAL CHANGE EFFECTS ON SOIL NITROUS OXIDE FLUXES IN MANAGED GRASSLAND**

Merle Gerding, Katharina Keiblinger, Evi Deltedesco, Sophie Zechmeister-Boltenstern

Department of Forest and Soil Sciences, Institute of Soil Research, University of Natural Resources and Life Sciences, Vienna (BOKU), Peter Jordan Straße 82, 1190 Vienna, Austria.

According to the latest climate scenarios of Austria (ÖKS15) strong and significant increase in mean temperature of 1 to 7 °C during the last 25 years in Austria were observed. We expect a further rise of 1.3 to 1.4 °C in till 2050. The massive CO<sub>2</sub> production is one of the major causes for this trend. The aim of the study is to investigate effects of temperature increase in combination with the elevated CO<sub>2</sub> concentration on N<sub>2</sub>O emissions in typical european mountain regions.

The experimental site is located in Styria, Austria at the Agricultural Research and Education Centre Raumberg-Gumpenstein (AREC). The plots are treated with individual and combined effects of CO<sub>2</sub> elevation (ambient, +150, +300 ppm and temperature increase (ambient, +1.5 °C, +3°C). To determine the temporal emissions of N<sub>2</sub>O over the growing season gas sampling was conducted on a biweekly interval from May to October 2016, with intense measurement campaigns around the harvest and fertilization events. Manual chambers of different height were used for gas sampling in closed chamber mode. During an incubation period of 60 min four gas samples were taken into headspace vials in 20 min intervals. The samples were analyzed for N<sub>2</sub>O with a GC-ECD, and fluxes calculated by linear regression.

Preliminary results show distinct effects of harvesting on N<sub>2</sub>O emissions and expectedly high rates after the fertilization events. Further results will be presented here.



## ARSENIC SPECIATION IN THE RHIZOSPHERE OF HYPERACCUMULATOR PLANTS

Stefan Wagner<sup>1\*</sup>, Christoph Höfer<sup>1</sup>, Jakob Santner<sup>2</sup>, Brett Robinson<sup>3</sup>, Markus Puschenreiter<sup>1</sup>, Walter W. Wenzel<sup>1</sup>

<sup>1</sup>Department of Forest and Soil Sciences, Institute of Soil Research, University of Natural Resources and Life Sciences, Vienna (BOKU), Konrad-Lorenz-Strasse 24, A-3430, Tulln, Austria. \*stefan.wagner@students.boku.ac.at

<sup>2</sup>Department of Crop Sciences, Division of Agronomy, University of Natural Resources and Life Sciences, Vienna (BOKU), Konrad-Lorenz-Strasse 24, A-3430, Tulln, Austria.

<sup>3</sup>Faculty of Agriculture and Life Sciences, Department of Soil and Physical Sciences, Lincoln University, PO Box 85084, Lincoln 7647 Canterbury, New Zealand.

Most plant species are known to acquire arsenate [As(V)] and to reduce it to arsenite [As(III)] which may then be released back to the soil, constituting an important mechanism for As-detoxification. Recently it was shown in hydroponic, sterile conditions that As-hyperaccumulator fern *Pteris vittata* may excrete relatively high amounts of As(III) via the root when exposed to large As concentrations in the medium. Here we test the hypothesis that (i) release of excess As(III) concentrations by hyperaccumulator ferns is observed also in soil-grown specimen, and (ii) that As(III) released into the rhizosphere is re-oxidized to As(V).

To this end, two As-hyperaccumulators (*Pteris vittata* and *P. quadriaurita*) were grown in rhizotrons under greenhouse conditions on highly As-contaminated soil. Co-localized, high-resolution chemical mapping of labile As(III) and As(V) and other elements at the soil-root interface was performed using diffusive gradients in thin-films combined with laser ablation ICP-MS (DGT-LA-ICPMS). The deployment of 3-mercaptopropyl-functionalized silica gel for selectively mapping of As(III) along with HR-MBG-DGT for total soluble As allowed for in-situ As speciation. Oxygen was mapped using color ratiometric planar optodes (PO).

The DGT-LA-ICPMS mapping shows zones of labile As(V) depletion in the rhizosphere of individual *P. vittata* roots confining zones of labile As(III) and As(V) enrichment. Those zones of enrichment coincide with elevated levels of labile Mn. No As(III) was found in the rhizosphere of *P. quadriaurita* indicating different plant physiological processes. PO measurements revealed zones of oxygen depletion expanding from fern roots. We conclude that highly dynamic redox transformations in the direct vicinity of hyperaccumulator roots may trigger the spatial distribution and rapid transformation of As species along other elements involved in the redox chemistry of As. The observed increase in labile manganese (Mn) may be attributed to the chemical re-oxidation of released As(III) by electron transfer to Mn (III, IV) oxides.

Our findings demonstrate the complexity of biogeochemical interactions in the rhizosphere of As-hyperaccumulator ferns and indicate that part of the As taken up in ferns may cycle between roots and the associated rhizosphere. Better understanding the biogeochemistry of As and other associated elements in the rhizosphere of As hyperaccumulators may help to improve the design of As phytoextraction technologies.

## **EVALUATING THE RELATION BETWEEN SOIL CHEMICAL AND MICROBIOLOGICAL CHARACTERISTICS AND NICKEL ACCUMULATION IN THE HYPERACCUMULATOR *NOCCAEA GOESINGENSIS***

Christoph Noller<sup>1\*</sup>, Petra S. Kidd<sup>2</sup>, Walter W. Wenzel<sup>1</sup>, Markus Puschenreiter<sup>1</sup>

<sup>1</sup>Department of Forest and Soil Sciences, Institute of Soil Research, University of Natural Resources and Life Sciences, Vienna (BOKU), Konrad-Lorenz-Strasse 24, A-3430, Tulln, Austria. \*christoph.noller@students.boku.ac.at

<sup>2</sup>Instituto de Investigaciones Agrobiológicas de Galicia (IIAG), Consejo Superior de Investigaciones Científicas (CSIC), Santiago de Compostela, Spain

Hyperaccumulation of metals is a fascinating phenomenon in the plant kingdom. Whereas some molecular and physiological processes have been elucidated in the last decades, rhizosphere processes are still largely unknown. Furthermore, hyperaccumulators are candidate species for soil clean-up (i.e. phytoextraction) and metal recovery (i.e. phytomining). The use of plants is a potential low-cost alternative to the conventional soil remediation approaches and phytomining in particular represents a very promising method for gentle mining of trace elements. Unravelling processes in the rhizosphere will contribute to a better understanding of metal hyperaccumulation and might also help to improve phytoextraction and phytomining technologies.

In this study, we aim to clarify the interactions between rhizosphere characteristics and Ni accumulation in *Noccaea goesingensis*. Plants and associated rhizosphere soil were sampled along gradients of soil development, total Ni concentrations, and altitude. Rhizosphere soil will be characterized for microbiological (total and Ni-tolerant culturable bacterial communities) and soil chemical characteristics, with a particular focus on Ni fractionation. The latter will be assessed using conventional (i.e. sequential extraction) and novel (i.e. diffusive gradients in thin films) techniques. The relationship between soil characteristics, Ni availability and Ni concentrations in plants will be assessed using multiple regression and principal component analysis.

The obtained data will provide novel insight into the relation between soil characteristics, Ni dynamics and Ni accumulation in plants. The uptake of trace elements in plants depends on their availability in soil. Weathering of primary and/or secondary Ni-bearing minerals is likely to be one crucial process determining Ni resupply to soil solution and thus the plant accumulation rates. Further fractioning and transformation processes are influenced by the activities of roots and associated microbes in the rhizosphere. Root exudates, like microbial processes and metabolites can strongly affect the solubility of trace elements in soil and therefore have the potential to increase the bioavailability and uptake rates. Our work will help to better understand these processes in the root-soil interface of a Ni-hyperaccumulating plant.

## **IMPLEMENTATION OF METHODS AND RELATED ANALYTICAL APPROACHES FOR SILICON EXTRACTION/DIGESTION IN SOIL**

Enrico Porotti<sup>1\*</sup>, Markus Puschenreiter<sup>1</sup>, Jakob Magid<sup>2</sup>, Walter W. Wenzel<sup>1</sup>

<sup>1</sup>Department of Forest and Soil Sciences, Institute of Soil Research, University of Natural Resources and Life Sciences, Vienna (BOKU), Konrad-Lorenz-Strasse 24, A-3430, Tulln, Austria. \*e.porotti@students.boku.ac.at

<sup>2</sup>Department of Plant and Environmental Sciences, Section for Plant and Soil Sciences, University of Copenhagen (KU), Thorvaldsensvej 40, 1871 Frb. C

Silicon is the second most abundant element in Earth's crust and it is known to increase the resistance of plants to pests and abiotic stress factors alike. Most research has focused on plant physiology and genetics linked to silicon, while in-depth knowledge of silicon in soil is lacking.

In this regard there are two main concerns. On one hand, all certified reference materials that includes Si concentration, report only the total Si concentration, with no information regarding the different fractions of soil silicon; on the other hand, there is a lack of deeply described methods for quantification of Si in solution.

The aim of my thesis is to address these two issues, with a focus on quantification of Si in 0.01M CaCl<sub>2</sub> soil extracts (plant available silicon) and 0.2M NaOH (biogenic amorphous silica). Robustness of the extraction procedures is assessed against shaking speed, time between end of shaking and separation of the liquid solution from the solids and separation method.

An ICP-OES method is developed as a potential alternative to spectrophotometry. The parameters considered include RF power, plasma torch Z position, wavelength, viewing distance and rinsing time. The selection of optimal method parameters is based of BEC, RMSEC, R2, %RSD of measurements performed on standard solutions. External standard and standard addition are compared, on soil samples with different SOM and lime content and pH, in order to assess the existence of a matrix effect on Si measurements. In addition to this, the effect of sample acidification with HNO<sub>3</sub> is also assessed.

The novel ICP-OES method is compared against a well-established colorimetric method. For both methods an uncertainty budget is performed to identify areas of concern and as a further field of comparison between the analytical procedures.

Based on results from the matrix effect assessment, a number of soil samples from Austria will be developed as in-house reference materials by performing repeated measurements and assessing the homogeneity of the material. Moreover, the storability of soil extracts prepared in 0.01M CaCl<sub>2</sub> and 0.2M NaOH is to be assessed, both at room temperature and in refrigerated conditions.

## COMBINATION OF CHEMICAL AND BIOLOGICAL PCE DEGRADATION TO INCREASE THE EFFICIENCY OF IN-SITU GROUNDWATER REMEDIATION

Dorothea Summer, Thomas Reichenauer, Andrea Watzinger, Martin Gerzabek

Department of Forest and Soil Sciences, Institute of Soil Research, University of Natural Resources and Life Sciences, Vienna (BOKU), Peter Jordan Straße 82, 1190 Vienna, Austria.

Perchloroethylene (PCE) is a common and hazardous organic groundwater pollutant.

PCE reaches the environment through anthropogenic sources, such as dry-cleanings and metal-working industries. Therefore PCE contaminations can mainly be found in build-up regions and only in-situ remediation methods can be used for clean-up.

In this PhD-project two *in-situ* remediation methods (chemical and biological) will be combined. The chemical degradation uses zero-valent iron (ZVI) to reductively dechlorinate PCE-molecules. But ZVI is also consumed by anaerobic corrosion producing H<sub>2</sub>. Thus, an excess of ZVI particles has to be used to accomplish a successful clean-up. To achieve biological degradation strictly anaerobic strains of the bacteria *Dehalococcoides* are used, which are the only known bacteria able to completely dechlorinate PCE to ethene by utilizing H<sub>2</sub>. By combining these processes the H<sub>2</sub>, produced during the anaerobic corrosion of ZVI, could be used by the bacteria for further PCE degradation. Therefore, remediation time, needed amount of ZVI and as a consequence also remediation costs could be reduced.

In the first phase of the project PCE-degradation experiments in microcosms were conducted. The degradation rates of different ZVI particles (nano- and micro-scaled), *Dehalococcoides* cultures and their combinations were determined. To gain a better understanding of the needed environment for biotic dehalogenation different carbon sources and other parameters were tested. To further investigate the metabolism of biological PCE-degradation PLFA analyses, stable-isotope analyses and DNA analyses will be done.

In the second part of the project the results of the first phase will be tested in column experiments with a simulated groundwater flow. Also the toxic effect of the physical contact with ZVI particles on the bacteria can be investigated.

In the third phase additional DNA-samples in an on-going lysimeter experiment will be analysed to gain further information on the development of the existing microbial community.

## **CHARACTERISTICS OF STABLE CARBON ISOTOPE FRACTIONATION OF CHLORINATED ETHENES DURING BACTERIAL DEGRADATION**

Simon Leitner, Andrea Watzinger, Sophie Zechmeister-Boltenstern

Department of Forest and Soil Sciences, Institute of Soil Research, University of Natural Resources and Life Sciences, Vienna (BOKU), Peter Jordan Straße 82, 1190 Vienna, Austria.

Chlorinated hydrocarbons, especially chlorinated ethenes, are persistent and highly toxic groundwater contaminants present at a huge number of sites worldwide. Still, these contaminants can be degraded by native microorganisms in the groundwater representing the natural attenuation process. The exploration of biodegradation mechanisms facilitates the protection and preservation of the resources water and soil.

The presented work aimed to reveal and quantify the impact of different bacteria on the degradation of chlorinated ethenes. Therefore sediment and groundwater samples were taken at a Perchloroethene (PCE) contaminated site in Upper Austria. Sediment samples were incubated in various microcosm studies and analyzed by compound specific stable isotope analysis. Attended research questions focused on the characterization and further quantification of carbon isotope fractionation of PCE and its metabolites at bacterial degradation.

Major findings comprised (1) the observation of complete PCE to ethene degradation by a yet unknown bacterium of the genus *Dehalogenimonas*, (2) the indication of degrader's dependency on carbon isotope enrichment factor magnitudes of PCE, (3) the development of an evaluation method to determine carbon isotope enrichment factors of the PCE metabolite cis-dichloroethene (*cis*-DCE) at successive PCE degradation and (4) the identification of PCE sorption processes to bacterial membranes and/or cell compartments hindering dechlorination monitoring.

## **THE EFFECT OF LAND USE ON CARBON STORAGE IN THE GAURISHANKAR CONSERVATION AREA - BASELINE CALCULATION OF CARBON STOCKS FOR THE BOKU CARBON OFFSET PROJECT NEPAL**

Owen Bradley<sup>1</sup>, Viktor Bruckman<sup>2</sup>, Anjana Giri, Klaus Katzensteiner<sup>1</sup>

<sup>1</sup>Department of Forest and Soil Sciences, Institute of Forest Ecology, University of Natural Resources and Life Sciences, Vienna (BOKU), Peter Jordan Straße 82, 1190 Vienna, Austria.

<sup>2</sup>Austrian Academy of Science

The BOKU carbon offsetting project has chosen the Gaurishankar Conservation Area in Nepal as the location for its latest intervention. The baseline values of the existing carbon stocks is a necessary reference point to be taken at the beginning of this 20-30 year project. We stratified the ridgeline between the two communities of Ladhuk and Bulungkhani into five different land use types; Pine Plantation, Degraded Forest, Degraded Grazing, Farm Land and Abandoned Farm Land. We are also conducting a comparative study between the two communities, to see how differing circumstances and forest management practices effect the carbon stocks. This will be useful for estimating the effects of our proposed interventions, with particular regard to the potential for carbon sequestration.

Above ground biomass was measured using nested circular fixed area plots and angle counts and below ground carbon was measured to a depth of one meter. The study found that the above ground carbon stock was effected primarily by stand type, with the 30 year old pine plantations having an average of 116 t C ha<sup>-1</sup> and degraded forest an average of 32 t C ha<sup>-1</sup>. When comparing the above ground carbon stocks between the two communities, the pine plantations in Bulungkhani contain an average of 43 t C ha<sup>-1</sup> more than in Ladhuk, and conversely the natural forests of Bulungkhani contain an average 14 t C ha<sup>-1</sup> less than Ladhuk. Due to complications at the laboratory, soil carbon analysis is not yet complete, however with the use of transform functions I will have preliminary results at the time of presentation.

## **EFFECTS OF UNGULATE HERBIVORES ON POST DISTURBANCE FOREST SOIL CARBON DYNAMICS IN THE NORTHERN CALCAREOUS ALPS**

David Keßler, Mathias Mayer, Klaus Katzensteiner

Department of Forest and Soil Sciences, Institute of Forest Ecology, University of Natural Resources and Life Sciences, Vienna (BOKU), Peter Jordan Straße 82, 1190 Vienna, Austria.

Ungulate herbivores play a crucial role in the establishment of tree regeneration after forest disturbance. This might affect the post-disturbance carbon dynamics of forest ecosystems. Information on the effects of tree herbivory on soil carbon processes after disturbance is, however, sparse. Since forest disturbances are expected to increase with changing climate more studies are required to close this gap in knowledge. The present study investigates how soil respiration and its autotrophic and heterotrophic sources are affected by ungulate herbivores at two windthrown forest sites in the Northern Calcareous Alps, Austria. Additionally, potential abiotic and biotic driving parameters (i.e. litter input, humustypes, soiltypes) of soil respiration were investigated. Sampling locations were installed in ungulate affected (unprotected) plots and fenced (protected) plots. Root trenching was applied to separate autotrophic and heterotrophic soil respiration. Measurements were conducted during the growing season of 2016. Data were analyzed with mixed effects models. Preliminary results suggest a considerable effect of ungulate herbivory on soil respiration. Further results will be presented at the conference.

## Session 2 – Plants, their friends and foe

*Oral presentation - Session 2*

### **THE EFFECT OF SHELTERWOOD FELLING ON THE DIAMETER INCREMENT IN MIXED FORESTS**

Georg Marchart, Arne Nothdurft, Sonja Vospernik

Department of Forest and Soil Sciences, Institute of Forest Growth, University of Natural Resources and Life Sciences, Vienna (BOKU), Peter Jordan Straße 82, 1190 Vienna, Austria.

As many studies have shown, increased growth occurs when a thinning is carried out. Lowering the stand density and the associated competition reduction increase the growth of the remaining stock. Most studies are concerned with the growth responses to the thinning of pole stage forest or young/middle-aged timber tree (BEBBER et al., 2003), but few investigated the effects on old-growth stands, which have been thinned for the purpose of initiating natural regeneration. A total of 15 stands have been selected in the Lower Austria, where shelterwood cuts were done during the years 1995 – 2010 for regeneration under shelter. The stand density index of the test stands was reduced between 0.33 and 0.68. The experiment was designed in such a way that site influences, like sea level, exposition and slope can be largely excluded. The aim of the study is to describe the effects of the shelterwood felling, on the diameter increment and to interpret the response of old trees by using statistical methods.



## EINFLUSS VON SCHADHOLZAUFARBEITUNG AUF DIE VERJÜNGUNGSDYNAMIK IM NATIONAL PARK KALKALPEN

Karin Oberaigner, Rupert Seidl

Institut für Waldbau, Department für Wald- und Bodenwissenschaften, Universität für Bodenkultur Wien (BOKU), Peter Jordan Straße 82, 1190 Wien, Österreich.

Störungen gehören zum natürlichen Ablauf in Waldökosystemen. Die Charakteristiken des Ökosystems werden jedoch durch Störungen nachhaltig beeinflusst, was wiederum Auswirkungen auf die Funktionen (Schutz-, Nutz-, Erholungs- und Wohlfahrtsfunktion) des Waldes hat. Besonders Störungen, die durch Wind verursacht werden, haben in den letzten Jahrzehnten zugenommen und die Walddynamik verändert. Entwurzelte und fehlende Baumvegetation machen das Ökosystem anfälliger gegenüber abiotischen und biotischen Sekundärschäden. Besonders der Bergwald ist davon betroffen, wo die limitierten Wachstumsfaktoren die Regeneration des Ökosystems erheblich erschweren. Aufgrund dessen ist es Ziel dieser Arbeit, den Einfluss der Schadholzaufarbeitung nach Windwurf auf die natürliche Verjüngung von Bergwäldern zu beurteilen. Durch die Sturmereignisse Kyrill (2007), Paula und Emma (2008) ist der National Park Kalkalpen in jüngerer Vergangenheit von zahlreichen Windwürfen betroffen worden. Aufgrund der unterschiedlichen Zonierungen im National Park, in Naturzone und Bewahrungszone, konnten 46 Windwurfflächen im Sommer 2016 aufgenommen werden. Diese wurden in Bezug auf Schadholzaufarbeitungen und die danach aufkommende Naturverjüngung verglichen. Auf der einen Hälfte der Flächen (23) wurde Räumung durchgeführt („Geräumt“) und auf der anderen Hälfte nicht („Ungeräumt“). Die auftretende Naturverjüngung wurde mittels drei Probekreisen pro Fläche erfasst und anschließend statistisch ausgewertet. Die ersten Ergebnisse deuten darauf hin, dass auf ungeräumten Flächen eine höhere Anzahl von Baumarten vorzufinden ist. Des Weiteren wurde mehr Tanne (*Abies alba*), Buche (*Fagus sylvatica*) und Bergahorn (*Acer pseudoplatanus*) auf ungeräumten Flächen vorgefunden, während auf geräumten Flächen Fichte (*Picea abies*) dominierte. Allerdings konnte kein signifikanter Einfluss von Schadholzaufarbeitungen auf Baumartenanzahl nachgewiesen werden.

## **EINHEITSHÖHENKURVEN IM FORSTREVIER LEND UND TAXENBACH**

Matthias Höckner, Lukas Röck, Sonja Vospernik

Institut für Waldwachstum, Department für Wald- und Bodenwissenschaften, Universität für Bodenkultur Wien (BOKU), Peter Jordan Straße 82, 1190 Wien, Österreich.

Zur Erhebung des stehenden Holzvorrats in Waldbeständen wird das Stichprobenverfahren der Winkelzählprobe angewandt. Da die Messung jeder Baumhöhe am Probepunkt zu kosten- und zeitintensiv ist, bedient man sich der Einheitshöhenkurve. Die derzeitigen Einheitshöhenkurvenmodelle beinhalten die lokalen Bestandes- und Standortfaktoren nur unzureichend. Diese beeinflussenden Größen lässt man anhand von gemischten Modellen (mixed model) miteinfließen. Ziel dieser Arbeit ist es zwei gemischte Modell zu konstruieren. Ein Modell wurde aus den Höhenmessung aus allen Bäumen in der Winkelzählprobe entwickelt um die Einflüsse von Bestandes- und Standortseinflüssen zu testen. Ein zweites Modell wurde nur aus den Höhen der Zentralstämmen konstruiert um zu testen, ob mittels mixed model geschätzte Höhenkurven bessere Schätzwerte als Einheitshöhenkurven liefern, wenn die Höhen nur am Zentralstamm gemessen wurden. Die Daten stammen aus der Stichprobeninventur 2016 in den Forstrevieren Lend und Taxenbach der Österreichischen Bundesforste AG, Forstbetrieb Pongau. Die aufgenommenen Parameter wurden hinsichtlich ihres signifikanten Einflusses auf das Baumhöhenwachstum getestet. Waren die Größen signifikant, so wurden sie in das Modell als feste Effekte aufgenommen. In beiden Modellen lassen sich der Grundflächenmittelstamm, die Seehöhe und Konkurrenzmaße als beeinflussende Faktoren definieren. Im statistischen Vergleich mit RMSE und dem BIAS zur Einheitshöhenkurven nach POLLANSCHÜTZ beweist sich das „mixed model“ nur zu gut einem Drittel bzw. einem Viertel beim BIAS als besser an die wahren Baumhöhen angepasst. Es ist der Trend erkennbar, dass sich das MM in Beständen mit einer inhomogenen BHD-Klassen-Verteilung besser anwenden lässt. Da die Daten aus einer Erstinventur stammen und der Stichprobenumfang zu gering ist, lässt sich die teilweise noch nicht zufriedenstellende Kalibrierung des Modells am überwiegenden Teil der Punkte im Wesentlichen auf diese beiden Gründe zurückführen. Mit den Folgeinventuren an den permanenten Stichprobenpunkten wird das Modell schrittweise genauer, weshalb sich in Zukunft eine dem Aufnahmegebiet sehr gut angepasste Einheitshöhenkurve darstellen lassen wird.

## APPLICATION OF PRINCIPAL COMPONENT ANALYSIS FACILITATES UNRAVELING THE EFFECTS OF AMF AND BENEFICIAL BACTERIA ON PISUM SATIVUM NUTRIENT STATUS

Jiangsan Zhao<sup>1\*</sup>, Virginia Sánchez-Navarro<sup>2</sup>, Hans Sandén<sup>1</sup>, Christoph Rosinger<sup>1</sup>, Juan A. Fernández<sup>2</sup>, Gernot Bodner<sup>3</sup>, Boris Rewald<sup>1</sup>

<sup>1</sup>Department of Forest and Soil Sciences, Institute of Silviculture, University of Natural Resources and Life Sciences, Vienna (BOKU), Peter Jordan Straße 82, 1190 Vienna, Austria. \*Jiangsan.zhao@boku.ac.at

<sup>2</sup>Producción Vegetal, E.T.S. Ingeniería Agronómica, Universidad Politécnica de Cartagena, 30203 Cartagena, Spain

<sup>3</sup>Department of Crop Sciences, Division of Agronomy, University of Natural Resources and Life Sciences, Vienna (BOKU), Konrad-Lorenz-Strasse 24, 3430, Tulln, Austria

Plant nutrient status is often highly correlated with AMF and *Rhizobia* sp. symbionts. In order to determine how symbionts effect plant nutrient status, a growth chamber experiment with six inoculation treatments, i.e. control, bacteria1, bacteria2, AMF, combination of both bacteria and AMF, and combination of both bacteria was established using *Pisum sativum* cultivars as model species. Principal component analysis (PCA) is a multivariate analysis which has been widely used in research. However, PCA is mostly treated as a dimension reduction method: to retain the few top principal components (PCs) explaining most of data variance while leaving the rest of PCs behind. In this methodological study we describe how we combined the information of all the PCs and used it for further k nearest neighbor (k-NN) classification. The accuracies of classifications based the combinations derived from all PCs were increased compared to those based on original variables. We show that the important variables contributed to the highest classification were not only those top few PCs but also many PCs containing little variance of data. Including trait combinations derived from all PCs thus tend to be more powerful than restricting analyses to the top PCs in revealing treatment effects on plant nutrient status and other analysis. The project received funding from the EU 7<sup>th</sup> FP for research, technological development and demonstration under grant agreement #613781 (EUROLEGUME).

## **HISTORIC TRANSLOCATION OF LARIX DECIDUA IN THE CARPATHIANS REVISITED: A MOLECULAR ANALYSIS**

Hannes Raffl, Heino Konrad, Thomas Geburek

Austrian Research Centre for Forests (BFW), Institute of Forest Genetics, Vienna, Austria.

European larch (*Larix decidua* Mill.) has been always an important forest tree due to its timber and turpentine as well as for its shingles. Hence, it was one of the favoured tree species heavily planted between the 17<sup>th</sup> and the early 20<sup>th</sup> century. After the second half of the 19<sup>th</sup> century the rapid establishment of the railway system in Central and Northern Europe enhanced the trade with forest plant material and also triggered the cultivation of larch especially outside its native range. Subsequently the native area of *L. decidua* has been more than doubled and nowadays the species is found throughout the temperate zone of Europe.

From the forelands of the Alps and Carpathians, which represent the main refugia of European larch during the last glacial period, it re-colonized its native range (Alps, Carpathians, Sudetes, Poland) forming different ecotypes. These ecotypes are differentiated at the morphological, ecophysiological, and molecular level.

For the first time larch plant material originating from the Alps translocated to the Carpathians has been studied on a molecular basis in forest stands. We focused on the native range of larch in the Southern and Eastern Carpathians, which were strongly affected through a plant transfer, especially from Tyrol. Therefore, we sampled cambium or needle material from 16 *L. decidua* populations from Tyrol (North and South Tyrol) and Romania (Vâlcea - Prahova - Braşov –County) and analysed the genetic structure by using 13 highly polymorphic nuclear microsatellite loci.

We compared obtained genetic structures with several population-genetic statistics made available by different computer programmes (STRUCTURE, Fstat, SPAGeDI etc.) in order to assess (1) whether the approach taken can confirm a translocation in presumptive affected larch stands in Romania and (2) to quantify the extent of the translocation within single stands.

In particular forests in Transylvania and along the Prahova River were affected probably starting in the middle of the 19<sup>th</sup> century by Tyrolean seed sources. However, as Tyrolean seed sources are not strongly differentiated the exact region of origin must remain open.

## REVEALING PATTERNS IN BIODIVERSITY AND ECOSYSTEM FUNCTIONING IN ECTOMYCORRHIZAL COMMUNITIES IN EUROPEAN FORESTS

Christoph Rosinger, Bradley Matthews, Mathias Mayer, Hans Sandén, Douglas L. Godbold

Institute of Forest Ecology, Department of Forest- and Soil Sciences, University of Natural Resources and Life Sciences Vienna, Peter Jordan Straße 82, 1190 Vienna, Austria.

Ectomycorrhizal fungi are pivotal drivers of ecosystem functioning in temperate and boreal forests. They are an important pathway of plant-derived carbon into the soil and facilitate nitrogen and phosphorus acquisition. Species richness of ectomycorrhizal fungi is vast and contrasts with the low tree species richness in temperate and boreal forests. However, the mechanisms that drive ectomycorrhizal community composition and structure are still subject to discussion. We investigated the structural traits of ectomycorrhizal communities of three important tree species in European forests, namely *Fagus sylvatica*, *Picea abies* and *Pinus sylvestris*. A common universal pattern in the community structure with a small number of abundant taxa and a large number of rare taxa emerged. Root colonising taxa appear to be selected from a larger taxa pool in the soil. Host tree species is the most important factor shaping the ectomycorrhizal community. Superimposed upon the filtering effect of the host tree are factors such as soil properties, temperature and precipitation. Furthermore, we investigated response and effect traits of ectomycorrhizal species. We found that abundant ectomycorrhizal species show broad ranges for all the environmental parameters that we examined, while rare species exhibit narrow niche breadths for certain environmental factors. Our dataset further allowed a more detailed examination of rare ectomycorrhizal species. Rarity occurs as (i) low abundance at one site and (ii) low frequency across numerous sites. We suggest that rare taxa are maintained by the high dynamics of the root system through root turnover, with exchange of C for nutrients further acting as a mechanism of functional selection.

## **INFLUENCE OF PHOTOPERIOD AND CHANGING TEMPERATURE CONDITIONS ON THE DEVELOPMENT AND OVERWINTERING BEHAVIOUR OF THE LARCH BARK BEETLE, *IPSCEMBRAE* HEER. (COL., SCOLYTINAE)**

Gerlinde Weizer, Martin Schebeck, Axel Schopf

Institute of Forest Entomology, Forest Pathology and Forest Protection, Department of Forest- and Soil Sciences, University of Natural Resources and Life Sciences Vienna, Peter Jordan Straße 82, 1190 Vienna, Austria.

The European larch bark beetle, *Ips cembrae*, attacks larch trees and occasionally stone pine (*Pinus cembra* L.) in all age classes and occurs in central Europe from lowlands to the timberline in the alpine region. In context with climate change, this bark beetle species may become more and more economically important in future forestry. In order to develop a monitoring and risk assessment programme for this species, we investigated its development under changing temperature and photoperiod conditions. Based on these results we determined the effective temperature sum necessary for the development of one generation. In particular, the maturation process of young female beetles under various rearing conditions was studied.

Since the beetle's overwintering behaviour was insufficiently studied, we investigated the mortality rate and frost resistance in different developmental stages under lab and field conditions during the winter period.

*I. cembrae* is a frost intolerant insect. Nevertheless, the results show a significant correlation between frost resistance and temperature conditions in the environment. The results further show a difference between the super cooling points for the developmental stages of *I. cembrae*. The pupae had a lower SCP than adult beetles. From January to February, the super cooling point of adult beetles shows a decrease in their frost resistance.

First results regarding the development of these bark beetles reveal that the time of hatching and maturation of the females ovaries depend significantly on photoperiod and temperature conditions. Temperature alone had no effect on the maturation process in female beetles after overwintering.

## CONSTITUTIVE DEFENCES AND INDUCED WOUND RESPONSES OF SPRUCE AFTER A SAWFLY INFESTATION IN THE WALDVIERTEL, LOWER AUSTRIA

Bernhard Schmieder, Sigrid Netherer, Christa Schafellner

Institute of Forest Entomology, Forest Pathology and Forest Protection, Department of Forest- and Soil Sciences, University of Natural Resources and Life Sciences Vienna, Peter Jordan Straße 82, 1190 Vienna, Austria.

The sawfly *Cephalcia abietis* (Hym., Pamphiliidae) is a forest pest of Norway spruce. In 2013, a mass outbreak with severe feeding damage was observed in a mature spruce stand near Zwettl. From 2014 onwards, sawfly population densities and development of the resting larvae (nymphs) in the soil were recorded to predict the next swarming year. The population had a 3-year generation cycle, mass swarming occurred in June 2016, however, the feeding damage was much less severe than in 2013.

Spruce trees that suffer from heavy needle loss are supposed to have reduced defenses and become more vulnerable to secondary forest pests such as bark beetles. By contrast, moderate feeding damage may increase the defense rates of trees. In this study we determined the resin flow of 32 spruce trees before and after inoculation of the trees with the blue-stain fungi *Endoconidophora polonica*, *Grosmannia penicillata* and *Leptographium* sp. The two former species were originally isolated from *Ips typographus*, the latter from *Pityogenes chalcographus*.

Resin flow of sample trees was recorded twice (summer and autumn 2016) overnight by inserting two glass tubes into holes cut with a cork borer on opposite sides of the stem. For fungal inoculations, an inoculum was inserted into a small hole in the bark. Each tree received 2 inoculations/fungus and 2 control inoculations (sterile agar). The inoculations were distributed in two rings encircling the trunk, with each fungus occurring once in each ring. After 6 weeks the necrotic lesions were measured. Additionally, development status, vitality and energy budgets of newly-burrowed and older nymphs from the soil were analyzed.

Resin flow rates increased from 1.34 mm<sup>3</sup>/h before to 2.23 mm<sup>3</sup>/h after the inoculation, which indicates that the tree defenses were activated by inoculation. *Grosmannia penicillata* induced the largest wound reaction zones of all fungi tested; there were no significant differences among the trees.

## **UNTERSUCHUNGEN ZUM AUSBREITUNGSVERHALTEN DES BUCHDRUCKERS (COL., SCOLYTINAE) IM WILDNISGEBIET DÜRRENSTEIN**

Roland Paumann, Axel Schopf

Institut für Forstentomologie, Forstpathologie und Forstschutz, Department für Wald- und Bodenwissenschaften, Universität für Bodenkultur Wien (BOKU), Peter Jordan Straße 82, 1190 Wien, Österreich.

Um das Dispersionsverhalten des Buchdruckers (*Ips typographus*) in Abhängigkeit von Geländegegebenheiten und Windströmungen zu untersuchen, wurde 2016 um eine Ausschlüpfstelle der Käfer konzentrisch angebrachte Pheromonfallen in unterschiedlichen Abständen aufgestellt, die als Auffangeinrichtung der Tiere dienten. Um ein einwandfreies Erkennen der aus den Versuchsstämmen schlüpfenden Käfer zu ermöglichen, wurden die besiedelten Stämme vor dem Ausschluß der Käfer mit fluoreszierender Farbe behandelt. Somit war ohne Manipulation der Käfer gewährleistet, dass sich diese beim Verlassen der Stämme selbst markierten. Um die vorherrschenden Windbedingungen im Gelände zu erfassen, wurden an sechs Positionen hochauflösende Ultrasonic-Windmesser verwendet. Für das Monitoring der Entwicklung des Borkenkäfers diente das Phänologie-Modell „PHENIPS“.

Im Untersuchungsgebiet entwickelten sich 2016 zwei Buchdrucker-Generationen inklusive Geschwisterbruten, wobei die 2. Geschwisterbrut-Generation nur unter optimalen Bedingungen das überwinterungsfähige Adultstadium erreichte. Insgesamt wurden 1946 mit Farbstoffpulver markierte Käfer gefangen, was einer Wiederfangrate von nur ca. 3% der ausgebohrten, markierten Buchdrucker von der Ausschlüpfstelle entspricht. Dabei wurden 95% der gefangenen Käfer in einem Umkreis von 350 m gefangen. Der Hauptteil der Fänge war auf wenige Wochen konzentriert und von Lufttemperatur, Niederschlagsereignissen und Photoperiode abhängig. Im möglichen Schwärmzeitraum zwischen 09:00 und 19:00 Uhr überwiegen Windrichtungen aus Südwest (15%), Südsüdwest (14%) und Süd (12%) bei zumeist niedrigen Windgeschwindigkeiten (72% der im Intervall von 10 min. durchgeführten Windmessungen wiesen Werte von < 1 m/s auf). Hingegen waren solche Windgeschwindigkeiten, bei denen der Buchdrucker laut Literatur nicht mehr gegen den Wind anfliegt (> 2 m/s) und damit einem Pheromon-Duftstoffgradienten entsprechend folgen konnte, sehr selten (2% der Messungen).



## Poster presentations – Master and PhD students

### Section Soil Research

#### Poster 1

### **INFLUENCE OF SOIL CHARACTERISTICS ON PHOSPHORUS EXTRACTABILITY ASSESSED BY DIFFERENT EXTRACTION METHODS**

Robert Manglberger<sup>1</sup>, Jakob Santner<sup>2</sup>, Markus Puschenreiter<sup>1</sup>

<sup>1</sup>Department of Forest and Soil Sciences, Institute of Soil Research, University of Natural Resources and Life Sciences, Vienna (BOKU), Konrad-Lorenz-Strasse 24, A-3430, Tulln, Austria

<sup>2</sup>Department of Crop Sciences, Division of Agronomy, University of Natural Resources and Life Sciences, Vienna (BOKU), Konrad-Lorenz-Strasse 24, A-3430, Tulln, Austria

The use of mineral phosphate fertilizers constitutes an integral part of modern agriculture. Due to the limited availability of mineral phosphate resources (“peak phosphorus”), it becomes evident that a more sustainable use of P fertilizers is urgently needed. Furthermore, economical and especially the ecological implications of its misuse are profound.

Optimization of P fertilization is largely depending on the accurate determination of plant-available phosphorus in the soil. Nowadays numerous measurement techniques are in use in different countries and it is challenging to compare them to each other. The basic principle of these techniques is always the extraction of soil-P with the help of chemical reagents. The amount of P extracted with these techniques has typically a weak correlation with plant P concentrations and/or yield.

To improve the determination of plant available phosphorus in arable soils and the derived fertilizer recommendations, the establishment of a new sampling method is highly required. The proposed work attempts to clarify if the diffusive gradients on thin films-technique (DGT) is a suitable means to predict plant-available P in a wide range of soils. The further aim is to unravel the influence of soil characteristics on the extractability of P with the use of the DGT technique in comparison to conventional extraction techniques. Thus, DGT measured labile soil P will be compared with P values obtained from conventional standard extraction techniques such as the Olsen- or Mehlich 3-method.

For this aim 41 Austrian soil-samples covering a large variety of soil-types and P concentrations are currently analyzed in order to assess their main characteristics as well as the different extractable P fractions that were described above. The influence of soil characteristics on extractable P will be assessed statistically with multiple regression analysis and a principal component analysis (PCA). Finally, a plant-experiment will be conducted to compare the predictability of plant P uptake and yield between conventional extraction methods and the DGT approach.

*Poster 2*

**CANCELLED**

## PHOSPHORUS AVAILABILITY FROM RECYCLED AND CONVENTIONAL FERTILIZERS APPLIED IN GRANULATED FORM

Andreas Füssl<sup>1</sup>, Olivier Duboc<sup>1</sup>, Jakob Santner<sup>2</sup>, Franz Zehetner<sup>3</sup>, Walter W. Wenzel<sup>1</sup>

<sup>1</sup>Department of Forest and Soil Sciences, Institute of Soil Research, University of Natural Resources and Life Sciences, Vienna (BOKU), Konrad-Lorenz-Straße 24, A-3430, Tulln, Austria. \*Andreas.fuessl@boku.ac.at

<sup>2</sup>University of Natural Resources and Life Sciences, Division of Agronomy, Konrad-Lorenz-Straße 24, 3430 Tulln, Austria.

<sup>3</sup>University of Natural Resources and Life Sciences, Vienna, Institute of Soil Research, Peter Jordan Straße 82, 1190 Vienna, Austria.

Due to the need to recycle Phosphorus (P), an increasing variety of products is becoming available as potential fertilizers, produced from various residual P streams. Moreover, testing their P availability with traditional extractions is inaccurate, hence, more process-based testing methods are required. Our previous experiments have shown that to predict plant P availability from different recycled fertilizers, ion sink methods were superior to conventional extractions.

Farmers commonly apply their fertilizers in granular form in the field. But most of the former research on struvite and other new fertilizers tested fertilizer powder mixed homogeneously with the soil. The present work will set the basis for an experiment in which the effect of fertilizer application (homogeneous vs. spot-applied) will be assessed on a set of contrasting P fertilizers.

First, we will perform a 6-week dose response pot experiment in order to determine the optimal P fertilization rate for fertilizer comparison. Ten rye seedlings (*Secale cereale* L.) will be planted in 1 kg pots and fertilized at 0 – 200 mg P with monocalcium phosphate ( $\text{Ca}(\text{H}_2\text{PO}_4)_2$ ) which will be spot-applied in order to simulate granules.

Secondly, the availability and solubility of P in about 15 recycled products will be analyzed. Total P content will be determined using aqua regia digestion, available P will be assessed using an ion sink extraction with ferrihydrite (the “iron bag” method) and with a  $\text{H}_2\text{O}$  extraction. Furthermore, the diffusive gradients in thin film technique (DGT) will be performed on fertilized soil. On the basis of those results a set of suitable fertilizers can be chosen for a main pot experiment which will be performed later this year.

## INVESTIGATION OF MICROBIOLOGICAL PARAMETERS OF SOILS FROM THE GALAPAGOS ISLANDS

Armin Bajraktarevic, Katharina Keiblinger, Axel Mentler, Martin Gerzabek, Franz Zehetner

Department of Forest and Soil Sciences, Institute of Soil Research, University of Natural Resources and Life Sciences, Vienna, Peter Jordan Straße 82, 1190 Vienna, Austria.

This Master thesis project is being conducted on soil samples from the Galápagos Islands, which are located at the equator and characterized by diverse volcanic parent materials and pronounced climatic gradients. Agricultural activities on some of the islands have severely altered the natural ecosystems, and the pressure of invasive species like *Rubus niveus* (blackberry) has increased dramatically and represents a problem for the conservation of the natural ecosystems. In this Master thesis, soil microbiological parameters are being analyzed for different settings and following different research topics. The analyzed parameters include microbial biomass and respiration, enzyme activities as well as other soil characteristics, i.e. OC, pH, DOC, ammonium and nitrate content. The research topics are: (1) Two very contrasting soil parent materials, i.e. rhyolitic pumice and basaltic lava, are found in close proximity on Isabela Island; it will be analyzed how these lithological differences affect the soils' microbiology. (2) The soils from intensively managed agricultural fields are compared to soils from nearby natural forests on San Cristóbal and Santa Cruz Islands. (3) *Rubus niveus* has become a strong competitor for the endemic flora in the Scalesia forests of Santa Cruz Island, and the Galápagos National Park authorities have developed and tested different strategies to combat this invasive plant, notably manual removal and herbicide treatment. Three treatments (control, manual removal and herbicide) and an additional herbicide trial with 3 sampling campaigns (before application, 20 hours and 3 weeks after application) are compared in terms of their effects on soil microbiology. Here, the background and experimental setting as well as preliminary results will be presented.

## **COMBINED EFFECTS OF ELEVATED ATMOSPHERIC CO<sub>2</sub> AND TEMPERATURE LEVELS ON THE N<sub>2</sub>O AND CH<sub>4</sub> FLUXES IN A MANAGED ALPINE GRASSLAND DURING A SIMULATED DROUGHT PERIOD**

Alexandre Fahringer, Sophie Zechmeister-Boltenstern, Katharina Keiblinger, Eugenio Diaz-Pines, Evi Deltedesco

Department of Forest and Soil Sciences, Institute of Soil Research, University of Natural Resources and Life Sciences, Vienna, Peter Jordan Straße 82, 1190 Vienna, Austria.

As a consequence of the steadily increasing atmospheric CO<sub>2</sub> concentrations, most climate scenarios predict a significant enhancement of air temperature, as well as a rise in the frequency and the intensity of extreme weather events (i.e. drying-wetting cycles). The “ClimGrass” research facility in Raumberg-Gumpenstein (Styria) was established in 2014 and it is used to study the ongoing effects of warming, elevated atmospheric CO<sub>2</sub> concentrations and water stress on the greenhouse gas balance, the soil microbial community structure and function (including N cyclin) in a subalpine, managed grassland.

The aim of this thesis is to investigate the in situ N<sub>2</sub>O and CH<sub>4</sub> production and consumption rates in different soil depths in plots under ambient conditions, under elevated (“extreme”) CO<sub>2</sub> (+300 ppm) and temperature (+3 °C) conditions. Half of these plots will be placed under a rainout-shelter to simulate a drought event subsequently followed by an episodic precipitation event. Further, the observation period will include a grass mowing and a fertilization event, as they are common management practices on these ecosystems. The measurements will be performed with a Los Gatos Research quantum cascade laser system which can measure concentrations of CH<sub>4</sub> and N<sub>2</sub>O very sensitively. In the plots under investigation, greenhouse gas porous tubing has been installed at different depths, which will enable the measurements of concentrations of CH<sub>4</sub> and N<sub>2</sub>O at different soil depths. This will be complemented with static chamber measurements to assess the net soil-atmosphere exchange rate of CH<sub>4</sub> and N<sub>2</sub>O. Additional microdialysis will be implemented on all plots to measure plant-available N forms (NH<sub>4</sub><sup>+</sup>, NO<sub>3</sub><sup>-</sup>).

## **CALIBRATION OF DIFFUSIVE GRADIENT IN THIN FILMS (DGT) AS SOIL TEST FOR PHOSPHORUS USING SWEDISH LONG-TERM EXPERIMENTS**

Eric John Florida<sup>1\*</sup>, Maria C. Romic<sup>2</sup>, H. Kirchmann<sup>3</sup>, Walter W. Wenzel<sup>1</sup>

<sup>1</sup>Department of Forest and Soil Sciences, Institute of Soil Research, University of Natural Resources and Life Sciences, Vienna (BOKU), Konrad-Lorenz-Strasse 24, A-3430, Tulln, Austria; \*ericjohn.florida@gmail.com

<sup>2</sup>Department of Soil Amelioration, Faculty of Agriculture, University of Zagreb, Svetošimunska cesta 25, 10000 Zagreb, Croatia

<sup>3</sup>Department of Soil and Environment, Faculty of Agriculture, Swedish University of Agricultural Sciences, P.O.Box 7014, SE-75007 Uppsala, Sweden

Availability of soil nutrient elements for plant uptake is greatly dependent on the physico-chemical properties of the soil at a particular site. At present, many methods for soil nutrient analysis do not represent natural transport process which generally governs the availability of nutrient elements for plant uptake in the soil. Furthermore, large amount of nutrient elements in the chemical analysis using conventional method does not necessarily imply that, these are available for root uptake.

Thus, a study is conducted which aims at creating natural scenario of nutrient transport and root absorption in the soil. The Diffusive Gradient in Thin Gel (DGT) will be used in the experiment. DGT works by mimicking nutrient uptake by roots in the soil. Using several long-term field experiments established on different soils in Sweden, including treatments with mineral P fertilizer and livestock manure application with autumn wheat as experimental crop we will measure DGT-available P on archived soil samples and compare the results to conventional P analysis (AL extraction, water extraction). Correlation and regression analysis will be performed to evaluate the predictive power of DGT versus conventional extraction techniques for the actual yield of the autumn wheat crops. We hypothesize that DGT generally performs better in predicting yields as compared to soil extraction techniques, and that the advantage of DGT becomes even more pronounced if different soils are included.

## **ASSESSING PHOPHORUS AVAILABILITY WITH DGT IN ORGANICALLY AND CONVENTIONALLY FARMED SOILS**

Anne Gamper<sup>1\*</sup>, Jürgen K. Friedel<sup>2</sup>, Walter W. Wenzel<sup>1</sup>

<sup>1</sup>Department of Forest and Soil Sciences, Institute of Soil Research, University of Natural Resources and Life Sciences, Vienna (BOKU), Konrad-Lorenz-Strasse 24, A-3430, Tulln, Austria. \*anne.gamper@students.boku.ac.at

<sup>2</sup>Department of Sustainable Agricultural Systems, Division of Organic Farming (IFÖL), University of Natural Resources and Life Sciences, Vienna (BOKU), Gregor-Mendel-Strasse 33, A-1180, Wien Austria.

Plants take up phosphorus (P) as inorganic orthophosphate while organic P becomes only available after mineralization by microorganism. Organic P ranges up to about 40-60% of the total P in mineral soils, and especially in organic farming systems, P mineralization is deemed to constitute an important source for the P nutrition of the crops.

The method of diffusive gradients in thin films (DGT) has gained increasing attention in soil and rhizosphere research, because of its ability to predict ion availability in soils. It is based on diffusion of P along the diffusive gel and the fixation on the phosphate-binding-layer (ferrihydrite-containing polyacrylamide hydrogel). As DGT measures diffusional fluxes and the resupply of ions from the solid phase, it can serve as a mechanistic surrogate of plant uptake of diffusion-limited nutrients such as P. As shown in various studies, it therefore typically performs better than equilibrium-based chemical extraction for predicting plant-available P in soil and related fertilizer requirements.

However, the short-term deployment (24 hours) is likely to exclude most of the contribution of P mineralization from organic sources that may become available during the life-time of a crop.

Here we investigate the potential contribution of organic P by comparing P uptake in DGT deployments during the incubation (20°C) of sterilized (with mercuric chloride, HgCl<sub>2</sub>) versus non-sterilized arable mineral topsoils (Ap horizons) for several days to weeks. We hypothesize that considerably more DGT-labile P is released in the non-sterilized treatments. The results will be used to determine optimal incubation times for routine application of the method.

In a second step we will apply the optimized approach to pairs of organically (extended crop rotation of eight to ten years, green manure, no fertilizer) and conventionally (synthetic fertilizer) farmed Ap horizons (Chernozems / Phaeozems, Gleyic Phaeozems, Fluvisols) from the Tullnerfeld region to test the hypothesis that organic farming may considerably increase the potential supply of P from organic sources.

## NUTRIENT RECYCLING FROM DIVERSE SOURCES OF BIOWASTE

Sarah Pienisch<sup>\*</sup>, Olivier Duboc<sup>1</sup>, Niklas Lehto<sup>2</sup>, Walter W. Wenzel<sup>1</sup>, Brett Robinson<sup>2</sup>

<sup>1</sup>Department of Forest and Soil Sciences, Institute of Soil Research, University of Natural Resources and Life Sciences, Vienna (BOKU), Konrad-Lorenz-Strasse 24, A-3430, Tulln, Austria. \*sarah.pienisch@students.boku.ac.at

<sup>2</sup>Faculty of Agriculture and Life Science, Department of Soil and Physical Science, Lincoln University, PO Box 85084, Lincoln 7647, Canterbury, New Zealand

Extensive evidence has shown that nutrients including global phosphorus are limited, hence the need to recycle biowastes such as animal manures, slaughterhouse waste and sewage sludge.

In this research, I would like to use different methods aiming to separate the nutrients and pollutants from diverse biowaste sources to make biowaste available for products such as fertilizer in organic farming.

After collecting biowaste samples including biogas slurry, pig waste and struvite the samples were carbonised by using hydrothermal carbonisation (HTC). Following the samples were looked at under a digital microscope to compare two stages of the samples, one being the feedstock - and the other the hydrochar stage. With this method, visual pore distribution and size evaluation was estimated. In the next phase of the research X-ray fluorescence and total element analysis will be conducted to determine both total element content (in % range) including Si, Fe, Al, Ca, K, Mg, Na, P, and  $C_{org} / C_{min}$ , H, N, S. The general aim of this study is to make nutrients available as fertilizer without containing potential contaminants such as trace metals, organic pollutants and pathogens.

Preliminary results from the microscope analysis indicate that in general increasing HTC temperature, pressure and / or processing time results in smaller, more homogeneous particle size and apparently also increased abundance of smaller pores as compared to the unchanged feedstock. Furthermore, the observed samples decrease in particle size with increased intensity of HTC treatment which simultaneously means that increased surface area may be considered beneficial for its use as carrier of nutrients or other compounds.



## **SOIL DEGRADATION UNDER DIFFERENT AGRICULTURAL PRACTICES IN THE DESERTIFIED AREA OF BINH THUAN, VIETNAM**

Alena Rabitz, Sophie Zechmeister-Boltenstern, Axel Mentler

Institute of Soil Research, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna, Peter Jordan Straße 82, 1190 Vienna, Austria.

Land degradation caused by human impacts and climatic factors leads to desertification and results in loss of soil fertility, increased salinization, wind and water erosion as well as a reduction of vegetation cover followed by socioeconomic problems. Furthermore, there is also an effect on the water cycle, the biogeochemical cycle and the climate. Especially land use practices like non-adjusted agricultural methods, overgrazing and degradation of the vegetation cover through deforestation are main driving forces for desertification.

The aim of this Master's Thesis is to examine how different land use practices influence soil fertility. Moreover, it will be explored if there are farms in the area that approach forms of sustainable agriculture and if their fields are less vulnerable to soil degradation than at farms with conventional agricultural practices. Soil analyses at different field sites, including peanut, dragon fruit, dragon fruit intercropped with peanut and barren land were combined with a socio-scientific survey based on quantitative interviews. For evaluating the extent of applied sustainable practices of the farms in the research area a SWOT analysis was conducted.

The research area was situated in Binh Thuan Province in the South of Vietnam and is characterised by soils of very low soil fertility as well as hot and dry climate what complicates agricultural production. In order to improve soil fertility and subsequently crop yields and economic development in the coastal area sustainable management practices are needed. Soil samples were taken two times on one field – close to the plant and inbetween – in a depth of 0 – 100 cm on red and white sandy soil to analyse total organic Carbon (TOC), total Nitrogen (TN) and salt content as well as other soil parameters to determine soil fertility.

First results show that most farms usually combine conventional farming with different sustainable agricultural practices. The concentrations of the measured soil parameters are highest at the dragon fruit area. In addition there is a significant correlation between the distance to the plant and TN, dissolved organic Carbon (DOC) as well as salt content. Furthermore the concentration decreases with depth.

To sum up, desertification due to human impacts and climate change is an ongoing local and global problem. For that reason, agricultural practices adapted to environmental conditions become even more important and should be accelerated even in the frame of the SDGs (Sustainable development goals).

## IMPACTS ON *CERTHIDEA OLIVACEA*'S DIET AND TROPHIC RELATIONS DUE TO INVASIVE SPECIES CONTROL IN THE *SCALESIA* FOREST, GALAPAGOS

Ingrid Rabitsch<sup>1</sup>, Sophie Zechmeister-Boltenstern<sup>1</sup>, Sabine Tebbich<sup>2</sup>, Marcela Suarez-Rubio<sup>3</sup>, Karen Armstrong<sup>4</sup>, Rebecca Hood-Nowotny<sup>1</sup>

<sup>1</sup>Institute of Soil Research, Department of Forest- and Soil Sciences, University of Natural Resources and Life Sciences Vienna, Peter Jordan Straße 82, 1190 Vienna, Austria.

<sup>2</sup>Department of Behavioural Biology, University of Vienna

<sup>3</sup>Institute of Zoology, University of Natural Resources and Life Sciences, Vienna

<sup>4</sup>Bio-Protection Research Centre, Lincoln University.

A number of Darwin's finches in the Galapagos Islands have been affected by the presence of exotic invasive fly species, *Philornis downsi*, which parasitizes the hatchlings and causes high mortality. Moreover, the finches' native habitat, *Scalesia* forest, has been heavily invaded by a raspberry species *Rubus niveus*. The administration of the Galapagos National Park together with collaborative research teams have been developing measures to control these invasive species. Three areas have been set-up to test the impact of specific *Rubus* management strategies resulting in three treatment areas of different control intensity (C1, C3, SC, *Rubus* removed for one year, three years and without removal respectively). In this research, we set out to track the consequent changes in the dietary resources used and available to the Warbler Finch (*Certhidea olivacea*), across the breeding season (start and finish) and these treatments using traditional and stable isotope approaches. We analysed nitrogen ( $\delta^{15}\text{N}$ ) and carbon ( $\delta^{13}\text{C}$ ) in the birds' blood as indicators of resource use change and arthropod samples as indicators of the potential diet available. We aim to determine whether the birds exhibit dietary dependence on what is available or whether there is some selectivity and choice according to the availability and the quality of food. We also set out to investigate how the quality of the food-resource (arthropods) is in turn influenced by the quality of the vegetation and the precipitation. Preliminary results suggest that the *Rubus* management "treatment" affects the finches' nutrient intake significantly. Although, changes in carbon are significant throughout seasons. In the blood samples, higher values are shown for nitrogen at the beginning of the season, in the area where the removal of *Rubus* has been applied for a longer time. However, larger isotope variability in the area without *Rubus* removal, suggests dietary plasticity in terms of selection and diversity of prey. Indeed the arthropod samples showed greater variability, suggesting a higher diversity of arthropod components. There is evidence, from the isotopic signatures, that individuals belong to different levels of the trophic chain. Finally, we analysed arthropod orders individually to see which ones are closer to the birds' blood signatures. From our results, it seems that Aranea, Hemiptera, Hymenoptera, Lepidoptera and Orthoptera are dominant components of the Warbler finch diet.

## **EFFECT OF ENVIRONMENTAL FACTORS AND LANDUSE ON SILICON FRACTIONS IN LOWER AUSTRIAN SOILS**

Johanna Reiter<sup>1\*</sup>, Anna Schiefer<sup>1\*</sup>, Markus Puschenreiter<sup>1</sup>, Walter W. Wenzel<sup>1</sup>

<sup>1</sup>Department of Forest and Soil Sciences, Institute of Soil Research, University of Natural Resources and Life Sciences, Vienna (BOKU), Konrad-Lorenz-Strasse 24, A-3430, Tulln, Austria. \*johanna.reiter@students.boku.ac.at;

\*schiefer.anna@students.boku.ac.at

Silicon (Si) has received increasing retention as plant nutrient during the last few years. Research has shown that Si is a very important factor for plant health and plant growth. Information about the Si concentrations in Austrian soils is not available apart from recent master thesis conducted in our research group.

To get information about the Si status of the Lower Austrian soils a comparison between 200 resampled soils (taken between November 2016 and March 2017) and 200 soil samples taken 20-30 years ago by the Austrian soil mapping services at the same locations is being made.

The focus of our research lies on measuring potentially plant-available and amorphous Si fractions in arable, grassland and forest soils from Lower Austria. The plant-available Si is being extracted with a diluted CaCl<sub>2</sub> solution (Haysom and Chapman, 1975), the amorphous Si with NaOH (Georgiadis et al., 2015). The Si concentrations are measured using the molybdenum blue method and spectrophotometry (Morrison and Wilson, 1963).

Furthermore the organic carbon content and pH of the resampled and the archived soils will be measured.

We hypothesize that the Si concentrations in Lower Austrian topsoils on average have been decreasing due to soil management practices resulting in exports exceeding the imports of Si to managed soils. We also expect distinct differences in plant-available Si concentrations in soils under different general land use regime (arable versus grassland) and among different soil groups (reflecting the impact of weathering intensity, organic matter, carbonate content). Our hypotheses will be tested using multiple correlation and regression analysis.

## DEVELOPMENT OF METHODS TO TEST SILICON CONCENTRATION AND AVAILABILITY IN RECYCLED FERTILIZERS

Anja Robbe\*, Olivier Duboc<sup>1</sup>, Walter W. Wenzel<sup>1</sup>

<sup>1</sup>Department of Forest and Soil Sciences, Institute of Soil Research, University of Natural Resources and Life Sciences, Vienna (BOKU), Konrad-Lorenz-Strasse 24, A-3430, Tulln, Austria. \*anja.robbe@gmx.at

Silicon (Si) has- although not essential- many positive effects on plant growth like higher yield or resistance to several stresses (drought, salinity etc.). The use of mineral Si fertilizers like wollastonite (a calcium silicate) is widespread but it is only sparingly soluble and therefore has low plant availability.

Different industrial and agricultural wastes may offer a more cost-efficient and renewable alternative, but to date there exists no single extraction technique for a realistic indication of plant availability of Si from such heterogeneous resources. An ion sink technique with ferrihydrite (“iron bag” method) was shown in our previous work to give good indication of phosphorus bioavailability from different recycled fertilizers, and a preliminary experiment suggested that this method could function similarly for Si. A particular aspect of this work will be to investigate solubility and plant availability of Si in rice straw and rice straw biochars in relation to increasing pyrolysis temperature.

To this effect we will conduct a 10-week pot trial with rye (*Secale cereale L.*) and 11 Si-bearing fertilizers and relate the results to several Si-solubility tests. Silicon concentrations in the extracts will be measured with spectrophotometry.

The aim is to investigate (1) whether the iron bag method determines the Si-uptake of plants from different fertilizers better than existing extraction methods and (2) how straw pyrolysis temperatures affect the Si availability to plants.

## ORGANIC ACID-INDUCED SOLUBILIZATION OF NICKEL AND OTHER METALS IN SERPENTINE SOILS

Stefanie Vietz<sup>\*</sup>, Markus Puschenreiter<sup>1</sup>, Walter W. Wenzel<sup>1</sup>

<sup>1</sup>Department of Forest and Soil Sciences, Institute of Soil Research, University of Natural Resources and Life Sciences, Vienna (BOKU), Konrad-Lorenz-Strasse 24, A-3430, Tulln, Austria. \*s.vietz@aon.at

Contamination of Nickel and other heavy metals caused by industry and other human activities is a very important issue. To deal with these contaminations a lot of effort was put into soil remediation. A promising approach is phytoremediation, whereby hyperaccumulating plants are used to absorb contaminations e.g. Nickel and other metals from the soil.

In regions with high Nickel concentrations it is very likely to find specific species of plants e.g. *Alyssum murale*. These plants have distinctive characteristics which enable them to accumulate Nickel in concentrations that would be toxic for other species. Metal hyperaccumulators release a mix of organic acids into the soil to mobilize nutrients, metals and trace elements. The efficiency of single or combined organic acid compounds is insufficiently known.

To investigate the efficiency of the two organic acids citric acid, oxalic acid and the combination on the solubilization of Nickel and other trace elements in serpentine soils, two different experiments with three different soil types (serpentine rock, serpentine soil and arable soil with serpentine properties) were conducted. The first experiment was a time-dependent extraction and the second experiment was a concentration-dependent extraction.

## TREE-RING EVIDENCE OF SPRUCE SAWFLY OUTBREAKS IN THE NORTHERN PREALPINE LOWLANDS OF AUSTRIA AND BAVARIA

Thomas Disep, Christa Schafellner<sup>1</sup>, Arne Nothdurft<sup>2</sup>

<sup>1</sup>Institute of Forest Entomology, Forest Pathology and Forest Protection, Department of Forest- and Soil Sciences, University of Natural Resources and Life Sciences Vienna, Peter Jordan Straße 82, 1190 Vienna, Austria.

<sup>2</sup>Institute of Forest Growth, Department of Forest- and Soil Sciences, University of Natural Resources and Life Sciences Vienna, Peter Jordan Straße 82, 1190 Vienna, Austria.

Insect feeding during mass outbreaks can severely affect tree growth and forest production. Tree ring analysis is a suitable tool for measuring growth reduction and an indicator of past environmental stress (e.g. drought) or insect attack.

Several spruce sawfly species are monophagous defoliators of Norway spruce. During the past decades, outbreaks of *Pristiphora abietina* occurred frequently, but irregularly, especially in secondary spruce plantations of the prealpine lowlands in Austria and Bavaria with thousands of hectares of spruce stands severely defoliated. Surprisingly, the last outbreak from 2010-2014 was caused by *Pachynematus montanus*, while *P. abietina* remained in latency. *P. abietina* larvae feed exclusively young needles, but *P. montanus* feeds young and old needles resulting in high loss of assimilation tissue.

The aim of the present thesis is to study the impact of defoliation on tree growth during the past 70 years where data on sawfly mass outbreaks are available from stands in Upper Austria, Salzburg and Bavaria.

Field sampling will be conducted on mature spruce trees located inside and outside outbreak areas. Approximately twenty trees with similar stem diameter will be selected from each site, ten unaffected and ten previously defoliated. Two cores will be extracted at 180° from each other at breast height using an increment borer.

Drill cores will be prepared in the laboratory for optimal surface resolution to allow annual rings to be detected under the microscope. Ring width on each core will be measured to the nearest 0.001 mm. In order to remove effects of decreasing ring width with age and inter-annual variations standardization procedures will be necessary. Several statistical analyses will be conducted to determine the key features (e.g. climate signal) of each site chronology. Common environmental factors on defoliated and control chronologies will be removed to check for differences in radial growth reductions after defoliation.

## THERMAL DEVELOPMENT THRESHOLDS OF PARASITIC WASPS

Bertram Zambelli Gnocco, Christa Schafellner

Institute of Forest Entomology, Forest Pathology and Forest Protection, Department of Forest- and Soil Sciences, University of Natural Resources and Life Sciences Vienna, Peter Jordan Straße 82, 1190 Vienna, Austria.

Larvae of the gypsy moth, *Lymantria dispar*, are frequent hosts for endoparasitic wasps. In Austria, braconid wasps of the genus *Glyptapanteles* are important natural enemies of gypsy moth populations in oak forests. A recent thesis investigated the lower development thresholds of three *Glyptapanteles* species. The aim of this thesis is to get accurate data on the upper developmental thresholds, i.e. the temperatures at which development rates level off and then drop quickly near the upper limit of survival. The data will be used to provide accurate predictions of phenological events in the field.

The upper thresholds of two gregarious *Glyptapanteles* species, *G. liparidis* and *G. fulvipes*, will be determined for the endoparasitic development (egg and larval stages), pupal stage and entire development (egg to adult wasp). Wasps will develop in gypsy moth larvae parasitized as newly molted third instars. Host larvae will be kept individually in Petri dishes at constant 28°C, 32°C and 36°C under long day photoperiod (16:8 L:D) in growth chambers and provided with high wheat germ diet. For upper development thresholds of pupae, cocoons will experience the same temperature regimes as parasitized hosts. In addition, lethal temperatures will be taken into account. From the obtained data, the thermal constants (measured in degree-days) will be estimated for the immature stages and for the complete developmental cycle. Information of the lower and upper development thresholds will be incorporated in a mathematical model that predicts how long development will take at each different temperature.

Additionally, wasp lifetimes will be recorded at 28°C, 32°C and 36°C. Adult wasps will be supplied with honey and water until wasp death. For biomass determination, wasps will be sexed and males and females will be weighed. The data will give information on the effect of high temperatures on adult fitness and lifespan.

## LIFETIME REPRODUCTION, FITNESS AND LONGEVITY IN SYNOVIGENIC PARASITIC WASPS

Mario Wieser, Christa Schafellner

<sup>1</sup>Institute of Forest Entomology, Forest Pathology and Forest Protection, Department of Forest- and Soil Sciences, University of Natural Resources and Life Sciences Vienna, Peter Jordan Straße 82, 1190 Vienna, Austria.

*Glyptapanteles fulvipes* and *Glyptapanteles liparidis* (Hym., Braconidae) are gregarious, endoparasitic wasps that develop in larvae of lepidopteran species. The gypsy moth, *Lymantria dispar*, is their main host in Austria. The gypsy moth is a serious forest pest with periodic mass outbreaks. Preferred host trees are various oak species, hornbeam and beech.

The aim of this thesis is to determine and compare performance, lifetime fecundity and offspring fitness of *G. fulvipes* and *G. liparidis* wasps from parasitized third-instar gypsy moth larvae. Additionally, offspring sex ratio, wasp fresh and dry weight and energy compounds (protein, lipids, free sugars and glycogen) will be determined.

For the experiments, six newly-emerged, mated female wasps per species will be kept separated in boxes in climate chambers at constant 15°C under long-day photoperiods (16:8, L:D) and provided with honey and water. Every second day the wasps will be offered five third-instar gypsy moth larvae for oviposition until the wasps die or refuse to oviposit. The parasitized larvae will be kept in groups in Petri dishes in climate chambers at 20°C under long-day conditions and reared on high wheat germ diet until parasitoid emergence. Adult wasps that emerge from the cocoons will be immediately frozen and stored for further analyses.

The total number and sex ratio of the wasp offspring will be calculated over the wasps' whole lifespan. The biochemical parameters will be determined on individual male and female offspring from batches derived during early and late periods of the wasp mothers' lifetime. To assess the four main categories of nutrients, an assay designed for microplates will be used which allows simultaneous measurements on large sample sizes.

In a second set of experiments, the courtship behavior of the two wasp species will be recorded and analyzed from individual pairs of male and female wasps.



### **UNTERSUCHUNGEN ZUR MÖGLICHEN INTROGRESSION VON HYBRIDPAPPELGENEN IN DIE SCHWARZPAPPELPOPULATION DES NATIONALPARKS DONAU-AUEN**

Melanie Micek, Berthold Heinze<sup>1</sup>, Eduard Hochbichler<sup>2</sup>

<sup>1</sup>Austrian Research Centre for Forests (BFW)

<sup>2</sup>Institute of Silviculture, Department of Forest- and Soil Sciences, University of Natural Resources and Life Sciences Vienna, Peter Jordan Straße 82, 1190 Vienna, Austria.

The black poplar (*Populus nigra*) is one of the characteristic species of riparian forests. Plantation of hybrid poplars associated with the risk of hybrid poplar gene introgression in the populations of black poplars and the loss of habitat endanger the distribution of the black poplar.

By the accession to the EU, Austria committed among others to protect the genetic diversity of indigenous species and woodlands.

The ambition of this master thesis is to analyse the genetic composition of the black poplar population located in the Danube National Park to determine if hybrid poplar gene introgression in the black poplar population is taking place. The findings of this thesis are the basis for in-situ and ex-situ conservation of black poplars.

The genetic material of 317 offspring and 122 adult black poplars is investigated, paternity analysis is made and distribution-tendencies are shown.

First of all the gene locus WIN3 is analysed, in further consequence 17 nuclear gene loci are investigated for the presence of hybrid poplar genes through microsatellite analysis. The programs R, Structure, Cervus and GenAIEx are used for this examination.

The results show that introgression is taking place and about 7 % of the offspring contain hybrid poplar genes.

## FOREST FIRES AND FUEL CHARACTERISTICS OF STYRIA

Hořejši Matous, Harald Vacik

Institute of Silviculture, Department of Forest- and Soil Sciences, University of Natural Resources and Life Sciences Vienna, Peter Jordan Straße 82, 1190 Vienna, Austria.

Austria is dominated by mountains and mostly alpine environments which implies a highly diverse environment in terms of climate, vegetation and fauna. This results in a wide variety of sites with different levels of susceptibility and predisposition to fire. Several research initiatives have been launched in Austria to study fire danger rating, fire behavior modeling and fire management in Austria. The Austrian Forest Fire Research Initiative (AFFRI) identified forest fire “hot spots” in dependence of vegetation, climate and location, and within the EU funded project ALP FFIRS an alpine forest fire warning system was designed in close collaboration with the neighboring partner countries. Styria is one of the provinces of Austria with an abundant occurrence of forest fire events, specially there are some forest fire hotspots around Graz, Kapfenberg and Leoben. Styria has a 20% share of all forest fires in Austria during the last 50 years, which makes a proper fire management important.

The objectives of the thesis are to analyse the forest fire events from years 1957 – 2016 from the AFFRI database of wildfire records from Institute of Silviculture and from the summary tables of the federal ministry. ArcGis spatial analyst tools will be used to analyse the spatial distribution of forest fires and provide a characterisation of the fire events according to seasonality, cause of ignition, size and impact of vegetation. A digital relief model with 5 meters resolution, a forest map with forest inventory data and a set of climatic data containing information about precipitation, temperature and snow occurrence will be used to design a fire danger classification for the different districts in Styria.

To develop and validate the fire danger classification 6 - 12 pilot areas will be selected in three different climatic zones in Styria. In each of these three regions 4 areas (with high/low human activity, high/low occurrence of forest fires) will be chosen to cross validate the fire danger classification. The pilot areas will help to understand the influence of different factors on forest fire ignition and occurrence.

## **CHARAKTERISIERUNG DER FICHTEN-TANNEN-BUCHEN-ZONE IN SÜDTIROL HINSICHTLICH AUSGEWÄHLTER KLIMAPARAMETER UND SENSIBILITÄT GEGENÜBER KLIMAÄNDERUNGEN**

Michael Kessler, Harald Vacik

Institute für Waldbau, Department für Wald und Bodenwissenschaften, Universität für Bodenkultur Wien, Peter Jordan Straße 82, 1190 Wien, Österreich.

Im Rahmen der Waldtypisierung Südtirol wurden mittels eines vegetationsökologischen Modells aus den Parametern Wuchsgebiet, Substratgruppe, Höhenstufe, Sonneneinstrahlung und Topographie 111 Waldtypen, welche die potenziell natürlichen Waldgesellschaften Südtirols darstellen, abgeleitet und zu Waldgruppen zusammengefasst. In Hinblick auf die prognostizierten Klimaänderungen besteht ein zunehmendes Interesse an einer Analyse möglicher Auswirkungen dieser Änderungen auf die Waldtypen.

Dazu wird zunächst eine Untersuchung auf Ebene der Waldgruppen in der Fichten-Tannen-Buchenzone (diese ist eine klimatologisch und vegetationsökologisch einheitliche Subregion des Wuchsgebietes Südliches Zwischenalpines Fichten-Tannen-Waldgebiet 3.3) durchgeführt.

Zumal detaillierte Kenntnisse zu den klimatischen Gegebenheiten innerhalb der Waldgruppen sowie zu den klimatischen Unterschieden zwischen diesen fehlen, sind ausgewählte Waldgesellschaften (Mannaeschen-Hopfenbuchenwälder, Buchenwälder, Fichten-Tannen-Buchenwälder, Fichten-Tannen-Wälder und subalpine Fichtenwälder) zunächst hinsichtlich ihrer klimatischen Charakteristika zu beschreiben. Dazu werden die Waldgruppen aus dem vegetationsökologischen Modell „Waldtypisierung Südtirol“ mit interpolierten Klimadaten aus dem Projekt „3PClim“, in dessen Rahmen die Beschreibung des Klimas in Südtirol mittels aufbereiteter Messdaten aus dem Zeitraum 1980 - 2010 erfolgte, sowie mit der mittleren jährlichen Sonneneinstrahlung aus dem Projekt „Solar Tirol“ verknüpft. Hierzu erfolgte aus dem verfügbaren Datenset eine Auswahl von 47, vegetationsökologisch aussagekräftigen Klimaparametern, welche in weiterer Folge in einem Geoinformationssystem für die jeweiligen Waldgruppen in einer Rasterauflösung von 50 m aufbereitet und für die statistische Analyse extrahiert wurden.

Mit Hilfe der Statistik-Software R wird unter Anwendung einer multiplen Regressionsanalyse und einer Hauptkomponentenanalyse (PCA) das Parameter-Set auf die aussagekräftigsten Klimaparameter reduziert, um die klimatischen Charakteristika der Waldgruppen möglichst effizient zu beschreiben.

In einem weiteren Schritt erfolgt für das reduzierte Klimaparameter-Set aufbauend auf skalierten Datensätzen der EURAC eine Szenarioanalyse; für die relevanten Klimaparameter werden drei Klimaszenarien durchgespielt und zu zwei unterschiedlichen Zeitpunkten (2050 und 2080) betrachtet. Anhand von Klimahüllen wird schließlich der mögliche Rahmen für das potenzielle, zukünftige Klima aufgezeigt, interpretiert und mit den bisherigen Bedingungen verglichen, um die Herausforderungen und das mögliche Maßnahmenspektrum für den Waldbau abschätzen zu können.

## **DIE ENTWICKLUNG DER ÖKOSYSTEMLEISTUNGEN IM KLIMAWANDEL IN DEN BERGWÄLDERN DES STUBAITALES**

Lea Oberhofer, Katharina Albrich, Rupert Seidl

Institute für Waldbau, Department für Wald und Bodenwissenschaften, Universität für Bodenkultur Wien, Peter Jordan Straße 82, 1190 Wien, Österreich.

Die Wälder der Alpen sind besonders von der gegenwärtigen und vor allem der zukünftigen Veränderung des Klimas betroffen. Mit dem sich ändernden Klima werden sich auch die Zusammensetzung und der Aufbau von Wäldern ändern und damit ihre Fähigkeit Ökosystemleistungen zu erfüllen. Gerade im Gebirgswald, wo viele verschiedene Leistungen zugleich erfüllt werden müssen, könnte dies zu einem Problem werden.

Diese Arbeit betrachtet in Zusammenarbeit mit der Europäischen Akademie Bozen (EURAC), dem Institut für Ökologie der Universität Innsbruck und dem Institut für Waldbau der Universität für Bodenkultur Wien die Entwicklung der Gebirgswälder des Stubaitales (Tirol) unter verschiedenen Klimaszenarien und schätzt mögliche Auswirkungen des Klimas auf die Waldentwicklung ab. Zusätzlich werden die daraus resultierenden Wirkungen auf verschiedene Ökosystemleistungen analysiert, wobei das Hauptaugenmerk auf die Schutz- und Nutzfunktion sowie die Kohlenstoffspeicherung und die Biodiversität gelegt wird.

Für die Analysen wird das individuen-basierte Waldlandschaftsmodell iLand verwendet. Es handelt sich dabei um ein Modell, welches die Wechselbeziehungen zwischen Wald, Klima, Störungen und Management dynamisch auf Einzelbaumebene räumlich explizit für ganze Waldlandschaften simuliert. Als Input benötigt iLand Boden-, Bestandes- und Managementdaten, welche im Vorfeld aus bestehenden Datenbeständen extrahiert wurden. Für die Generierung der Bestandesdaten wurden Inventurdaten des Landesforstdienstes Tirol verwendet, welche den jeweiligen Waldtypen aus der Waldtypisierung zugeordnet wurden. Die Bodendaten wurden mithilfe der Ellenberg-Diagramme und den Daten der Waldbodenzustandsinventur vervollständigt. Um die Eignung des Modells für den Stubai-Gebirgswald zu testen, wird ein Modelltest durchgeführt, bei welchem die mittels des Modells berechneten Bonitäten mit den beobachteten Bonitäten verglichen werden. In weiterer Folge soll unter Fortschreibung der aktuellen Waldbewirtschaftung die zukünftige Waldentwicklung simuliert werden. Die Veränderungen des Gebirgswaldes und deren Auswirkungen auf ausgewählte Ökosystemleistungen werden unter historischem und zwei bis drei zukünftigen Klimaszenarien betrachtet und miteinander verglichen.

## **STÖRUNGSANALYSE FÜR ÖSTERREICH ANHAND VON SATELLITENBILDERN VON 1984 BIS 2016**

Julius Sebald, Cornelius Senf, Rupert Seidl

Institute für Waldbau, Department für Wald und Bodenwissenschaften, Universität für Bodenkultur Wien, Peter Jordan Straße 82, 1190 Wien, Österreich.

Um zu verstehen wie sich Störungsaktivitäten durch Klimaänderungen geändert haben und welche Maßnahmen zu ergreifen sind um Wälder an diese geänderten Störungsregime anzupassen, ist es wichtig zeitlich und räumlich explizite Daten über möglichst große Flächen zu akquirieren. Zu diesem Zweck bietet sich die Analyse von Satellitenbild-Zeitreihen an. In diesem Fall werden Landsat-Bilder aus den Jahren 1984 bis 2016 verwendet und mit Hilfe der Software TimeSync analysiert. Für die Analyse wird die Tasseled-Cap Transformation verwendet, die das Spektralprofil eines jeden Pixels in Indices der Albedo, der photosynthetischen Aktivität und, des Blattwasserhaushalt überführt und je nach Intensität der jeweiligen Eigenschaft im Rot-Grün-Blau (RGB) Farbraum mischt. Nadelwald weist zum Beispiel einen hohen Blattwassergehalt auf und wird daher im resultierenden Bild blau dargestellt, wohingegen landwirtschaftliche Flächen meist eine höhere Albedo und photosynthetische Aktivität aufweisen und folglich grün, gelb oder rot dargestellt werden. Zunächst wurden für Österreich zufällig 4000 Pixel mit einer Größe von 30x30 Metern ausgewählt und anschließend nach ihrer Waldbedeckung in bewaldete und nicht bewaldete Pixel unterteilt. Im Anschluss daran gilt es die bewaldeten Pixel auf Störungen zu untersuchen und die Störungsursache zu identifizieren. Dabei wird zwischen Feuer, Holzernte, Mortalität, Wind, hydrologischen Ereignissen, und Lawinen unterschieden. Außerdem gilt es zu identifizieren ob es sich um eine einjährige oder mehrjährige Störung handelt und ob es sich um eine teilweise (zum Beispiel bei einer Durchforstung) oder vollständige Störung (zum Beispiel Lawine) handelt. Nach Abschluss dieser manuellen Interpretation werden die Daten genutzt um räumliche und zeitliche Störungsmuster in Österreich zu analysieren. Die so gewonnenen Daten lassen Rückschlüsse auf besonders störungsanfällige Gebiete und Bewirtschaftungsformen zu und können für Vergleiche, sowohl innerhalb Österreichs als auch innerhalb Europas, herangezogen werden.

### **COMMUNICATION BETWEEN AND WITHIN PLANTS - LITERATURE REVIEW**

Clementine Brakspear, Hans Sandén<sup>1</sup>, Douglas L. Godbold<sup>1</sup>, Hussam Hassan Nour-Eldin<sup>2</sup>

<sup>1</sup>Institute of Forest Ecology, Department of Forest- and Soil Sciences, University of Natural Resources and Life Sciences Vienna, Peter Jordan Straße 82, 1190 Vienna, Austria.

<sup>2</sup>Section for Molecular Plant Biology, Department of Plant and Environmental Sciences, University of Copenhagen, Copenhagen, Denmark

Plants respond rapidly to environmental stimuli via electrical and biochemical transmission pathways which result in physiological phenomena such as volatile metabolite production, hormone secretion, antimicrobial agent production or movement.

In addition to abiotic conditions such as nutrient, water or light conditions, biotic threats such as pathogens, herbivores and symbionts must be appropriately resisted by plants. Interactions such as these induce plant defence strategies which can act directly through defence compound production and release, or indirectly through symbionts. Nutrient acquisition and defence against pathogens often involves symbiosis with mycorrhizal fungi, however it is difficult to quantify the advantages conveyed as fungi not only provide resources but also interfere with the plant defence response.

Electrical and biochemical signalling can trigger physiological changes in plant communities above and below ground in response to environmental stimuli such as predation or physiological condition variation. Much research in the past decade has investigated the ways in which plants perceive and respond to environmental stimuli at a molecular level and at the visible expression level, however it is a challenge to link molecular signalling pathways to phenotypical phenomena. A complete picture is important to understand community responses to altered global environmental conditions and to identify appropriate crop varieties for increasingly extreme environmental conditions. My thesis critically reviews the current understanding of molecular pathways and mechanisms which connect external signals to physiological responses.

## **EFFECT OF A WATER RETAINING POLYMER ON TREE GROWTH, ROOT DISTRIBUTION AND MYCORRHIZATION UNDER SUMMER DROUGHT**

Dunja Šustić, Ricardo Siller, Joseph Ruda, Boris Rewald, Hans Sandén

Institute of Forest Ecology, Department of Forest- and Soil Sciences, University of Natural Resources and Life Sciences Vienna, Peter Jordan Straße 82, 1190 Vienna, Austria.

Newly planted tree seedlings do often not survive the first or second summer due to summer drought, especially in mountain forests. Their root system is still small which makes them more sensitive. To prevent young trees from dying we test the effect of a new polymer based on cellulose—which is more environment friendly than the synthetic one— on plant performance under drought. Purpose of the polymer is absorbing large amounts of water that the plant can use during a drought period and provide continuous availability of nutrients, in the same time we will observe effect on the root system and mycorrhiza establishment. The experiment is taking place in greenhouse. Four typical mountain region species were used: Beech (*Fagus sylvatica*), Larch (*Larix europea*), Norway spruce (*Picea abies*) and Douglas fir (*Pseudotsuga menziesii*). Seven-liter pots were filled with a mixture of 2/3 B-horizon and 1/3 sand. We planted two-year-old tree seedlings in the pots under 3 different treatments: 1) control with only soil, 2) synthetic polymers without nutrients and 3) polymer with nutrients. Each treatment has 12 replicates. To 6 replicates each, mycorrhiza ingrowth bags were added. Each pot is connected to an automatic watering system that will supply sufficient water for growth during the plants' establishment phase. Starting in June, half of the pots will be exposed to a series of drought events. Therefore we have: 4 species x 3 polymer treatments x 2 water levels x 12 replicates = 288 pots + 24 control pots without trees = 312 pots. In September we will harvest the pots, analyse leaf C:N ratio and measure biomass. Biomass of different organs will be analysed in all 12 replicates and chemical analysis will be done on a subset of 6 replicates in early September 2017. We will separate the area with the polymer and the surrounding soil to analyse for root distribution and root morphology. Ectomycorrhiza infection and morphotypes will be determined. Mycorrhiza bags will be retrieved and analysed for mycelia establishment and ergosterol content.

## **EFFECT OF STRESS ON ROOT MORPHOLOGY, MYCORRHIZA COLONIZATION RATE AND DIVERSITY IN ACER PLATANOIDES AND TILIA CORDATA STREET TREES**

Dylan Goff, Vera Mayr, Hans Sandén, Boris Rewald

Institute of Forest Ecology, Department of Forest- and Soil Sciences, University of Natural Resources and Life Sciences Vienna, Peter Jordan Straße 82, 1190 Vienna, Austria.

Urban trees in Vienna and cities world-wide are exposed to multiple stresses like soil compaction, restricted root zone, water and nutrient deficiency, excessive heat, and several types of pollution. A major cause of soil pollution in urban areas of the temperate and boreal zone is the excessive use of de-icing salts. Due to the subsequent decline in vitality, trees have to be replaced frequently at the expense of ecological functions and substantial monetary costs.

Roots of most tree species form symbioses with mycorrhizal fungi, resulting in enhanced tolerance against abiotic and biotic stresses. However, the mycorrhizal variety and frequency of symbioses are thought to be reduced in urban soils. In spite of this, field studies on mycorrhiza fungi in urban soils are scarce.

This research aims to shed light on the mycorrhizal colonization and diversity in urban environments and examines the mycorrhizal species living in association with salt-stressed trees. For the study the salt-sensitive species *Acer platanoides* and *Tilia cordata* have been chosen, as both are capable of developing symbioses with arbuscular mycorrhizal and/or ectomycorrhizal fungi. Non-stressed tree individuals in parks will serve as a control.

We hypothesise that mycorrhizal diversity and infection rates of roots are reduced due to lower soil quality in planting pits, thereby limiting tree growth and resistance against stress in urban environments compared to non-stressed park trees.

This study will determine if lower symbiotic activity and diversity is found in street trees compared to more protected trees and see if retro- or proactive inoculation of planting pit soil with mycorrhizal spores should be tested. Therefore it will be of high practical benefit for municipalities in need of cost-efficient and sustainable solutions for Urban Horticultural management.



## **EINFLUSS VON UMBRUCH UND WIEDERAUFNAHME DER NUTZUNG AUF DEN KOHLENSTOFFKREISLAUF VON UNTERSCHIEDLICH ALTEN BIODIVERSITÄTSFLÄCHEN**

Peter Muck<sup>1\*</sup>, Matthias Mayer<sup>1</sup>, Gernot Bodner<sup>2</sup>, Boris Rewald<sup>1</sup>

<sup>1</sup>Department of Forest- and Soil Sciences, University of Natural Resources and Life Sciences Vienna, Peter Jordan Straße 82, 1190 Vienna, Austria. \*petermuckenergy@gmail.com

<sup>2</sup>Department of Crop Sciences, Division of Agronomy, University of Natural Resources and Life Sciences, Vienna (BOKU), Konrad-Lorenz-Strasse 24, 3430, Tulln, Austria

Böden sind der größte terrestrische Speicher für Kohlenstoff und gleichzeitig eine der wichtigsten natürlichen Quellen für CO<sub>2</sub> in der Atmosphäre. Dadurch ist organische Bodensubstanz nicht nur für die Bodenfruchtbarkeit, sondern auch als Umschlagort von Treibhausgasen für den Klimawandel von Bedeutung. Infolge von Nutzungsänderungen landwirtschaftlicher Flächen, wie zum Beispiel der (vorübergehenden) Stilllegung als Biodiversitätsfläche oder dem anschließenden Umbruch und Wiederaufnahme der Nutzung kommt es zu Veränderungen der Kohlenstoffkreisläufe. Um vorhersagen zu können, wie Böden auf Landnutzungsänderungen reagieren, müssen die Prozesse, die zur Speicherung oder Mobilisierung von Kohlenstoff im Boden führen, verstanden und mengenmäßig erfasst werden. Von aktuellem Interesse ist es zu bestimmen ob und ab wann Biodiversitätsflächen zur deutlichen Erhöhung der organische Bodensubstanz führen und wie schnell mit verstärktem Kohlenstoffverlust nach Nutzungsaufnahme (Umbruch) zu rechnen ist.

Im Rahmen eines zweijährigen Experiments wird daher im nördlichen Weinviertel, im Bezirk Mistelbach, die Umwandlung von unterschiedlich lange aus der Nutzung genommenen Biodiversitätsflächen in Ackerland untersucht. Die Bodenart am Versuchsstandort ist lehmiger Schluff. Die Jahresniederschlagsmenge beträgt etwa 450mm. Im Versuchsdesign ist auf jeder der 4 Versuchsflächen eine (unterschiedlich alte) Biodiversitätsfläche mit einer landwirtschaftlich genutzten Kultur (Mais) gepaart um lokale edaphische und klimatische Unterschiede auszugleichen. Die Biodiversitätsflächen sind vor 15, 3, 2 und einem Jahr angelegt worden. Analog dazu wird über den Zeitraum der Untersuchungen jährlich eine Teilfläche der Biodiversitätsflächen umgebrochen und auf diesen Mais angelegt. Auf allen Flächen werden CO<sub>2</sub> Ausgasung (EGM 4, 5, PP Systems) und DOC Verluste (Saugkerzen) während der Vegetationsperiode (zweiwöchentlich) untersucht. CO<sub>2</sub> Ausgasungen mit und ohne Wurzeln (trenching) werden verglichen um die heterotrophe Bodenatmung zu bestimmen. Bodenproben werden auf Enzymaktivitäten, Wurzelbiomassen und Gesamtkohlenstoffgehalte untersucht. Begleitend finden kontinuierliche Messungen der Luft-, Bodentemperatur, Luftfeuchtigkeit, Niederschlag, Strahlungsintensität sowie der Bodenfeuchtigkeit (in verschiedenen Tiefenstufen) statt. Weitere Untersuchungen z.B. zur Qualität des gespeicherten Kohlenstoffs und zur Auswirkung der Landnutzungsänderung auf den Wasserhaushalt der Flächen sind geplant.

## **INFLUENCE OF CHILLING EVENTS ON THE ABOVE- AND BELOWGROUND CO<sub>2</sub> FLUXES OF TREE SEEDLINGS**

Zana Lak, Boris Rewald

Institute of Forest Ecology, Department of Forest- and Soil Sciences, University of Natural Resources and Life Sciences Vienna, Peter Jordan Straße 82, 1190 Vienna, Austria.

Temperate trees have evolved to cope with the seasonal occurrence of freezing temperature. One part of the adaptation to seasonality is cold acclimation in autumn and a dormancy period in winter, followed by a deacclimation period in spring. However, global warming is modifying the phenology of temperate trees, particularly the onset of spring. Late spring cold spells are potentially damaging if the tissues are not hardy enough. In this study we want to determine if the temperature sensitivity (Q<sub>10</sub>) of tree seedlings' photosynthesis and leaf and root respiration is modified by a mild freezing/chilling event early after bud break.

This experiment was performed at the Institute Forest Ecology during September 2016 to April 2017 on seedlings (3-yrs-old) of two broad-leaved tree species *Carpinus betulus* and *Tilia cordata*. 30 7-L pots / species were grown in a Phytotron under controlled light, temperature, and air moisture conditions. Immediately after leaf flushing, IR gas analyzers EGM5 & EGM4 were used to measure net CO<sub>2</sub> fluxes above- and belowground at 5, 15 and 25°C before and after a one-day freezing/chilling event (0 to -1°C). Measurements were performed by using ecosystem respiration chambers.

Data analysis is ongoing and first results regarding the influence of the stress events on CO<sub>2</sub> fluxes and Q<sub>10</sub> above and belowground will be discussed.

## **PLANT DIVERSITY, CARBON POOLS, SELECTED SOIL PROPERTIES AND LIVELIHOOD SITUATION IN THE INDIGENOUS AGROFORESTRY OF SOUTH-EASTERN RIFT- VALLEY LANDSCAPES, ETHIOPIA**

Hafta Mebrahten Tesfay<sup>1</sup>, Oliver Meixner<sup>1</sup>, Andreas Melcher<sup>1</sup>, Andras Darabant<sup>1</sup>, Karin Wriessnig<sup>1</sup>, Mesele Negash<sup>2</sup>, Herbert Hager<sup>1</sup>

<sup>1</sup>BOKU University of Natural Resources and Life Sciences, Gregor-Mendel-Straße 33, 1180, Vienna, Austria

<sup>2</sup>Hawassa University Wondo-genet College of Forestry and Natural Resources, P.O.Box 128, Shashemene, Ethiopia

Increasing the size of the global terrestrial sink is one strategy for mitigation of CO<sub>2</sub> concentration in the atmosphere. The most significant increases in C storage can be achieved by moving from lower biomass land-use systems to tree-based systems like agroforestry systems. The analysis of C stocks from various parts of the world shows that 1.1–2.2 x 10<sup>15</sup> g C could be removed from the atmosphere over the next 50 years if Agroforestry systems are implemented on a global scale. However, Estimation of carbon stocks, contribution to livelihood enhancement in indigenous agroforestry systems remains unexplored. The hypothesis of this study is a) Can Carbon stock among the three indigenous agroforestry systems differ because of having different system management? b) Do the three indigenous agroforestry systems have different content of macro-nutrients (N,P,K) c) How significant difference in Soil organic carbon could we get if we compare these three agroforestry systems with agricultural land? d) How coffee-fruit tree- enset agroforestry system can enhance the livelihood of the rural households? This study aims to investigate plant diversity, carbon pools, selected soil properties in three indigenous agroforestry (Enset based agroforestry system, Enset-coffee based agroforestry system and Coffee-Fruit tree-enset based agroforestry system) and their contribution to livelihood enhancement. The study will be conducted in the south-eastern Rift Valley landscapes of Ethiopia. For this study, two sites of each three agroforestry types and 20 farms representative of each agroforestry system will be randomly selected. Also five adjacent mono-cropping farms will be selected purposively for comparison. Inventory of the floristic diversity and different parameters will be measured. Biomass C stocks of Trees and shrub, enset, coffee, herbs, fine roots will be estimated by adopting different allometric equations, SOC, N, P and K contents will be determined and livelihood survey will be also employed. All statistical analysis will be done by IBM SPSS version 22 (SPSS Inc. 2010). The expected outcome of this study will be getting good results and sharing findings by publishing journal articles, conference presentations etc. The required budget for this research study is USD 23,400 and will be conducted from July, 2017- August, 2019.

## Section Forest Growth

Poster 28

### **HARVESTING ALGORITHMS FOR INDIVIDUAL TREE GROWTH MODELS**

Amilia Meškin, Sonja Vospernik, Arne Nothdurft

Institute of Forest Growth, Department of Forest- and Soil Sciences, University of Natural Resources and Life Sciences Vienna, Peter Jordan Straße 82, 1190 Vienna, Austria.

Different management concepts combined with different cutting rates can have a great impact on the future forest development, in the first place on the increment and regeneration. For the future planning it is very important to understand how different concepts affect forest state, to be able to make decisions that will fulfill principles of sustainability.

One of the tools for securing these principles is allowable cutting rate, which is a measure of the planned logging during a certain period. It is usually given for one year and corresponds to the amount that can be taken annually without jeopardizing the sustainability of the forest area.

Annual cutting rate for small-forest owners in the region of South Tyrol, where this study was conducted, is given by the forestry authorities and it is a fixed percentage of the standing stock (currently 1.66%).

Overall objective of this study is to explore whether it makes a difference for the future increment, if the allowable cutting rate is taken as a clear cut or in a form of a single tree selection with a target diameter and how will that affect forest regeneration. To be able to accomplish that, using data collected on the field, computer based simulation was conducted. All necessary data were obtained from 24 fixed sample plots, from two stands: "Hauswald" and "Holderbichl". Sample plots were established in year 2012 and 2013.

For the purpose of this study we decided to use PROGNAUS functions (implemented in R Studio) to directly estimate increment (diameter and height) and mortality, depending on tree dimensions, competition variables and a set of site factors as identified by the ANFI. In order to simulate different types of thinning and harvesting, different algorithms were implemented to clearly describe which trees have to be removed from the forest stand.

First, methods to evaluate management concepts are presented. Then models that predict future forest development were estimated and applied for the two stands.

### **PRODUKTIVITÄTS- UND TREIBSTOFFVERBRAUCHSMODELL FÜR DIE RÜCKUNG MITTELS TRAKTORKRANANHÄNGER**

Philipp Gruber, Christian Kanzian, Karl Stampfer

Universität für Bodenkultur Wien, Department für Wald- und Bodenwissenschaften, Institut für Forsttechnik, Peter Jordan Straße 82, 1190 Wien, Österreich

Traktorkrananhänger kommen zunehmend für die Rückung zum Einsatz. Trotz der häufigen Verbreitung gibt es nur wenige Kennzahlen zu Produktivitäten und Treibstoffverbrauch. Für die Erstellung von Treibhausgasbilanzen in der Holzerntekette sind diese Zahlen unabdingbar. Ziel der vorliegenden Arbeit ist eine umfassende Analyse der Rückung mittels Traktorkrananhänger. Es soll ein Aufnahme- und Auswertekonzept unter Berücksichtigung der statistischen Analysemethoden erstellt werden. In weiterer Folge sollen ein Produktivitätsmodell sowie ein Treibstoffverbrauchsmodell in Abhängigkeit von den festgelegten und analysierten Parametern erstellt werden. Die Zeitstudie wird mit Hilfe einer Action Camera vorgenommen. Diese wird dabei am Traktorkrananhänger montiert um eine lückenlose Darstellung des gesamten Arbeitstages zu gewährleisten. Anschließend werden die Daten mittels eines Zeitstudienprogramms ausgewertet. Der Arbeitszyklus des Traktorkrananhängers wird dabei in verschiedene Arbeitstakte unterteilt, welche wären: Leerfahrt, Laden, Auf- und Absteigen vom Kran, Manipulationen beim Arbeiten, Manipulationen am Krananhänger, Lastfahrt, Entladen, Sortierarbeiten am Lagerplatz, Aufräumarbeiten, Unterbrechungen <15 Minuten, Unterbrechungen >15 Minuten, Studienbasierte Unterbrechung. Die unterschiedlichen Einflussgrößen auf die Krananhängertätigkeiten (Volumen/Fuhre, Volumen/Stück, Trassenneigung, Trassenlänge, Rückedistanz, Ladedistanz) werden ebenfalls vor Ort aufgenommen. Um das Fuhrevolumen zu ermitteln wird das Linienstichprobenverfahren angewandt. Dabei wird an der Stirnseite des voll beladenden Anhängers eine Linie über den gesamten Querschnitt gezogen. Anschließend werden die Bloche nummeriert und nach dem abladen gemessen. Mittels Durchmesser, Länge und Baumart, sowie Blochanzahl einer Fuhre kann auf das Volumen rückgeschlossen werden. Der Treibstoffverbrauch wird mittels Nachtanken aus einem Kanister bzw. abwägen ermittelt.

Folgende Punkte sollen in den Ergebnissen aufgezeigt werden:

- Aufzeigen der Verteilung der Arbeitszeit auf die jeweiligen Arbeitsschritte
- Erstellung eines Produktivitätsmodells sowie Bestimmung der wichtigsten Einflussfaktoren
- Erstellung eines Treibstoffverbrauchsmodells sowie Bestimmung der wichtigsten Einflussfaktoren

## Poster presentations – Bachelor students

Poster 30

### **WIEDERHOLUNGSGENAUIGKEIT VON TERRESTRISCHEM LASERSCANNING BEI DER BHD-UND HÖHENMESSUNG**

Barbara Öllerer, Tim Ritter

Institut für Waldwachstum, Department für Wald- und Bodenwissenschaften, Universität für Bodenkultur Wien, Peter Jordan Straße 82, 1190 Wien, Österreich.

Terrestrisches Laserscanning ist ein relativ neues und effizientes Aufnahmeverfahren im Rahmen von Bestandesinventuren. Bisher gibt es allerdings wenige Erkenntnisse dazu, wie wiederholungsgenau Messungen im Bestand sind.

Basierend auf zwei wiederholten Aufnahmen in belaubtem und unbelaubtem Zustand von Probekreisen im Wienerwald wird die Mess- und Wiederholungsgenauigkeit von terrestrischem Laserscanning im Vergleich zu den konventionellen Verfahren der BHD-Messung mit Kluppe und der Höhenmessung mit Ultraschallhypsometer an n=64 Bäumen untersucht. Basierend auf den Ergebnissen werden Empfehlungen für den Einsatz terrestrischer Laserscanner im Rahmen von Wiederholungsinventuren gegeben.

## **NACHHALTIGKEIT IN HALLSTATT ZUR HALLSTATTZEIT**

Peter Wagenristl, Stefanie Görig, Hubert Sterba

Institut für Waldwachstum, Department für Wald- und Bodenwissenschaften, Universität für Bodenkultur Wien, Peter Jordan Straße 82, 1190 Wien, Österreich.

Diese Bachelorarbeit beschäftigt sich mit dem Thema der nachhaltigen Holznutzung von 600 – 300 v. Chr. zur Zeit der Bronzezeit im Hallstätter Hochtal. Basierend auf der Fragestellung ob man bereits zu dieser Zeit von einer nachhaltigen Forstwirtschaft sprechen kann oder ob Holz importiert werden musste, um den aufwendigen Salzabbau sowie die Siedlungen zu erhalten und auszubauen, wurde im Zuge dieser Arbeit mithilfe des Simulationsprogramms PROGNAUS der 100-jährige Verlauf von Zuwachs, Mortalität und Nutzung dargestellt. In Kooperation mit dem Naturhistorischen Museum Wien wurde versucht, die These der Nachhaltigkeit zu überprüfen. Da zurzeit aus den Funden nicht ermittelt werden kann, wieviel Holz dazu nötig war, wurde untersucht, wieviel Holz der nutzbaren Dimensionen (BHD 10 – 50cm) so genutzt werden kann, dass es nach 100 Jahren noch immer in der entsprechenden Menge verfügbar war. Aus den Simulationen ergab sich die jährlich nutzbare Menge von 2,89 Vorratsfestmetern pro Jahr und Hektar.

## BIOMASSEALLOKATION IM STAMM

Bernhard Trinko, Bernhard Zotter, Sonja Vospernik

Institut für Waldwachstum, Department für Wald- und Bodenwissenschaften, Universität für Bodenkultur Wien, Peter Jordan Straße 82, 1190 Wien, Österreich.

Der Bestandeszuwachs ist eine wichtige Größe für die Waldbewirtschaftung. Der Zuwachs verteilt sich unterschiedlich auf die einzelnen Bäume im Bestand. Mayer (1958) und Sterba (2005) untersuchten den Volums- bzw. den Durchmesserzuwachs in Abhängigkeit der Schirmfläche und der sozialen Stellung. Dabei kam man zum Ergebnis, dass die Zuwachsleistung mit steigender Kronenschirmfläche zunimmt. Betrachtet man dagegen nicht die absoluten Zuwächse, sondern die Zuwächse pro m<sup>2</sup> Kronenschirmfläche, zeigt sich eine bedeutende Leistungsüberlegenheit der kleinkronigen Bäume in jeder sozialen Schicht über die großkronigen.

Darüberhinaus unterscheidet sich die Verteilung des Zuwachses nicht nur zwischen den Bäumen, sondern auch innerhalb eines Baumes.

Bei der Verteilung über die Schafthöhe kam Guttenberg (1915) zum Ergebnis, dass sich der Zuwachs bei den herrschenden Bäumen eher im unteren Schaftbereich ansiedelt, hingegen legt er sich bei den beherrschten Bäumen mehr im oberen Schaftbereich an. (vgl. Wenk, 1990).

Wenig untersucht sind die Verteilung des Zuwachses innerhalb der Krone und die unterschiedliche Biomasseallokation in der Krone in verschiedenen Jahren.

Für diese Arbeit wurden drei vorherrschende, drei mitherrschende und drei beherrschte Fichten gewählt. Es wurden jeweils neun Baumscheiben geworben, wobei eine vom Stock, eine in Höhe des Brusthöhendurchmessers, eine in Höhe des D03, eine am Kronenansatz bzw. im ersten Kronensechstel und jeweils eine in den restlichen fünf Kronensechstel entnommen wurden und anschließend wurden Jahrringanalysen an den Stammscheiben durchgeführt. Insgesamt wurden somit 81 Stammscheiben gemessen.

Aus diesen Daten wird mittels Regressionsanalyse die Verteilung des Zuwachses in den Kronen in verschiedenen Jahren untersucht.



## BEHANDLUNG VON KIEFERNJUNGBESTÄNDEN

René Huber, Manfred J. Lexer

Institut für Waldbau, Department für Wald- und Bodenwissenschaften, Universität für Bodenkultur Wien, Peter Jordan Straße 82, 1190 Wien, Österreich.

Im Focus dieser Arbeit steht primär die Errichtung von drei Dauerbeobachtungsfeldern in einem homogenen Kiefernjungwuchs in der Dobrova, Bezirk Völkermarkt – Kärnten. Diese wurden mittels Kompass und Maßband eingemessen, an den Eckpunkten verpflockt und die GPS – Daten erhoben. Danach wurde an allen Bäumen, unterteilt in die drei Flächen, der BHD gemessen, die Baumart bestimmt, sowie Schäden und Qualitätsmerkmale erhoben. Zusätzlich wurde an jedem 10. Baum der Stockdurchmesser, Höhe, Zuwachs der letzten 5 Jahre, Alter, Kronenansatz und -breite bestimmt. Da im Bestand schon ein forstlicher Eingriff stattgefunden hat, wurde auch die Anzahl und der Stockdurchmesser der entnommenen Bäume festgehalten.

Am PC wurden danach durch Berechnung der Höhenkurve die Höhe und der Vorrat (V), Grundfläche (G) und Stückzahl (N) sowie weiterer Qualitätsmerkmale aller stehenden Bäume am Ort und am Hektar ermittelt. Mittels Stockdurchmesser/BHD – Verhältnis am Stehenden konnte der BHD der entnommenen Bäume, und somit auch deren Vorrat, Grundfläche am Ort und am Hektar berechnet werden. Durch die Zuwachsbohrung/-ermittlung wurden auch G, V und N zum Zeitpunkt des Eingriffs errechnet. Ziel ist es BHD-Verteilungen V, G, und N am Ort und am Hektar für die einzelnen Flächen vor dem Eingriff, nach dem Eingriff, der gegenwärtig stehenden und der entnommenen Bäume darstellen zu können. Dies dient dann als Fundament weiterer Berechnungen zum Vergleich der unterschiedlichen Durchforstungs- und Behandlungsvarianten in der Zukunft.

## TONMINERALE IN BÖDEN AUS BHUTAN

Stefanie Gruber<sup>1</sup>, Karin Wriessnig<sup>1,2</sup>, Klaus Katzensteiner<sup>1</sup>

<sup>1</sup>Institut für Waldökologie, Department für Wald- und Bodenwissenschaften, Universität für Bodenkultur Wien, Peter Jordan Straße 82, 1190 Wien, Österreich.

<sup>2</sup>Institut für Angewandte Geologie, Universität für Bodenkultur Wien

Tonminerale sind Schichtsilikate mit unterschiedlichem Aufbau, die durch Silikatverwitterung im Boden entstehen. Sie sind somit ein kennzeichnendes Resultat der Bodenbildung und tragen wesentlich zu den Eigenschaften eines Bodens bei. Für diese Arbeit wurde ein repräsentatives Transekt aus sechs Bodenprofilen (22 Proben), die aus unterschiedlichen Höhenlagen in Bhutan stammen, zusammengestellt. Die Profile werden hinsichtlich ihrer Mineralogie untersucht, um damit Rückschlüsse auf abgelaufene Bodenbildungsprozesse entlang des Transektes zu ziehen. Im Zuge der Untersuchung werden für jede Probe der Gesamt-Mineralbestand sowie die Zusammensetzung der Tonfraktion untersucht. Für die Analyse der Gesamt-Mineralogie wird ein Teil der Proben vermahlen und mittels Röntgendiffraktometer gemessen. Um die Tonfraktion ( $\leq 2 \mu\text{m}$ ) zu gewinnen, werden die Proben zuerst kleiner  $20 \mu\text{m}$  gesiebt und anschließend abzentrifugiert. Die gewonnene Tonsuspension wird auf Keramikplättchen aufgebracht und mittels Röntgendiffraktometer gemessen. Abschließend werden die Diffraktometer-Ergebnisse mithilfe eines Computerprogramms ausgewertet, um Ton- sowie Begleitminerale zu identifizieren.

## **ANALYSE UND ENTWICKLUNG ERTRAGSKUNDLICHER PARAMETER IM FORSTBETRIEB PEZOLD**

Ferdinand Hönigsberger, Stephan Knapp, Johannes Scharf, Otto Eckmüller

Institut für Waldwachstum, Department für Wald- und Bodenwissenschaften, Universität für Bodenkultur Wien, Peter Jordan Straße 82, 1190 Wien, Österreich.

Die Bachelorarbeit beschäftigt sich mit einer Stichprobeninventur mit anschließender Analyse und Prognose ertragskundlicher Parameter eines Forstbetriebes, welcher sich in der Obersteiermark befindet.

Dieser teilt sich in drei Reviere:

- Revier 1 Gusterheim (Pölstal)
- Revier 2 Frauenburg (Murtal)
- Revier 3 Pusterwald (Pusterwaldtal)

Die Aufnahmen erfolgten im Sommer 2016, wobei im Vorfeld über den gesamten Forstbetrieb ein Stichprobenraster für Winkelzählproben und fixe Probekreise für Kulturpunkte angelegt wurde.

Aus den neu erworbenen, betriebsrelevanten Kennzahlen der Stichprobeninventur lassen sich viele waldbauliche Ziele für die zukünftige Betriebsentwicklung definieren. Da im Forstbetrieb Pezold nach dem Konzept des Altersklassenwaldes gewirtschaftet wird, ist es das Ziel sich einer Altersklassenverteilung, die dem Normalwaldmodell von Hundeshagen entspricht, anzunähern.

Der Betrieb steht jedoch vor folgender Problematik:

- linksschiefe Altersklassenverteilung
- zweite Altersklasse hat den größten Flächenanteil
- nur noch wenig alte Bestände
- einige junge Bestände schlechter Qualität (Fäule bei Wiesenaufforstungen)

Da der Ist-Stand bekannt ist, soll mithilfe einer Prognosedatei die zukünftige Entwicklung, hin zum Normalwaldmodell, berechnet werden. So können diverse Eingriffe in den Forst besser geplant werden. Die Prognosedatei dient als Orientierung und Wegweiser der zukünftigen Betriebsentwicklung.

Die Datei wurde im Excel programmiert und speziell für den Forstbetrieb Pezold entwickelt.

## **VERGLEICH DES TANNENVORKOMMENS IM REVIER DIPPELEITEN AUFGRUND VON STICHPROBENINVENTUR UND TAXATIVER ERHEBUNG**

Johannes Doppler, Eduard Hochbichler

Institut für Waldbau, Department für Wald- und Bodenwissenschaften, Universität für Bodenkultur Wien, Peter Jordan Straße 82, 1190 1190 Wien, Österreich.

Einleitung: Im Revier Dippelleiten, der Forstverwaltung Langau, diese befindet sich an den nördlichen Voralpen, im Ötschergebiet, wurde eine Stichprobeninventur auf 400ha durchgeführt. Die Resultate der Inventur ergaben einen geringeren Tannenanteil als erwartet.

Anhand dieser Bachelorarbeit soll mittels taxativer Erhebung jede fruktifizierende Tanne im Revier Dippelleiten erhoben werden. Mit Hilfe der resultierenden Daten der taxativen Erhebung soll ein Vergleich der Ergebnisse der Stichprobeninventur und der taxativen Erhebung erstellt werden.

Ziel soll sein, die Frage zu beantworten - ob eine engmaschige Stichprobeninventur, den Anteil von seltenen Baumarten in einem Bestand überschätzt, richtig schätzt oder unterschätzt.

Materialien & Methoden: Die taxative Erhebung erfolgt mittels GSP gestützter Punktkartierung, weiters wird der BHD der fruktifizierender Tannen geschätzt, die BHD-Abschätzung geschieht jeweils in 5 Zentimeter Schritten.

Das bereits vorhandene Inventurergebnis der engmaschigen Stichprobeninventur vom Revier Dippelleiten, wird seitens der Forstverwaltung Langau zur Verfügung gestellt.

Mittels den erhobenen Daten, das sind, die Daten der Stichprobeninventur sowie die Daten der taxativen Erhebung, soll einerseits eine Vergleichsrechnung erstellt werden, mit welcher festgestellt werden kann, welche Stichprobenpunkte als genaue Schätzer zu betrachten sind und welche nicht. Weiters kann auf Grundlage der taxativen Erhebung, die örtliche Verteilung der gewählten Inventurpunkte beurteilt werden.

Aktueller Stand: Im Sommer 2016 wurde bereits mit der Kartierung der fruktifizierenden Tannen begonnen, ca. 50% der Revierfläche wurde bereits kartiert und in die digitale Revierkarte übernommen. Bereits zum jetzigen Zeitpunkt ist ein Verteilungsmuster der Tannen im Revier zu erkennen. Ein Großteil der Tannen sind gruppenweise anzutreffen, an Reviergrenzen sowie an sehr steilen Revierabschnitten. An leicht zugängliche, flache Revierteilen sind meist nur solitär stehende fruktifizierende Tannen anzutreffen.

## **ANALYSE EINER EIBENPOPULATION IM SCHUTZWALD STEINBACH/OBERÖSTERREICH**

Markus Edenhauser, Franz Keil, Raphael Klumpp, Harald Vacik

Institut für Waldbau, Department für Wald- und Bodenwissenschaften, Universität für Bodenkultur Wien, Peter Jordan Straße 82, 1190 1190 Wien, Österreich.

Die Eibe (*Taxus baccata* L.) gehört zu den seltenen Baumarten in Europa. In Österreich gibt es derzeit dreizehn Eiben-Generhaltungswälder, deren Ziel es ist, die „*in situ*“ Erhaltung zu fördern. Eigentümer werden für besondere Leistungen oder Unterlassung wirtschaftlicher Nutzung dabei entschädigt. Darüber hinaus gibt es unterschiedlich große Eibenvorkommen in genutzten Wirtschaftswäldern Österreichs. Im Rahmen dieser Bachelorarbeit wird eine Eibenpopulation in Steinbach am Attersee analysiert. Diese Eiben befinden sich in einem Fichten-Tannen-Buchenwald (Blockschuttwald), der als Wirtschaftswald (Schutzwald) im Besitz der Österreichischen Bundesforste ist. Die Versuchsfläche liegt im Wuchsgebiet 4.1 „Nördliche Randalpen- Westteil“.

Ziel der vorliegenden Untersuchung ist die Beurteilung der Alteibenpopulation bezüglich Vitalität und Konkurrenz zu den Hauptbaumarten des Untersuchungsbestandes. Außerdem erfolgt eine Analyse der vorhandenen Naturverjüngung mit Eibe.

Dazu wurde der Untersuchungsbestand mit einem Aufnahmeraster im Abstand von 60 x 60 m versehen und die Probepunkte in unmittelbarer Nähe der Eibenaltbäume permanent markiert (systematische Stichprobe). An diesen Stichprobepunkten wird jeweils in einem fixen Probekreis mit 12,6 m (500m<sup>2</sup>) eine Vielzahl von Merkmalen angesprochen. Einerseits wurden standortkundliche Merkmale wie Neigung, Exposition, Wasserversorgung und Geländeform erhoben, andererseits wurden baumbezogene Merkmale (Höhe, BHD, Kronenansatz etc.) erfasst. Darüber hinaus wurden bestandesbeschreibende Merkmale mittels Winkelzählprobe erfasst. Zur Beschreibung der Konkurrenzverhältnisse zwischen Alteiben und ihren Nachbarn wurde die Strukturelle Vierergruppe nach Földner erhoben. Weiters wurde eine Verjüngungsanalyse durchgeführt, wo in jedem Probepunkt über zusätzliche Satellitenstichproben die vorhandene Naturverjüngung erfasst wurde.

## **BESCHREIBUNG DER BÖDEN DES NORDBURGENLANDES ANHAND AUSGEWÄHLTER STANDORTE**

Livia Klenkhart, Nicola Rampazzo

Institut für Bodenforschung, Department für Wald- und Bodenwissenschaften, Universität für Bodenkultur Wien, Peter Jordan  
Straße 82, 1190 Wien, Österreich.

Ziel dieser Arbeit ist es, zehn ausgewählte Standorte/ Böden im Nordburgenland anhand deren physikalischen und chemischen Eigenschaften zu beschreiben. Dabei können aufgrund der Wahl der Böden 3 thematische Schwerpunkte ausgemacht werden: 1. der geologisch-bodenkundliche Transsekt Kristallin – Leithakalk am Leithagebirge inkl. eines anthropogen beeinflussten Schüttungsbodens, 2. landwirtschaftlich genutzte Böden im nördlichen Burgenland: der Leithaniederung und -terrassen, sowie 3. Salzböden des Seewinkels.

Als Grundlage zur Beschreibung der Bodengenese und aktueller bodenbildender Prozesse werden bereits vorhandene Laborwerte der jeweiligen Böden und im Labor eigens bestimmte Parameter herangezogen. Der erste Teil der Arbeit besteht in der Auswertung der Laborergebnisse und in der anschließenden Aufbereitung relevanter Bodenparameter in tabellarischer Form für die folgende Analyse. Bei der Interpretation der Ergebnisse wird neben den Hauptprozessen im Bodenprofil auch das Klima, die Lage und die Geologie berücksichtigt werden, wodurch Erklärungen für die auffällige Heterogenität der Böden auf engem Raum gefunden werden soll, wie sie im Nordburgenland vorzufinden ist.

*Poster 39*

**Cancelled**

## **ZUSTANDSERHEBUNG UND ÖKOSYSTEMLEISTUNGEN IM BÄUERLICHEN KLEINWALD, ÜBERFÜHRUNG IN EIN PLENTERARTIGES DAUERWALDSYSTEM INCL. FORSTFÖRDERMÖGLICHKEITEN**

Gergo Dioszegi, Eduard Hochbichler

Institut für Waldbau, Department für Wald- und Bodenwissenschaften, Universität für Bodenkultur Wien, Peter Jordan Straße 82, 1190 Wien, Österreich.

Erhebung des Ist-Zustandes in einem 11,4 ha nicht bewirtschafteten Kleinbauernwald, der sich in West-Kärnten auf 1000 Meter Seehöhe befindet. Im Rahmen dieser Erhebung sind Ökosystemleistungen mittels Biodiversitätsindikatoren mit Schwerpunkt Vorrat, Totholz, Jungwuchs und Verjüngung aufgenommen. Weitere Biodiversitätsindikatoren (Wild verbunden mit Äsungstypen, Ameisen bzw. Ameisennester und Flechten) sollen erhoben werden. Aus dem Ist-Zustand kombiniert mit dem waldbaulichen Hiebsatz werden die waldbaulichen Maßnahmen zur Überführung in ein plenterartiges Dauerwaldsystem festgelegt. Sowohl für die Überführung als für die dazugehörigen Ökosystemleistungen werden Forstfördermöglichkeiten gesucht und beschrieben. Zum Schluss sollen die waldbauliche Maßnahmen in einem einfachen Leitfaden dargestellt werden. Um den Wald dieser Studie in plenterartiges System durchführen zu können, müssen die folgenden Fragen beantwortet werden: wo und wer ist der Wald, was für horizontale und vertikale Struktur hat er? In welcher Maße ist seiner Selbstregulierung? Bei Festlegung des Ist-Zustands spielen natürlich ökonomische und hauptsächlich ökologisch geprägte Faktoren eine wesentliche Rolle. Hier entsteht das Problem der ökologischen Bewertung des Waldes. Sie soll auch im Rahmen dieser Arbeit mittels Biodiversitätsindikatoren (siehe oben) für diverse Ökosystemleistungen behandelt werden. Nach Beantwortung der obengenannten Fragen (Festlegung des Ist-Zustands) stellen sich die zwei Hauptfragen: Wie ist die Plentermäßigkeit des Waldes? Wie (im Rahmen waldbaulicher Maßnahmen) führt man diesen nach Plentermäßigkeit bestimmten Bauernwald in ein plenterartiges System über? Das Ziel neben Annäherung des Plentergleichgewichts, ist das Erreichen einer stetigen Steigerung an Wert- und Ökosystemleistung. Diese Steigerung ist sowohl vom Bund als vom Land auch mittels möglicher Forstförderungen unterstützt. Der österreichische Schutzwald weist wegen nicht ausreichendes Nachwuchses Stabilitäts- und Generationsproblematik auf. Mit Sicherung einer Dauerwaldstruktur (durch plenterartige Waldbehandlung) kann diese Problematik in Bauernwälder auch behoben werden.



## Index of contributors

Albrich, K. ....	44	Kirchmann, H. ....	30
Armstrong, K. ....	34	Klenkhart, L. ....	62
Bajraktarevic, A. ....	28	Klumpp, R. ....	61
Bodner, G. ....	19, 49	Knapp, S. ....	59
Bradley, O. ....	5, 14	Konrad, H. ....	20
Brakspear, C. ....	46	Lak, Z. ....	50
Bruckman, V. ....	6, 14	Lehto, N. ....	32
Darabant, A. ....	51	Leitner, S. ....	5, 13
Deltedesco, E. ....	8, 29	Lexer, M.J. ....	57
Diaz-Pines, E. ....	29	Magid, J. ....	11
Dioszegi, G. ....	64	Manglberger, R. ....	25
Disep, T. ....	38	Marchart, G. ....	6, 16
Doppler, J. ....	60	Matous, M. ....	42
Duboc, O. ....	5, 7, 27, 32, 36	Matthews, B. ....	21
Eckmüllner, O. ....	59	Mayer, M. ....	15, 21, 49
Edenhauser, M. ....	61	Mayr, V. ....	48
Fahringer, A. ....	29	Meixner, O. ....	51
Fernández, J.A. ....	19	Melcher, A. ....	51
Florida, E.J. ....	30	Mentler, A. ....	28, 33
Friedel, J.K. ....	31	Meškin, A. ....	52
Füssl, A. ....	27	Micek, M. ....	41
Gamper, A. ....	31	Muck, P. ....	49
Geburek, T. ....	20	Negash, M. ....	51
Gerding, M. ....	5, 8	Netherer, S. ....	23
Gerzabek, M. ....	12, 28	Noller, C. ....	5, 10
Giri, A. ....	14	Nothdurft, A. ....	16, 38, 52
Godbold, D.L. ....	21, 46	Nour-Eldin, H.H. ....	46
Goff, D. ....	48	Oberaigner, K. ....	6, 17
Görig, S. ....	55	Oberhofer, L. ....	44
Gruber, P. ....	53	Öllerer, B. ....	54
Gruber, S. ....	58	Paumann, R. ....	6, 24
Hager, H. ....	51	Pienisch, S. ....	32
Heinze, B. ....	41	Porotti, E. ....	5, 11
Hochbichler, E. ....	41, 60, 64	Puschenreiter, M. ....	5, 9, 10, 11, 25, 35, 37
Höckner, M. ....	6, 18	Rabitsch, I. ....	34
Höfer, C. ....	9	Rabitz, A. ....	33
Hönigsberger, F. ....	59	Raffl, H. ....	6, 20
Hood-Nowotny, R. ....	34	Rampazzo, R. ....	62
Huber, R. ....	57	Reichenauer, T. ....	12
Kanzian, C. ....	53	Reiter, J. ....	35
Katzensteiner, K. ....	14, 15, 58	Rewald, B. ....	19, 47, 48, 49, 50
Keiblinger, K. ....	8, 28, 29	Ritter, T. ....	6, 54
Keil, M. ....	61	Robbe, A. ....	36
Keßler, D. ....	5, 15	Robinson, B. ....	9, 32
Kessler, M. ....	43	Röck, L. ....	6, 18
Kidd, P.S. ....	10	Romic, M.C. ....	30

Rosinger, C.....	6, 19, 21	Šustić, D.....	47
Ruda, J. ....	47	Tebbich, T.....	34
Sánchez-Navarro, V. ....	19	Tesfay, H.....	51
Sandén, H.....	19, 21, 46, 47, 48	Trinko, B. ....	56
Santner, J. ....	7, 9, 25, 27	Vacik, H.....	42, 43, 61
Schafellner, C.....	23, 38, 39, 40	Vietz, S.....	37
Scharf, J.....	59	Vospernik, S.....	16, 18, 52, 56
Schebeck, M. ....	22	Wagentristl, P.....	55
Schiefer, S. ....	35	Wagner, S. ....	5, 9
Schmieder, B.....	6, 23	Watzinger, A.....	12, 13
Schopf, A.....	22, 24	Weizer, G.....	6, 22
Sebald, J. ....	45	Wenzel, W. ....	5, 7, 9, 10, 11, 27, 30, 31, 32, 35, 36, 37
Seidl, R. ....	17, 44, 45	Wieser, M.....	40
Senf, C.....	45	Wriessnig, K.....	51, 58
Siller, R. ....	47	Zambelli Gnocco, B.....	39
Stampfer, K. ....	53	Zechmeister-Boltenstern, S.....	8, 13, 29, 33, 34
Sterba, H. ....	55	Zehetner, F. ....	7, 27, 28
Suarez-Rubio, M. ....	34	Zhao, J. ....	6, 19
Summer, D. ....	5, 12	Zotter, B. ....	56

The Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences, Vienna, Austria would like to thank all authors for their valuable contributions.

