



3. Student Conference Department of Forest and Soil Sciences, 2018

Book of Abstracts



25. May 2018

The student conference comprises the following BOKU courses (2018S)

Bachelorseminar 910110,

Masterseminar 910301, and

Dissertantenseminar 910400

Version: 23. May 2018, 12am (final)

Please be aware that slight modifications 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 978-3-900932-56-5

Universität für Bodenkultur Wien

3. Student Conference, Department of Forest and Soil Sciences, 2018 – Book of Abstracts / B. Rewald (Ed.). University of Natural Resources and Life Sciences, Vienna. 70 p.

Cite contributions as: AUTHOR NAME(S) (2018) TITLE. In: Rewald, B. (Ed.), 3. *Student Conference, Department of Forest and Soil Sciences, 2018 – Book of Abstracts*. University of Natural Resources and Life Sciences, Vienna, Austria.

Program overview

The meeting will take place at May 25th, 2018 at the **Schwackhöfer-Haus** (“Glass building”), Peter-Jordan-Straße 82, 1190 Vienna, Austria – Ground floor (Erdgeschoss / Aula). Oral presentations will start at **9.00 am** without delay.

Location	Time						
	8.30 - 9.00	9.00 - 10.30	10.30 - 11.00	11.00 - 12.30	12.30 - 13.30	13.30 - 14.30	~14.45
Aula SCHW	Conference desk (<i>put posters!</i>)		<i>Coffee break, Open poster session</i>		Poster session, Lunch break		Poster award
SCHW SR04		Session 1.1		Session 1.2		Session 1.3	
SCHW SR-Landtechnik		Session 2.1		Session 2.2		Session 2.3	

The **conference desk** is open from ~8.30 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.*

For **oral contributions**, all presenters are kindly asked to up-load their presentations to the provided computers (PC, Windows 7/10, 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 (**12+3 format**). Please **keep the time limits**, especially in Session 1!

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 (12.30-13.30) if questions arise. There will be a **best poster award!** Established scientists (≥Doctorate) at the Department: please pick up the ballot paper for voting at the conference desk and return them until 13.30 (after lunch break/poster session). Please join the award ceremony (**~14.45 o’clock**).

Table of Contents

Program overview	3
Time schedule	5
Session 1 – Soil Research and Forest Ecology	5
Session 2 – Forest Engineering, Silviculture, Forest Growth, and Forest Entomology, Pathology and Protection.....	6
Poster session	7
Oral presentations - Abstracts	8
Session 1 - Soil Research and Forest Ecology.....	8
Session 2 - Forest engineering, Silviculture, Forest Growth, and Forest Entomology, Pathology and Protection.....	24
Poster presentations - Abstracts	36
Institute of Soil Research	36
Institute of Forest Ecology	45
Institute of Silviculture	52
Institute of Forest Growth	56
Institute of Forest Engineering.....	59
Institute of Forest Entomology, Forest Pathology and Forest Protection	64
Other BOKU Institutes and External Organizations	66
Index of contributors	69

Time schedule

Session 1 – Soil Research and Forest Ecology

SCHW-SR 04: 9.00-10.30, 11.00-12.30 and 13.30-14.30 o'clock

Convener: Hans Sandén

<i>Time</i>	<i>Presenter</i>	<i>Title</i>
9.00-9.30	Watzinger, Hood- Nowotny	<i>KEYNOTE</i> - Stable isotopes in soil research
9.30-9.45	Spiridon	Consequences of climate change for agroecosystem carbon and nitrogen cycling – a stable isotope labelling study
9.45-10.00	Landl	CO ₂ exchange and enzyme activity of climate change simulation treatments in subarctic tundra heath in northern Sweden
10.00-10.15	Deltedesco	Linking denitrification losses to functional N-genes in Australia
10.15-10.30	Dinter	Major and trace elements in the volcanic soils of the agricultural zones of the Galápagos Islands
		<i>Open poster session & Coffee break (10.30 – 11.00)</i>
11.00-11.30	Gratzer	<i>KEYNOTE</i> - The UN - Sustainable Development Goals: a topic for forest- and soil sciences?
11.30-11.45	Simon	Predictive forest soil properties mapping at a regional scale
11.45-12.00	Hipfinger	Soil emissions of CO ₂ , CH ₄ and N ₂ O of disturbed and undisturbed beech stands, affected by decomposing foliage litter
12.00-12.15	Gamper	Assessing phosphorus availability with DGT in organic and conventional soils
12.15-12.30	Roschitz	Chemical imaging of tungsten shot weathering in soil
		<i>Lunch break & Poster session (12.30 – 13.30)</i>
13.30-13.45	Schiefer / Reiter	Pattern and temporal changes of silicon fractions, carbon and pH in lower Austria
13.45-14.00	Summer	Synergistic combination of biological and chemical degradation of tetrachloroethene to improve groundwater clean-up efficiency
14.00-14.15	Tognacchini	Nickel phytomining from galvanic sludge-derived technosols
14.15-14.30	Ridard	Evaluating Ni phytomining efficiency on Austrian serpentine soils in a long-term field experiment

Session 2 – Forest engineering, Silviculture, Forest Growth, and Forest Entomology, Pathology and Protection

SCHW-EG/115.5 (Seminarraum Landtechnik): 9.00-10.00, 11.00-12.00, 13.30-14.30 o'clock

Conveners: Karl Stampfer (9-10.00 o'clock), Tim Ritter (from 11 o'clock)

<i>Time</i>	<i>Presenter</i>	<i>Title</i>
9.00-9.20	Vilsmeier	Erstellung einer Sachbilanz des Seilgeräts MM-Syncrofalke 3to
9.20-9.30	Kirnbauer	Rückung mit Traktor und Seilwinde – Produktivität und Treibstoffverbrauch
9.30-9.45	Albrecht	Motorsäge 4.0 - von der klassischen Produktivitätsstudie zur elektronischen Treibstoff- und Laufzeitenanalyse
9.45-10.00	Riegler	Zustandserhebung und Klassifizierung von Forststraßen im Lehrforst Rosalia
		<i>Open poster session & Coffee break (10.30 – 11.00)</i>
11.00-11.15	Buchacher	Unterschiede im Wachstum von verschiedenen Herkünften der Schwarzkiefer
11.15-11.30	Ette	Major factors impacting biodiversity in forest ecosystems dominated by broad-leaved tree species
11.30-11.45	Kaufmann	Feasibility study natural park Dunkelsteinerwald
11.45-12.00	Gindra-Vady, Pousek	Potenzialabschätzung von Nichtholzprodukten und forstlichen Dienstleistungen in Österreich & Analyse von Nichtholzprodukten und Dienstleistungen im Rahmen einer nachhaltigen Waldbewirtschaftung
		<i>Lunch break & Poster session (12.30 – 13.30)</i>
13.30-13.45	Lechner	Additional investigations on the effect of <i>Verticillium nonalfalfae</i> on <i>Ailanthus altissima</i> and associated native and non-native tree species in Eastern Austria
13.45-14.00	Grollnigg	Energy budget of offspring parasitoid wasps from young, middle-aged and old mothers
14.00-14.15	Disep	A dendroecological reconstruction of spruce sawfly outbreaks in the alpine foothills of Upper Austria and Salzburg from 1950 to 2017
14.15-14.30	Wieser	Lifetime reproduction, fitness and longevity in synovigenic parasitic wasps

Poster session

Aula Schwackhöferhaus

Poster are on display from 9 am to 3 pm.

Dedicated times for poster sessions:

- 10.30-11 (Open Poster session),
- **12.30-13.30** (Poster session).

Please attend the **Poster award ceremony** at 14.45.

Supervisors / Scientist holding a PhD: Please participate in the election process. Ballot paper are available at the conference desk.

Oral presentations - Abstracts

Session 1 - Soil Research and Forest Ecology

KEYNOTE LECTURE

STABLE ISOTOPES IN SOIL RESEARCH

Andrea Watzinger, Rebecca Hood-Nowotny

Institute of Soil Research, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna.

Soils provide the four F's - food, fibre, feed, fodder and other agricultural products, the majority of which are entirely dependent on the soil's fitness. The ecosystem services that the soil provides are slowly starting to be recognised, including climate stabilisation through carbon sequestration, decomposition of wastes, nutrient cycling and probably most importantly water and chemical purification. Stable isotopes are useful safe tools for investigating and assessing these complex environmental problems in situ. For example, many of the best practices for synthetic fertiliser usage were developed using stable isotope techniques specifically nitrogen enriched with the stable isotope nitrogen fifteen (^{15}N) as they allow the fate of the nitrogen to be followed directly. Synthetic fertilisers are not permitted in organic farming and not easily available in many countries therefore extensive research into measuring N benefits from alternative organic fertilisers, such as cover crops, manures, soil organic matter mineralisation and biological nitrogen fixation, using isotope dilution approaches have been developed by the BOKU Isotope Group and remain at the core of our expertise.

Agricultural and forestry practices change with the introduction of new products and practices, understanding their impact on C and N cycles in crop production is paramount in risk assessment and societal acceptance. For example, biochar addition to soil in Austria and Africa has been shown to cause fundamental changes in soil nitrogen cycle and stable isotope techniques are key to understanding these microscopic processes which could have such global consequences.

Furthermore, soil carbon exchanges are ten times greater than human carbon emissions but tracing these exchanges against high background carbon levels is difficult. Over short time frames using non-isotopic methods it is impossible to detect the changes in percentage soil organic carbon accurately enough to assess the impact due to the small input against large background and inherent soil variability. Isotope tracers overcome this problem by labelling the input and allowing it to be immediately traced into the soil and sequestered, or lost to the atmosphere as isotopically labelled CO_2 . This means the impact of small changes in soil management or remediation practices can be assessed in terms of organic matter or compound cycling, mineralisation and carbon sequestration over short time frames and knowledge gained can be used to determine national and international policy based on sound scientific evidence. We are currently using such label and tracing methods to understand impacts of nitrogen pollution in forests, to look at the impact of drought on organic matter breakdown in agriculture, the impact of heavy metal and organic contaminant

remediation measures on soil carbon and nitrogen turnover as well as directly observing the degradation of organic contaminants.

Stable isotope probing of the metabolome (^{13}C PLFA) is a powerful tool to understand and quantify who is using what and when and trying to build up soil food webs. This method became available end of last century by coupling the isotope ratio mass spectrometers to gas or liquid chromatography to determine the compound specific isotope composition. We currently work on extending this methodology to the mesofauna (^{13}C FA) to fill the gap between the soil microorganisms and larger insects, which can easily be measured by bulk analytical IRMS methods. The use of compound specific stable isotope methods also opened the opportunity to look at the stable isotope fractionation during certain chemical, physical and biochemical processes and hence explore the behaviour of distinct molecules in the water – soil – atmosphere nexus. Monitoring the fractionation of compound tells us the story about their behaviour in the environment within the depth of differentiating between chemical reactions and quantify its extent. Rate limiting steps during a (bio)chemical process become visible. We mainly used this isotopic tool to characterize the degradation of organic volatile compounds. Additionally, we also used fractionation to characterize the process of denitrification and sulphate reduction in the saturated zone and discovered a litotrophic denitrification process. Just recently we started to look at the oxygen isotope composition of phosphate to get an insight into phosphate transport from a biochar loaded surface to the plant and to differentiate between microbial mediated and physical/chemical soil processes.

The methods described provide detailed microscale insight, in order to scale up to the field we need to look into the isotope composition of gaseous emissions in nature. The sky's the limit. Getting information on isotopic signatures of important greenhouse gases at a landscape scale is difficult and expensive. We are using drones to automatically sample carbon dioxide concentrations and fluxes. This project couples' isotope ratio measurement with the atmospheric sampling vision of measuring of carbon foot prints at a landscape scale.

In the BOKU Isotope Group we concentrate on the isotopes of the biologically active elements carbon, nitrogen, hydrogen, sulphur and oxygen at the lighter end of the periodic table. We have over fifty years of combined experience using stable isotope tools mainly in soils research but we have also conducted extensive research in food, forensics, soil remediation, entomology, agriculture and forestry.

CONSEQUENCES OF CLIMATE CHANGE FOR AGROECOSYSTEM CARBON AND NITROGEN CYCLING – A STABLE ISOTOPE LABELLING STUDY

Andreea Spiridon^{1,2}, Rebecca Hood-Nowotny², Simon Leitner², Helene Berthold³, Johannes Hösch³, Erwin Murer⁴, Johannes Wagenhofer⁴, Herbert Formayer⁵, Alexander Bruckner⁶, Maria Heiling⁷, Christian Resch⁷, Georg Weltin⁷, Andrea Watzinger²

¹Institute of Terrestrial Ecosystem, Department of Microbiology and Ecosystem Science, University of Vienna, ²Institute of Soil Science, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna, ³Department for Soil Health and Plant Nutrition, AGES Austrian Agency for Health and Food Safety, ⁴Institut für Kulturtechnik und Bodenwasserhaushalt, BAW Bundesamt für Wasserwirtschaft, ⁵Institute of Meteorology, Department of Water – Atmosphere - Environment, University of Natural Resources and Life Sciences Vienna, ⁶Institute of Zoology, Department of Integrative Biology and Biodiversity Research, University of Natural Resources and Life Sciences Vienna, ⁷Soil and Water Management & Crop Nutrition Laboratory, Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, International Atomic Energy Agency.

The impact of climate change on the determining factors of plant production, such as precipitation amounts and patterns are rarely studied in the Pannonian area. Even less is known to what extent different soils might alter ecosystem responses. To investigate the effects of future rainfall patterns on different soils, a regionalized scenario RCP6.0 derived from the 5th IPCC Assessment Report is used on a long-term lysimeter facility.

Stable isotope labelling is one of the more practical ways of tracing fate and behavior of nutrients in agricultural soils. In this study, white mustard (*Sinapis alba*) dual labelled with ¹³C and ¹⁵N stable isotopes is being used as green manure, and applied to the 3 m² lysimeters where future rainfall patterns are compared with current precipitation patterns on two different soil types – sandy calcareous phaeozem and calcic chernozem, representing the Marchfeld region in Austria.

Green manure provides nutrients and serves as a major component for the build-up of soil organic matter. Mineralization and cycling of carbon and nitrogen from the green manure will be calculated after measuring ¹³C and ¹⁵N isotopes in major pools (¹³C CO₂ and ¹⁵N N₂O, ¹³C in the soil and in the soil microorganisms – PLFAs and the mesofaunal FA, ¹⁵N in total soil, inorganic and organic pools, soil microorganisms, plants and soil solution). Preliminary results will be presented.

The study will allow for a better understanding of soil-water-plant interaction processes under changing conditions and contribute to better adaptation and mitigation strategies for climate change by examining the effects of future rainfall scenario on soil – water dynamics, the turnover of organic matter -the carbon and nitrogen cycle, as well as soil biodiversity.

CO₂ EXCHANGE AND ENZYME ACTIVITY OF CLIMATE CHANGE SIMULATION TREATMENTS IN SUBARCTIC TUNDRA HEATH IN NORTHERN SWEDEN

Balduin Landl^{1,2}, Sophie Zechmeister-Boltenstern¹, Anders Michelsen²

¹Institute of Soil Research, Department of Forest and Soil Sciences University of Natural Resources and Life Sciences Vienna, ²Terrestrial Ecology, Department of Biology, University of Copenhagen.

Tundra ecosystems are affected directly by climate change through temperature rise and indirectly by a plant community shift towards woody shrub vegetation. This can have a relevant impact on the soil carbon stocks and feedback on climate change. Climate change simulation plots were established in autumn 2011 in a subarctic tundra heath close to Abisko (Sweden), 200km north of the arctic circle, including warming with open top chambers and annual litter addition of expanding shrubs (birch and willow) and fungal fruit body addition for high nitrogen input as treatments.

In the 6th year of treatment in summer 2017, effects of treatment on ecosystem carbon cycling were investigated with 14 measurements of Ecosystem Respiration (ER), Gross Ecosystem Production (GEP), and Net Ecosystem Exchange (NEE) with darkened and transparent closed chambers during the growth period of 2017. ER and GEP were significantly increased by 6 years of warming and fungi addition treatment, probably through increased plant growth, which indicates possible similar effects of warming and removal of nitrogen limitation after few years of treatment. Both, Birch and Willow litter addition treatments showed similar tendencies of increased activity, but effect was not significant. Although ER and GEP was affected by treatments, effect on NEE was not detectable.

Soil samples were collected once in August 2017 and later analyzed for potential soil enzymatic activity. Enzyme activity of carbon cycling enzymes tended to be higher in 5-10cm depth, than in the top 5cm of the soil. In the top 5cm Phosphatase activity was highest followed by Protease, which changed in the 5-10cm soil layer with highest activity of Protease before Phosphatase. Treatment effects on extracellular enzyme activity could not be detected after 6 years of treatment.

LINKING DENITRIFICATION LOSSES TO FUNCTIONAL N-GENES IN AUSTRALIA

Evi Deltedesco^{1,2*}, Johannes Friedl¹, David W. Rowlings¹, Markus Gorfer³, Clemens Scheer¹, Katharina Keiblinger², Peter R. Grace¹, Sophie Zechmeister-Boltenstern²

¹Queensland University of Technology, Institute for Future Environments, Brisbane, Australia, ²Institute of Soil Research, University of Natural Resources and Life Sciences, Vienna, Austria, ³AIT Austrian Institute of Technology, Center for Health & Bioresources, Tulln, Austria; *evi.deltedesco@boku.ac.at

High inputs of water and nitrogen (N) are needed to drive productivity in pasture-based dairy systems in Australia. Dairy pastures are exposed to repeated wetting and drying cycles, defined by rainfall, irrigation and evapotranspiration. Both irrigation and fertilisation are known to trigger large pulses of N₂O emissions. However, the impact of wetting and fertilisation on total denitrification losses (N₂ + N₂O) and on the response of functional *nosZ* gene (N₂O reductase) remains uncertain.

The aim of the present study is to examine how irrigation management can be used to reduce anaerobic denitrification processes in intensively managed pastures in Casino, Australia. Therefore, we combined the direct quantification of N₂ and N₂O losses using the ¹⁵N gas flux method and an automatic N₂O measurement system with quantitative PCR, measuring the abundance of *nosZ*. The experiment was conducted over a grazing cycle of 16 days with two irrigation treatments (low and high frequency). An intense rainfall event was simulated at the end of the grazing cycle, aiming for saturated conditions in the topsoil.

Fertilization and irrigation led to a decrease in *nosZ* abundance in both treatments, reflecting increased NO₃⁻ production and a shift from N₂O to NO₃⁻ as final electron acceptor during denitrification. However, after the intense rainfall event copy number of the *nosZ*-encoded bacterial N₂O reductase increased and the NO₃⁻ decreased and it may indicate a shift in the N₂:N₂O ratio to N₂. The intense rainfall event triggered substantial N₂O emissions with higher emissions in the low frequency than the high frequency treatment. This is likely due to the lower soil moisture in the low frequency treatment, as N₂O emissions are known to be driven by antecedent soil moisture. Further analysis of ¹⁵N₂ will reveal if high frequency irrigation reduces overall denitrification losses or shifts the N₂:N₂O ratio to N₂.

MAJOR AND TRACE ELEMENTS IN THE VOLCANIC SOILS OF THE AGRICULTURAL ZONES OF THE GALÁPAGOS ISLANDS

Tamara Dinter^{1,2}, Franz Zehetner¹, Markus Puschenreiter¹, Bjarne Strobel², Martin H. Gerzabek¹

¹Institute of Soil Research, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences, Vienna; ²Section for Environmental Chemistry and Physics, Department of Plant and Environmental Sciences, University of Copenhagen, Denmark.

The Galápagos Islands have been of interest to natural scientists since the time of Charles Darwin. Although the flora, fauna and geology has long been studied, only recently have the islands' soils become a subject of investigation and literature on this topic is still relatively scarce. In this project, soil samples from different elevations within the agricultural areas of three Galápagos islands were subjected to *aqua regia* acid digestion to determine concentrations of major (Al, Ca, Fe, K, Mg, Na, P) and trace (Cd, Co, Cr, Cu, Mn, Ni, Pb, Sr, V, Zn) elements by ICP-OES and ICP-MS. Distinct differences in element assemblage were observed between the youngest (1-5 ka) and oldest (1-2 Ma) studied islands, as well as between areas of high (>600 m a.s.l.) and low (~100 m a.s.l.) elevation on the islands. Several weathering indices and multivariate statistical analyses were used to determine the soils' degree of chemical evolution and the driving factors behind observed differences. As the geologic parent material (basalt) on all islands is relatively homogenous, the main influences on changing soil geochemistry were determined to be climatic conditions and length of time the soils had been subjected to weathering processes. The most weathered soils of each island were found at the highest elevations (i.e., subjected to the highest level of rainfall), with the most weathered samples coming from the oldest island. Additionally, the results suggest that the use of agrochemicals may be causing build-up of certain trace metals (e.g. Cd) in the soil, which may pose a risk to plant and animal health.

THE UN - SUSTAINABLE DEVELOPMENT GOALS: A TOPIC FOR FOREST- AND SOIL SCIENCES?

Georg Gratzner

Institute of Forest Ecology, Department of Forest- and Soil-Sciences, University of Natural Resources and Life-Sciences, Vienna, Austria. *georg.gratzner@boku.ac.at

The challenges the world is facing are severe and urgent: more than 800 million people globally live in extreme poverty and are facing hunger. Over half of the world's arable land is degraded, thus weakening livelihoods for 1.5 billion people globally. Climate change affects livelihoods all over the world and puts severe threats to survival in many areas. Disparities of opportunity, wealth and power are stark and amplified by effects of climate change.

In responding to the multitude of these challenges, the resolution "Transforming our World: The 2030 Agenda for Sustainable Development" was adopted by the General Assembly of the United Nations in September 2015. The 17 SDGs and their 169 targets intend to build "peaceful, just and inclusive societies" (UN General Assembly 2015) and provide livelihoods free of poverty and hunger in sound and safe environments, where global threats like climate change are successfully combated. They envisage sustainable production patterns and inclusive, effective economies and institutions. The Agenda 2030 is ambitious, broad, and as the UN puts it, "indivisible". In my talk, I will outline the SDGs and discuss implications for science in general and for forest- and soil sciences in particular. I will explore issues of coherence of goals and targets and will discuss how the Agenda is tackled in Austria.

PREDICTIVE FOREST SOIL PROPERTIES MAPPING AT A REGIONAL SCALE

Alois Simon^{1,2}, Georg Gratzner¹, Clemens Geitner³, Klaus Katzensteiner¹

¹Institute of Forest Ecology, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna, Austria; ²Department of Forest Planning, Forest Administration Tyrol, Provincial Government of Tyrol, Innsbruck, Austria; ³Institute of Geography, University of Innsbruck, Austria.

The Tyrolean mountain forests cover the margins of the distribution ranges for a variety of temperate and boreal tree species. Beside temperate, also continentality limits the occurrence of native tree species. Especially at their continental distribution margin, the species tend to maintain competitiveness by preferring soils with better nutrient supply and higher water storage capacity, compared to their core distribution range. This implies a so-called soil compensatory effect, which can be decisive for the shift of species distribution margins under anthropogenic climate change. Therefore, the generation of spatially explicit soil information and its inclusion into tree species distribution models are important for the development of future forest management strategies. For this purpose, approaches for the regionalization of forest soil properties for the province Tyrol in Austria were developed. Based on data from 1653 existing soil profiles models for the prediction of amount of fine soil, water storage capacity, acid-base status of the topsoil and humus layer thickness as model response variables were derived. A great variety of predictor variables calculated from spatially explicit information on geology, topography, climatology and remote sensing data were tested for their predictive value in generalized additive models (gam) and random forest (rf) models. Preliminary predictions with gam explain a deviance of 58 % for amount of fine soil down to 100 cm mineral soil depth. Attempts with rf showed a model accuracy in the same range but on a somewhat lower confidence level. Beside topographical values as elevation, slope and saga-wetness-index, the genesis and mineralogical composition of the geological parent material turned out as important predictors. Moreover, the associated response curves of the gam were plausible and consistent within the model range.

SOIL EMISSIONS OF CO₂, CH₄ AND N₂O OF DISTURBED AND UNDISTURBED BEECH STANDS, AFFECTED BY DECOMPOSING FOLIAGE LITTER

Christina Hipfinger, Torsten W. Berger

Institute of Forest Ecology, Department of Forest Soil Sciences, University of Natural Resources and Life Sciences Vienna, Austria.

Background and aims. Soil-atmosphere exchange of CO₂, CH₄ and N₂O in forest ecosystems may be affected by disturbance regimes and associated litter decomposition rates. Hence, we performed forest manipulation experiments to investigate relations between various post-harvesting-practices and surface greenhouse gas fluxes.

Methods. The following four stand treatments (3 replications per treatment) were performed within a mountainous beech forest: i: control, ii: girdling, iii: clearcut with woody debris left and iv: clearcut without woody debris. Within each stand treatment, we installed microcosms (rings) in order to measure soil efflux of CO₂, CH₄ and N₂O (closed chamber method) during the summers 2016 and 2017. The soil below each ring was manipulated threefold: a: undisturbed control, b: added manipulated litter and c: no litter. Mineral soil- and litter samples were collected and chemically analyzed at the end of the study period.

Results. CO₂ efflux declined from control, over girdling, over clearcut with woody debris to clearcut without woody debris. Litter decomposition was highest at the clearcut stands with woody debris, triggered by enhanced soil temperature and soil moisture. Nutrient release of decomposing litter increased effluxes of CO₂ and N₂O, while litter acted as a physical barrier in terms of CH₄ uptake.

Conclusions. Post-harvesting practices (e.g., removal of biomass after clearcut) can be used as a tool to manipulate soil fluxes of CO₂, CH₄ and N₂O.

ASSESSING PHOPHORUS AVAILABILITY WITH DGT IN ORGANIC AND CONVENTIONAL SOILS

Anne Gamper^{1*}, Jürgen K. Friedel², Walter W. Wenzel¹

¹Department 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. ²Department 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. *anne.gamper@students.boku.ac.at

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 P nutrition of crops.

The method of diffusive gradients in thin films (DGT) has gained increasing attention in 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 available P in soil and relates fertilizer requirements. The combination with the measurement of heterotrophic soil respiration and extracellular phosphatase activity might give a better insight to the role of microorganisms and enzymes in P availability.

Here we investigated the potential contribution of organic P by comparing P uptake in punctual short-term DGT-deployments (24 hours) during an incubation period of 24 days (20°C) of sterilized (with mercuric chloride, HgCl₂) versus non-sterilized arable mineral topsoil (Ap horizons). We hypothesized that considerably more DGT-labile P is released in the non-sterilized treatments.

The pair of organically (extended crop rotation of eight to ten years, green manure, no fertilizer) and conventionally (synthetic fertilizer) farmed Ap horizons (Chernozem/ Phaezems, Gleyic Phaeozem, Fluvisol) from the Tullnerfeld region was also used to test the hypothesis that organic farming may considerably increase the potential supply of P from organic sources. Preliminary results indicate no significant difference between the two treatments and the two different managements although the inactivation of the extracellular phosphatase by HgCl₂ was successful.

CHEMICAL IMAGING OF TUNGSTEN SHOT WEATHERING IN SOIL

Christina Roschitz¹, Eva Oburger^{1,2}, Gabrielle Daudin³, Jakob Santner⁴, Walter Wenzel¹

¹Institute for Soil Research (UFT-Tulln), Department of Forest and Soil Sciences University of Natural Resources and Life Sciences Vienna; ²Terrestrial Ecosystem Research, Department of Microbial Ecology and Ecosystem Research University of Vienna; ³UMR Eco&Sols, French National Institute for Agricultural Research (INRA) Montpellier; ⁴Division of Agronomy (UFT-Tulln), Department of Crop Sciences University of Natural Resources and Life Sciences Vienna

The use of the transition metal tungsten (W) as W alloys in industry, military ammunition or households is rising and consequently the risk of W entering environmental systems in excess is increasing. Depending on dose and speciation, W is potentially toxic. In soil, monomeric tungstate prevails under alkaline conditions but at high W concentrations and $\text{pH} < 6$, W polymerizes with itself and other ions. To date, the geochemistry of W but also W alloys in soils is not well understood. The aim of this study was to reveal how soil pH determines W alloy weathering and how dissolution processes in turn affect soil pH locally using non-invasive, 2-dimensional imaging methods. W shots (W-Ni-Fe alloy) from hunting ammunition were incubated with a sandy soil, with soil pH either kept naturally acidic (pH 5.5) or adjusted to the neutral (pH 6.5) or alkaline range (pH 7.5) by the addition of lime. After 80 days, pH sensitive planar optodes were applied to visualise pH changes caused by W shot weathering. In the acidic and neutral soil, alkalinisation occurred around the shot suggesting W sorption and polymerisation processes. In addition to alkalinisation, acidification features occurred on the outer edges of the alkalinisation zone around the shot in the neutral soil, possibly because protons were released during the oxidation of metallic W. The high pH buffer capacity resulted in no observable pH changes in the alkaline soil. To link pH dynamics with element solubility, DGT-gels (diffusive gradients in thin films) capable of binding soluble cations and anions were also deployed and will be analysed by laser ablation ICP-MS to generate images of soluble element gradients around the shots. The combined knowledge about changes in soil pH and elemental solubility induced by W alloy weathering in soil with different pH will help to better understand W mobility in soils which is essential for accurate risk assessment.

PATTERN AND TEMPORAL CHANGES OF SILICON FRACTIONS, CARBON AND PH IN LOWER AUSTRIAN CAMBISOLS, LEPTOSOLS, REGOSOLS

Anna Schiefer*, Markus Puschenreiter, Walter W. Wenzel

Department of Forest and Soil Sciences, Institute of Soil Research, University of Natural Resources and Life Sciences, Vienna (BOKU), Tulln, Austria. *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 100 resampled soils (taken between November 2016 and March 2017) and 100 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 and grassland soils from Lower Austria. The plant-available Si is being extracted with a diluted CaCl₂ 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 is 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.

NOTE: Joined oral presentation with Reiter *et al.* (next page)

PATTERN AND TEMPORAL CHANGES: SILICON FRACTIONS, CARBON, NITROGEN AND PH IN LOWER AUSTRIAN CZERNOZEMS AND PHAEOZEMS

Johanna Reiter*, Markus Puschenreiter, Walter W. Wenzel

Department of Forest and Soil Sciences, Institute of Soil Research, University of Natural Resources and Life Sciences, Vienna (BOKU), Tulln, Austria. *johanna.reiter@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 100 resampled soils (taken between November 2016 and March 2017) and 100 soil samples taken 20-30 years ago by the Austrian soil mapping services at the same locations is being made.

The focus of the research lies on measuring potentially plant-available and amorphous Si fractions in Chernozem and Phaeozem soils from Lower Austria. The plant-available Si was extracted with a diluted CaCl₂ solution (Haysom and Chapman, 1975), the amorphous Si with NaOH (Georgiadis et al., 2015). The Si concentrations were measured using the molybdenum blue method and spectrophotometry (Morrison and Wilson, 1963). Furthermore the carbon and nitrogen content as well as the pH and the water content of the resampled soils was measured. Data about the pH is also available for the archived samples.

Potential changes in the Si content should be shown. How might soil- or climate factors influence the Si content. If there was a change in the C content; can this be explained through climate change or land use; atmospheric inputs? How did fertilization influence the C:N ratio? The hypotheses will be tested using principal component analysis, multiple correlation and regression analysis.

NOTE: Joined oral presentation with Schiefer *et al.* (previous page).

SYNERGISTIC COMBINATION OF BIOLOGICAL AND CHEMICAL DEGRADATION OF TETRACHLOROETHENE TO IMPROVE GROUNDWATER CLEAN-UP EFFICIENCY

Dorothea Summer¹, Thomas G. Reichenauer¹, Martin Gerzabek²

¹Environmental Resources & Technologies, Energy Department, Austrian Institute of Technology; ²Institute of Soil Research, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna.

An estimated number of 2000 severely contaminated sites can be found in Austria. Chlorinated hydrocarbons, like Tetrachloroethene (PCE), are common and hazardous groundwater pollutants. PCE was mainly used in dry-cleanings and metal-working industries and is therefore prevalent in build-up regions. Conventional clean-up methods cannot be used for the remediation and innovative in-situ techniques are needed.

This PhD-project focuses on the combination of two existing in-situ remediation methods (chemical and biological). During the chemical remediation zero valent iron (ZVI) is introduced into the underground to reductively degrade PCE-molecules. However, a high percentage of ZVI particles reacts anaerobically with water, forming H₂. To achieve sufficient PCE removal, an excess of ZVI particles is needed, which drastically increases the cost of a clean-up. For biological PCE-removal bacterial strains of *Dehalococcoides* are applied to enzymatically dechlorinate PCE to ethene. The strictly anaerobic *Dehalococcoides spp.* utilize H₂ as an electron donor for PCE-degradation and can dechlorinate it completely to ethene. With the combination of the chemical and biological degradation, the downsides of both methods could be eliminated. The H₂ produced by the iron particles could function as electron donors for the biological clean-up, making the remediation more time and cost effective.

First, batch experiments were conducted to investigate the degradation of different ZVI particles (micro- and macro-scaled), dehalogenating bacterial cultures and their combinations. To gain better understanding of the biological degradation processes different parameters (nutrients, carbon source, temperature, etc.) were tested. In the next step additional DNA-analysis in an on-going lysimeter experiment were performed to have an insight into the development of the microbial composition over the clean-up period. At the end of the project the influence of the spatial arrangement of the particles and bacteria will be tested in column experiments with a simulated groundwater flow.

NICKEL PHYTOMINING FROM GALVANIC SLUDGE - DERIVED TECHNOSOLS

Alice Tognacchini^{1,2}, Markus Puschenreiter², Antony van der Ent^{3,5}, Gaylord Machinet⁴, Guillaume Echevarria⁵

¹Alchemia-nova GmbH, Vienna, Austria; ²University of Natural Resources and Life Sciences Vienna, Department of Forest and Soil Sciences, Tulln, Austria; ³Centre for Mined Land Rehabilitation, Sustainable Minerals Institute, The University of Queensland, St Lucia, 4072 QLD, Australia; ⁴Microhumus, Université de Lorraine, ENSAIA, Laboratoire Sols et Environnement, Vandoeuvre, Cedex, France; ⁵Laboratoire Sols et Environnement, UMR 1120, Université de Lorraine – INRA, Nancy, France.

In phytomining operations plants capable to accumulate metals in their above-ground biomass are cultivated on mineral rich substrates, with the objective of recovering the metal for commercial gain (Chaney et al. 1998; van der Ent et al. 2015). Research and development of this technology has so far concentrated on nickel (Chaney et al. 2007; Nkrumah et al. 2016), with special regard to phytomining from naturally nickel enriched serpentine soils. Considering the large amounts of nickel-rich waste produced worldwide, the possibility to recover valuable metals from materials that would otherwise need to be disposed is of particular interest. The objective of the present study is to investigate the recovery of nickel from industrial waste through phytomining. Formulation of artificial waste-derived substrates, phytotoxicity assessments and a phytomining pot experiment have been conducted.

Nickel-rich waste materials were collected from industries operating in the galvanic processes of nickel plating and in serpentine rocks extraction. Different formulations of artificial substrates have been assayed to define appropriate waste-derived technosols. Depending on the available fraction (DTPA) of nickel and other metals as well as pH values, a lower number of formulations has been selected to assess plant toxicity. Phytotoxicity tests were conducted with *Lolium perenne* and the mixtures that resulted in the best germination index were selected for greenhouse pot tests. On the selected technosols, a phytomining pot experiment was conducted with the nickel hyperaccumulator specie

Odontarrhena muralis s.l.. After a growing period of 3 months, dry plant biomass varied from < 0.1 and 4.2 gr per pot, while nickel content varied in the range of 10 – 20 g kg⁻¹ dry weight.

While the amount of nickel accumulated by *O muralis* from the technosols is considered to be satisfactory in terms of phytomining applications, further improvements should be applied in order to increase plant biomass.

EVALUATING NI PHYTOMINING EFFICIENCY ON AUSTRIAN SERPENTINE SOILS IN A LONG-TERM FIELD EXPERIMENT

Charline Ridard^{1*}, Theresa Rosenkranz¹, Petra Kidd², Guillaume Echevarria³, Markus Puschenreiter¹

¹University of Natural Resources and Life Sciences, Vienna, Institute of Soil Research, Tulln, Austria; ²Instituto de Investigaciones Agrobiológicas de Galicia, CSIC, Santiago de Compostela, Spain. ³Laboratory of Soil and Environment, UMR 1120, ENSAIA, Vandoeuvre-lès-Nancy, France. *charline.ridard@boku.ac.at

Serpentine soils, derived from ultramafic parent material, are typically rich in nickel (Ni), chromium (Cr), cobalt (Co) and magnesium (Mg). The soils have typically a Ca/Mg ratio < 1, a total Ni concentration ranging from ~500 – 1500 mg kg⁻¹ and are deficient in essential nutrients. Most of the plants growing on such soils are limiting metal's transfer to their aerial part and are so-called excluders, but some of them are able to concentrate Ni in their biomass > 100 times than in excluders plants. These species are called hyperaccumulators plants and up to now 500 species have been identified as Ni hyperaccumulators. Agromining is a technology based on the use of these hyperaccumulator plants for recovering Ni from the harvested biomass. It represents an ecological re-valorisation option of these soils which can permit in a first time a sustainable metal recovery and in a second time a reduction of the Ni phytotoxicity over time, thus potentially leading to an improvement of the soil quality and fertility. For demonstrating the agromining efficiency on the field scale on four different serpentine sites in Europe, an EU-LIFE project started in 2016. The Austrian field experiment has been established near Bernstein, Austria (47,406397 N 16,260334 O) in autumn 2016, containing 24 plots of 10 m². The soil is characterized by a pH of 5,9; [Ni-DTPA]: 30 mg kg⁻¹; [Ni-SrNO₃]: 0,53 mg kg⁻¹. In the first year two species were tested, *Noccaea goesingensis* (*Ng*) and *Odontarrhena muralis* s.l. (*Om*). For *Ng*, 3 months old seedlings were planted in October 2016 in two different planting densities (20 vs. 10 cm distance between plants) and 2) an intercropping with *Lotus corniculatus* (IC) in the 20 cm density plots. For *Om*, 4 months old seedlings were planted in April 2017, 50 cm distance between plants. To improve Ni yield, intercropping with *Lotus corniculatus* vs the addition of elemental sulphur (0.71 g kg⁻¹) was tested. Both species were harvested in September 2017. We recovered 2.90 t.ha⁻¹ for the total biomass of *Ng* and 3.76 t ha⁻¹ kg for *Om*. For *Ng* intercropping decreased the yield compared to the untreated control, whereas for *Om* only a non-significant tendency for lower biomass was found. The higher density for *Ng* and the sulfur application for *Om* improved the biomass yield, however, there was no significant difference compared to the control treatment for both species. The mean Ni concentration in *Om* biomass was 12350 mg kg⁻¹, 7820 mg.kg⁻¹ for *Ng*, and no differences were found for the treatments. Due to the higher biomass production of *Om*, only this species will be tested in 2018. Four months old seedlings were planted in April 2018. For increasing biomass and Ni yield the following treatments have been established: 1) control, 2) high planting density, 3) NPK fertilization, 4) compost fertilization, 5) cow manure fertilization, 6) pig manure fertilization. All fertilizer treatments provided the same amount of P, but different levels of N. In parallel, different winter cropping mixtures containing *Avena strigosa*, *Lathyrus sativus*, *Vicia sativa*, *Trifolium resupinatum*, *Phacelia* sp for improving soil fertility were grown during 4 months in a pot experiment, followed by planting *Berkheya coddii* and *Odontarrhena muralis* s.l. On these plants the following additional treatments will be tested: plant growth promoting bacteria, co-culture with legumes, nitrogen application and sulphur application. The best performing plant treatment combination will be implemented in field experiment in 2019.

Session 2 - Forest Engineering, Silviculture, Forest Growth, and Forest Entomology, Pathology and Protection

ERSTELLUNG EINER SACHBILANZ DES SEILGERÄTS MM-SYNCROFALKE 3TO

Alexander Vilsmeier, Martin Kühmaier, Karl Stampfer

Institute of Forest Engineering, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna.

This thesis provides a life cycle inventory analysis of a mobile cable yarder system on truck produced by the MM-Forsttechnik GmbH in Frohnleiten, Austria. The analysed machine is a MM-Syncrofalke 3to combined with a Woody 60H processor head mounted on a 3-axle truck from IVECO which delivers operation records since 2010 and therefore is the primary data for this inventory analysis. To achieve recognisable results, the analysis was split into two different sets with clear limits. The first one is about the production of the machine from gate to gate at the facilities of the MM-Forsttechnik GmbH and the second one shows the use-phase of the machine considering the fuel consumption and emissions to air per one productive machine hour including breaks of 15 minutes (PMH₁₅). For the execution of this inventory analysis the systematics are adapted according to ecoinvent-database and the LCA database implemented by the BOKU LCA platform following the ISO 14040 standard. As part of the research project "Life cycle assessment of new technologies for wood processing from forest to mill" funded by BMNT, Austrian State Forests and the forest enterprise Mayr-Melnhof, this thesis aims to support a full life cycle assessment of the wood production in Austria and an evaluation of current and future timber harvesting technologies.

RÜCKUNG MIT TRAKTOR UND SEILWINDE – PRODUKTIVITÄT UND TREIBSTOFFVERBRAUCH

Alexander Kirnbauer, Karl Stampfer, Christian Kanzian

Institut für Forsttechnik, Department für Wald- und Bodenwissenschaften, Universität für Bodenkultur Wien.

In der österreichischen Forstwirtschaft kann der Trend zu größeren und leistungsfähigeren Holzerntemaschinen verfolgt werden. Trotzdem zählt die Seilwinde, vor allem im Bauernwald, nach der Motorsäge zum zweitwichtigsten Forstgerät. Ziel dieser Arbeit ist die Erstellung eines Produktivitäts- und Treibstoffverbrauchsmodelles für die Rückung von Rundholz mittels Traktor und Seilwinde. Im Weiteren soll die Verteilung der Arbeitszeiten dargestellt und eine Kostenanalyse für das Rückesystem erstellt werden.

Bei der untersuchten Maschinenkombination handelt es sich um einen landwirtschaftlichen Standardtraktor von Steyr mit entsprechenden Adaptierungen für den Forsteinsatz und einer Anbaseilwinde von Tiger. Zusätzlich war die Maschinenkombination mit einer Holzzange, aufgebaut am Frontlader ausgerüstet, was das Poltern und Sortieren der Stammabschnitte erleichtern soll. Die Aufnahmen für die vorliegende Studie wurden in einem Bauernwald im Bezirk Murtal getätigt. In die Auswertung der Produktivitätsstudie fließen insgesamt 85 Fuhren mit einem Gesamtvolumen von 219,97 Erntefestmeter ein. Für die Erstellung des Treibstoffverbrauchsmodelles werden die Tagesverbrauchsdaten der zehn Aufnahmetage verwendet. Als signifikante Einflussfaktoren auf die Produktivität erwiesen sich das Baumvolumen, die Rückedistanz, die Stückzahl und die Distanz des Zuzuges.

Bei einem durchschnittlichen Baumvolumen von $2,27 \text{ m}^3$ ohne Rinde, einer mittleren Rückedistanz von 29 m und einer durchschnittlichen Zuzugsdistanz von 29,84 m erreicht das Rückesystem eine Produktivität von $5,06 \text{ m}^3/\text{PSH}_{15}$. Der Treibstoffverbrauch beträgt laut Modell $503,00 \text{ ml/m}^3$. Die beobachteten Werte liegen dabei in einem Bereich von $379,59 \text{ ml/m}^3$ und $649,95 \text{ ml/m}^3$.

MOTORSÄGE 4.0 - VON DER KLASSISCHEN PRODUKTIVITÄTSSTUDIE ZUR ELEKTRONISCHEN TREIBSTOFF- UND LAUFZEITENANALYSE

Peter Georg Albrecht, Karl Stampfer, Christian Kanzian

Institut für Forsttechnik, Department für Wald- und Bodenwissenschaften, Universität für Bodenkultur Wien.

Bis heute ist die Motorsäge eines der wichtigsten Werkzeuge in der Holzernte. Speziell wenn die Gelände- und Witterungsbedingungen ein vollmechanisiertes Ernteverfahren nicht zulassen, ist die Motorsäge die einzige Alternative zur Holzgewinnung. Ziel der vorliegenden Arbeit ist es den Treibstoffverbrauch und die Produktivität bei der motormanuellen Holzernte zu untersuchen. Die gewonnenen Daten sollen in weiterer Folge als Grundlage für die Ökobilanzierung von Holzernteketten dienen. Im Rahmen einer Produktivitätsstudie wurden die Fällung und Aufarbeitung von 183 Bäumen mit einem Gesamtvolumen von 350 Efm analysiert. Für den Treibstoffverbrauch wurden die Messungen mittels Nachtanken durchgeführt. Aufgrund der einfachen Umsetzbarkeit im Gelände und des geringen Treibstoffverbrauches, wurden zur Mengenermittlung die Kanister gewogen. Diese Methode führt zu mittleren Verbrauchswerten, die nicht die gewünschte Auflösung vorweisen und verursacht zusätzlich störende Unterbrechungen im Arbeitsablauf. Deshalb suchte man nach einer effizienteren Lösung zur Verbrauchsmessung, z.B. durch Auslesen eines elektronischen Vergasers. Der Output dieser Variante lieferte nur unzureichende Ergebnisse, infolgedessen wird in Zusammenarbeit mit DI Florian Pröll vom Institut für Verfahrens- und Energietechnik ein Datenlogger entwickelt. Dieser soll die Motordrehzahl (U/min) und den Treibstoffverbrauch (ml) während des Betriebes aufzeichnen, um den Verbrauch und die Laufzeitenverteilung detaillierter analysieren zu können.

Der Datenlogger wurde am 25.04.2018 erstmals getestet. Die Drehzahlmessung funktionierte einwandfrei, bei der Verbrauchsmessung sind noch weitere Verbesserungen nötig, um die Genauigkeit der Aufzeichnung zu erhöhen.

Aus den bereits erhobenen Zeitstudien Daten wurde ein Produktivitätsmodell abgeleitet. Als wesentliche Einflussfaktoren bei der Fällung und Aufarbeitung stellten sich der BHD, die Höhe und das Kronenprozent heraus. Bei einem mittleren BHD von 45,8 cm, einer mittleren Höhe von 29,7 m und einem mittleren Kronenprozent von 47,9 % wurde eine Produktivität von 5,5 m³/PSH15 erreicht. Pro Kubikmeter wurden im Mittel 0,09 Liter Kraftstoffgemisch und 0,05 Liter Kettenöl verbraucht.

ZUSTANDSERHEBUNG UND KLASSIFIZIERUNG VON FORSTSTRAßEN IM LEHRFORST ROSALIA

Markus Riegler, Karl Stampfer, Franz Holzleitner

Institut für Forsttechnik, Department für Wald- und Bodenwissenschaften, Universität für Bodenkultur Wien.

Für die Planung und Umsetzung von Instandhaltungs- und Instandsetzungsmaßnahmen bei Forststraßen bedarf es einer detaillierten Erhebung des IST-Zustandes inklusive Informationen zum Ausbaustandard des betreffenden Wegenetzes.

Ziel dieser Arbeit ist es basierend auf einem extra entwickelten und standardisierten Inventurschema den Zustand aller LKW-befahrbaren Forststraßen im gesamten Lehrforst der Universität für Bodenkultur Wien zu erheben, um daraus den notwendigen Instandhaltung- und Instandsetzungs-aufwand abschätzen zu können.

Die Erhebungsparameter umfassen einerseits die Befahrbarkeit basierend auf Tragfähigkeits-messungen und andererseits den Zustand der Wasserableitung und der Fahrbahnoberfläche. Gleichzeitig werden die Fahrbahnbreite und der lichte Raum am Stichprobenpunkt vermessen. Die Erhebungen erfolgten auf insgesamt 183 Punkten auf einer Weglänge von 58 km in einem definierten Punkteabstand von 300 m. Zusätzlich wurden außerhalb der Erhebungspunkte noch offensichtliche Schwachstellen in der Fahrbahn dokumentiert und gemäß Inventurschema erfasst.

Basierend auf den Erhebungen des Zustandes und des Ausbaustandards, kann das bestehende Wegenetz im Lehrforst kategorisiert, bewertet und notwendige Instandhaltungs- und Instandsetzungsmaßnahmen abgeschätzt und in die Wege geleitet werden.

UNTERSCHIEDE IM WACHSTUM VON VERSCHIEDENEN HERKÜNFTEN DER SCHWARZKIEFER

Rafael Buchacher¹, Arne Nothdurft¹, Silvio Schüler²

¹Institute of Forest Growth, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna; ²Institute for Forest Growth and Silviculture, Federal Research and Training Centre for Forests, Natural Hazards and Landscape (BFW).

Prognosen zeigen, dass sich durch den Klimawandel die Durchschnittstemperatur in Europa bis 2100 bis zu 4°C erhöht und sich auch das Niederschlagsmuster verändert. Eine weitere Folge ist, dass klimatische Extremereignisse, wie zum Beispiel Trockenperioden, öfters und stärker vorkommen werden. Aufgrund dieser schnellen und starken Änderung der Umweltbedingung ist es wichtig, Maßnahmen zu treffen, um unsere Wälder rechtzeitig an diese neuen Umstände anzupassen und die verschiedenen Funktionen der Waldökosysteme zu erhalten. Eine Möglichkeit der Adaptierung der Wälder an dem Klimawandel ist, Baumarten oder Herkünfte aus warmen und trockenen Gebieten in Regionen einzubringen, bei welchen in Zukunft ähnliche klimatische Bedingungen erwartet werden. Hierbei spielt die Schwarzkiefer (*Pinus nigra*) für warme und trockene Standorte in Zentraleuropa eine interessante Rolle aufgrund ihres weiten Verbreitungsgebiets im Mittelmeerraum und ihrer hohen genetische Variabilität.

Im Zuge dieser Masterarbeit wurde eine Versuchsfläche mit vier Herkünften der Schwarzkiefer aus Korsika, Kalabrien und Österreich untersucht. Die Versuchsfläche liegt in der Nähe von Krems und wurde Anfang der 1960er Jahre angelegt. Pro Parzelle wurden 10 Bäume für Stammanalysen gefällt und mit den gewonnenen Daten das Wachstum der einzelnen Bäume rekonstruiert. Mit dieser Grundlage wurde untersucht, wie Radial-, Volumen- und Höhenzuwachs der Schwarzkiefer auf Niederschlag und Temperatur reagieren. Auch wurde überprüft, ob es diesbezüglich Unterschiede zwischen den Provenienzen und zwischen Bäumen unterschiedlicher sozialer Stellung gibt. Die Auswirkungen von einzelnen Trockenjahren auf das Wachstum wurden mit Indices bewertet, welche die Resistenz und Resilienz beschreiben. Hierbei war es von Interesse, ob sich die Herkünfte unterscheiden und es wurde auch die Schwarzkiefer mit Fichten aus einem benachbarten Bestand verglichen.

Mittels Mixed-Effect Modellen konnte nachgewiesen werden, dass eine höhere jährliche Durchschnittstemperatur keinen signifikanten Einfluss auf den Radial- und Volumenzuwachs hat, aber sich negativ auf das Höhenwachstum der Schwarzkiefer auswirkt. Herbstniederschlag des Vorjahres, Frühjahrs- und Sommerniederschlag haben sowohl auf den Radialzuwachs, als auch auf den Volumen- und Höhenzuwachs einen signifikant positiven Einfluss. Bei der Reaktion des Radial- und Volumenzuwachs auf Frühjahrs- und Sommerniederschlag wurden zudem Unterschiede zwischen den verwendeten Herkünften gefunden. Auch wurde nachgewiesen, dass Bäume mit einer besseren sozialen Stellung stärker auf Niederschlag reagieren und einen höheren Radial- und Volumenzuwachs aufweisen. Eine Wechselbeziehung zwischen sozialer Stellung und dem Einfluss des Niederschlags auf den Höhenzuwachs konnte hingegen nicht nachgewiesen werden. Bei der Untersuchung der Auswirkung von einzelnen Trockenjahren auf das Wachstum konnte gezeigt werden, dass sich die Herkünfte bezüglich der Resistenz gegenüber Trockenjahren auf Ebene des Radial-, Volums- und Höhenzuwachs unterscheiden, aber es konnte nicht nachgewiesen werden, dass es Unterschiede bei der Fähigkeit gibt, sich von diesen Extremereignissen zu erholen.

MAJOR FACTORS IMPACTING BIODIVERSITY IN FOREST ECOSYSTEMS DOMINATED BY BROAD-LEAVED TREE SPECIES

S. Ette, A. Nothdurft, T. Ritter, S. Vospernik

Institute of Forest Growth, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna.

ROCKSTRÖM ET AL. (2009) hold the loss of biodiversity to be globally the greatest ecological challenge of our time. Biodiversity is the fundament of the variegated ecosystem services, equivalent to the basis of our economic system. The political and scientific interest in the evaluation of biodiversity patterns of ecosystems is therefore increasing continuously. *Sustainable Forest Management* is characterized by taking consequences of operational decisions on biodiversity into consideration and establishing biodiversity monitoring in forest enterprises (Criterion 4; FOREST EUROPE, UNECE U. FAO, 2011).

The master thesis presented relies on 1649 forest inventory data plots out of the projects “Basismonitoring in den Kernzonen” and “Bodenmonitoring” gathered in the 37 unmanaged core zones of the Biosphere Reserve Vienna Woods with a total size of 5400ha. The resulting data set includes information stemming from the Angel Count Method (Bitterlich-Method), Dead Woody Debris recordings, data on rejuvenation and soil-analyses in the field and the laboratory. The examined biodiversity indices were chosen with the intention of covering the structural aspects of horizontal distribution (Clark & Evans-Index), stand-density (Stand Density Index, Crown Competition Factor), differentiation (index of diameter differentiation, Földner-Index) and species diversity (species heterogeneity index, Shannon-Index). The aim of the master thesis is to point out which parameters have the strongest impact on biodiversity in the unmanaged core zones of the Biosphere Reserve Vienna Woods. The impact factors that have been tested with “R Random Forest” are forest structure and forest composition, soil and bedrock consistency, site characteristics, tree competition, dead wood (lying and standing) and game browsing impact. Furthermore, the paper analyzes statistical interdependencies between selected biodiversity indices.

Based on the results recommendations and opportunities for intentional enhancement of biodiversity are derived for forest owners and managers of deciduous forests. Additionally, insights from the scientific monitoring of the natural forest dynamics in the unmanaged core zones are proposed to imitate in an ecological aligned forest management of the Vienna Woods. The paper concludes with a methodical evaluation of the monitoring system currently in place. Thus, it sheds light on optimization potentials for forest enterprises, offering a method to estimate forests’ biodiversity status from established forest inventory data.

FEASIBILITY STUDY NATURAL PARK DUNKELSTEINERWALD

Helmut Kaufmann, Hubert Hasenauer

Institute of Silviculture, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna.

Natural parks are an interesting way to combine the protection of nature, recovery, ecological education and regional development. The aim of this diploma project is to analyse, if it is possible to create a new natural park in the region *Dunkelsteinerwald* located in the Austrian state Lower Austria. The first step was to do some theoretical and practical research about natural parks. Therefore, I analysed their historical development as well as facts and figures in Europe and Austria. Based on some examples in Austria I then pointed out important facts, which should be crucial for the success of natural parks. I researched these things through the study of different literature as well as through a visit of an actual natural park and an interview with the manager. In the next step I examined the region *Dunkelsteinerwald*. How is the landscape of this region? How is the flora and fauna? Does it fulfill the legal requirements for the formation of a natural park? How does the local population think about this idea? I answer these questions through data analysis, exploration of the region and a standardized questionnaire of the local population. At last I can give a general answer, if the formation of a new natural park in the region *Dunkelsteinerwald* is possible or not with quantitative and qualitative methods and variables.

POTENZIALABSCHÄTZUNG VON NICHTHOLZPRODUKTEN UND FORSTLICHEN DIENSTLEISTUNGEN IN ÖSTERREICH & ANALYSE VON NICHTHOLZPRODUKTEN UND DIENSTLEISTUNGEN IM RAHMEN EINER NACHHALTIGEN WALDBEWIRTSCHAFTUNG

Lisa Gindra-Vady, Christina Pousek, Harald Vacik, Patrick Huber

Institut für Waldbau, Department für Wald- und Bodenwissenschaften, Universität für Bodenkultur, Wien (BOKU).

Im Zuge der Bachelorarbeit wird eine Abschätzung der Mengen und Wertschöpfung von Dienstleistungen (u.a. Mountainbikestrecken, Reitwege, Hochseilgärten) und Nichtholzprodukten (u.a. Wildbret, Pilze, Beeren) in Österreich vorgenommen.

Im Jahr 2005 wurden bereits entsprechende Grundlagen für die Erhebungen gelegt, aufbauend auf den bereits erhobenen und neu aufgenommenen Daten soll für 2010 und 2015 eine neuerliche Einschätzung durchgeführt werden, um die Information für die beiden Nachhaltigkeitsindikatoren 3.3 und 3.4 bereitzustellen. Bestehende Daten wie Experteneinschätzungen, Interviewgespräche, Statistiken und andere Informationsquellen welche für die weitere Ausarbeitung zur Verfügung stehen, werden überarbeitet und gegebenenfalls in der Struktur abgeändert. Umfragen werden an die jeweiligen Anforderungen angepasst bevor diese erneut durchgeführt werden, um neue und möglichst genaue Erkenntnisse zu bringen.

Die Struktur der Arbeit wird sich an der Kategorisierung der Dienstleistungen und Nichtholzprodukten aus der Studie im Jahr 2005 orientieren, allerdings die neuen Anforderungen hinsichtlich des Nachhaltigkeitsreportings berücksichtigen. Aufbauend auf den Stand der Erkenntnisse aus 2005 sollen neue Entwicklungen und Trends (u.a. Mobilfunkanlagen, Waldbestattungen) identifiziert werden. Aus der Recherchearbeit und den gewonnenen Informationen sollen Erkenntnisse gewonnen werden, welche Methoden verwendet werden können und wie aufschlussreich sie sein können. Die Ergebnisse werden in Form von Tabellen und Grafiken erläutert, gegebenenfalls neue Zusammenhänge hergestellt oder Strukturänderungen vorgenommen, um jede Information bestmöglich verwerten zu können. In der Diskussion werden die neuen Erkenntnisse mit jenen aus dem Jahr 2005 verglichen und interpretiert.

ADDITIONAL INVESTIGATIONS ON THE EFFECT OF *VERTICILLIUM NONALFALFAE* ON *AILANTHUS ALTISSIMA* AND ASSOCIATED NATIVE AND NON-NATIVE TREE SPECIES IN EASTERN AUSTRIA

Yvonne Lechner, Oliver Maschek, Erhard Halmschlager

Institute of Forest Entomology, Forest Pathology and Forest Protection (IFFF), Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna.

Ailanthus altissima is a highly invasive tree species, which was introduced from China to Europe and America. *Verticillium nonalfalfae* strain G1/5, which was obtained from wilting *Ailanthus* in Austria, turned out to be an effective biological control agent against Tree-of-Heaven. Prior investigations regarding undesired non-target-effects on other possibly susceptible hosts were already carried out on ten economically and ecologically important tree species. In this master study another five native and four invasive tree species were tested for susceptibility against *V. nonalfalfae* strain G1/5. For that purpose stem inoculations were performed on 20 potted seedlings of each species (18 seedlings in *Castanea sativa*) as well as on 20 *Ailanthus* seedlings in order to confirm pathogenicity of the fungal strain applied. Another four seedlings of each tree species were treated with sterile water and served as control. First symptoms like chlorosis, necrosis and wilting occurred already after two weeks on *Ailanthus*. At the end of the vegetation period all inoculated *Ailanthus* were almost completely defoliated or dead. Apart from three species, no mortality or wilting symptoms were observed on all other tree species tested. However, wilting symptoms and/or mortality were also observed on the controls and/or on additionally reared untreated seedlings of that three species. Furthermore, in one species symptoms already occurred even before inoculation on a few seedlings, indicating that *V. nonalfalfae* was not the cause of those symptoms. Vascular discolourations could be found on all tree species. Irrespective of symptom development the fungus could be re-isolated from more than 60% of the inoculated seedlings in 4 out of 9 non-target tree species and from 5 to 47% of the inoculated seedlings in the remaining 5 non-target tree species. Based on these results species were classified as susceptible (only *Ailanthus*!), tolerant, possibly resistant or resistant against *V. nonalfalfae* strain G1/5.

ENERGY BUDGET OF OFFSPRING PARASITOID WASPS FROM YOUNG, MIDDLE-AGED AND OLD MOTHERS

Katrin Grollnigg, 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.

Parasitic wasps benefit greatly from food resources that enhance longevity, and thus allow females to exhaust their supply of eggs before dying. This thesis analyzes the energy budget of two synovigenic endoparasitic wasps, *Glyptapanteles liparidis* (Hymenoptera, Braconidae) and *Glyptapanteles fulvipes*, that parasitize larvae of the gypsy moth, *Lymantria dispar* (Lepidoptera, Lymantriinae). Under laboratory conditions, longevity of the wasps is limited to 3 days in the absence of food, but can exceed 30 days when honey is provided. Females are able to lay eggs throughout their entire lifetime. Here, we tested the quality of the progeny from young (up to 10-day-old), middle-aged (10 to 20-day-old) and old (20 to 30-day-old) mothers by determining the content of proteins, carbohydrates (sugars), glycogen and lipids in male and female offspring wasps. Third-instar gypsy moth larvae served as hosts for both wasp species; starting with 6-day-old female wasps, five host larvae were offered every other day until the wasps died. The parasitized larvae were reared in climate chambers at 20°C under long-day photoperiod and fed wheat germ diet until the parasitoids emerged and pupated. The pupation cocoons were separated and adult wasps were removed as soon as they emerged from their cocoons. The wasps had no access to food and were immediately frozen, weighed, sexed, freeze-dried and reweighed to calculate the body water content. Protein, carbohydrates, glycogen, and lipids were determined simultaneously in the same individual with an improved van-Handel's method. Offspring-wasp protein contents varied between 20 and 30% of the body dry weight (dwt). While there was no difference between the sexes or species in wasps from young and middle-aged mothers, offspring female wasps from old mothers (both wasp species) contained significantly less proteins. Total sugar content of offspring wasps ranged between 5 and 9% dwt; the levels were not affected by the age of the mother at oviposition, however, *G. fulvipes* offspring females from old mothers had very low sugar levels. No differences between the sexes were observed for *G. liparidis* offspring wasps, for *G. fulvipes* offspring wasps, the sugar content of females was higher than that of males.

A DENDROECOLOGICAL RECONSTRUCTION OF SPRUCE SAWFLY OUTBREAKS IN THE ALPINE FOOTHILLS OF UPPER AUSTRIA AND SALZBURG FROM 1950 TO 2017

Thomas Disep, Arne Nothdurft¹, Christa Schafellner²

¹Institute of Forest Growth, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences, Vienna; ²Institute of Forest Entomology, Forest Pathology and Forest Protection, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences, Vienna.

In the past, outbreaks of the mountain spruce sawfly, *Pachynematus montanus* (Hymenoptera, Tenthredinidae) in the Alpine foothills were known from spruce forests at altitudes between 800 to 1200 m above sea level. In recent years, however, outbreaks were also observed in secondary spruce forests at low elevations (400-500 m) where the small spruce sawfly, *Pristiphora abietina* (Hymenoptera, Tenthredinidae) had frequent, but irregular outbreaks in the last decades. Studies on the population dynamics of the two sawfly species indicated that phenological asynchrony between budburst in the host tree, Norway spruce (*Picea abies*), and sawfly emergence in spring was responsible for the recent shift in sawfly dominance. The sawfly species differ in their feeding dynamics; larvae of the small spruce sawfly feed exclusively needles from the newly-expanding shoot while larvae of the mountain spruce sawfly feed both young and old needles, resulting in higher needle loss from the latter. The present thesis investigates the potential reduction in radial growth increments due to sawfly feeding. Radial increment cores from Norway spruce trees infested by the sawflies were analysed by means of dendrochronological methods and compared with cores from undefoliated trees growing on the same sites. Five sites from Upper Austria (Lambach 350 m, Mondseeberg 850 m, Hasenkopf 870 m) and Salzburg (Grafenholz 460 m, Gennersberg 420 m) with each 20 defoliated and 20 undefoliated trees per plot were selected for the study. In total, four hundred core samples from two hundred spruce trees were examined. Additionally, long-term climate data (temperature, precipitation) and silvicultural measures from the respective sites were included in the analysis. A mixed model was created with the statistics program R that includes variables for both biotic (insect attack) and abiotic parameters (temperature, precipitation) as well as variables for forest management practices (e.g. thinning) that enables us to separate their individual influences on the annual dynamics of the radial growth increments.

LIFETIME REPRODUCTION, FITNESS AND LONGEVITY IN SYNOVIGENIC PARASITIC WASPS

Mario Wieser, 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.

Glyptapanteles liparidis and *Glyptapanteles fulvipes* (Hym., Braconidae) are gregarious, endoparasitic wasps that develop in larvae of lepidopteran species. The gypsy moth, *Lymantria dispar*, a serious pest with periodic mass outbreaks especially in oak forests, is their main host in Austria. The aim of this thesis was to determine and compare the reproductive performance, lifetime fecundity and offspring numbers of the two wasp species. For analyzing the progeny of the wasps, gypsy moth larvae were used as hosts. For parasitization, six-day-old females of *G. liparidis* and *G. fulvipes* were randomly selected from the wasp laboratory colonies and kept singly in small boxes at constant 15°C under long-day photoperiod (16L:8D); the wasps were supplied with honey and water. Every other day, five newly-molted third-instar gypsy moth larvae were offered for oviposition until the wasps died or refused to oviposit. Larvae that were visibly parasitized by the wasps were transferred to climate chambers at 20°C under long-day photoperiod and fed high wheat-germ diet until the parasitoids emerged. Upon spinning a cocoon for pupation, the cocoons from each host larva were separated and placed singly into 96-well plates. The wells were checked daily for newly-emerged wasps. The wasps were immediately frozen, sexed, weighed, freeze-dried and reweighed to determine fresh and dry mass and water content. Endoparasitic and total parasitoid development times, offspring numbers and offspring sex ratio were recorded throughout the wasp lifetimes. *G. liparidis* and *G. fulvipes* female wasps lived an average of 20 (*G. liparidis*) and 32 days (*G. fulvipes*) and the mean number of offspring produced during their lifetimes was 278 ± 196 (*G. liparidis*) and 465 ± 87 (*G. fulvipes*). The average duration of the development stages of the wasp progeny was 20 (endoparasitic), 8 (pupation), and 27 days (total development), respectively; no differences between the species were observed. The average number of parasitoids that emerged from a single host was 12.5 ± 0.7 (*G. liparidis*) and 10.5 ± 0.6 (*G. fulvipes*). The offspring sex ratio was strongly male-biased, ranging from 1.5 – 16 males per female for individual *G. liparidis* wasps and 4.5 – 7.7 males per female for *G. fulvipes* wasps.

Poster presentations - Abstracts

Institute of Soil Research

Poster 1

INVESTIGATING THE INFLUENCE OF LAND-USE CHANGE ON SOIL MICROBIAL PARAMETERS IN ADJACENT NATURAL FORESTS AND AGRICULTURAL FIELDS ON THE GALÁPAGOS ISLANDS

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

Institute of Soil Research, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna.

Behind the scenes of the World Heritage for biodiversity, the Galapagos archipelago, things don't always look like suggested. The people rely heavily on the tourism and fishing industry and at the same time the demand for food is increasing. Alone on the island Santa Cruz, 74% of the humid region was clear-cut to satisfy this demand. In dry seasons, 69% of fruits and 80% of vegetables must be imported from the mainland. Further, 100% of staple crops and other products must be imported and the propagule pressure of invasive species is increasing. Because there is no control and monitoring of pesticide use, the use of agrochemicals is widespread in the agricultural zones of the islands. Due to the overlapping interests of stakeholders, coordination efforts remain difficult and if farmers abandon their fields, it results in an invasion of alien species. To analyze the effects of agricultural land use, soil samples were taken from Santa Cruz and San Cristóbal islands from agricultural fields and adjacent natural forests. Parameters like extracellular enzyme activity, SIR, microbial biomass as well as others, i.e. pH, OC, DOC, ammonium and nitrate content were analyzed. The results show that the NH_4^+ content was significantly ($P < 0.05$) higher at the forested sites, whereas the NO_3^- was significantly higher at the agriculture sites. The microbial parameters show very diverse results, SIR was significantly higher in the forest, the potential urease activity also, but the specific activity (related to C_{mic}) showed no significant differences. Further, the potential phenoloxidase activity showed no differences, but the specific phenoloxidase activity was higher at the agricultural sites. The potential phosphatase activity was higher at forested sites and the specific activity only at on site. These are only some results, it will be necessary to identify patterns and further investigate the impact of agricultural land use on the soil ecosystem.

Poster 2

REMEDIATION AND REVITALIZATION OF TRACE METAL CONTAMINATED GARDEN SOILS USING A SUSTAINABLE EDTA WASHING TECHNIQUE

Christoph Noller¹, Wolfgang Friesl-Hanl^{1,2}, Domen Lestan³, Andrea Watzinger¹

¹Institute of Soil Research, Department of Forest and Soil Sciences University of Natural Resources and Life Sciences Vienna; ²Environmental Recourses and Technologies, Center for Energy, AIT Austrian Institute of Technology GmbH; ³Agronomy Department, Biotechnical Faculty, University of Ljubljana.

The increasing world population and closely linked urbanization lead towards a shortage in arable land due to the sealing, degradation and pollution of soil. Besides the introduction of more conserving agricultural practices to prevent further losses, the remediation of polluted sites by extracting or stabilizing organic and inorganic pollutants has received increasing attention and features a large range of soil additives (e.g. biosolids, biochar, liming etc.).

Different in- and ex-situ remediation approaches have been intensively investigated already, also in combination with assisting soil amendments. Among this broad portfolio, the soil washing techniques have the advantage of combining high extraction rates of trace elements in multi-contaminated soils and short treatment cycles. On the other hand, the associated side effects of these rather invasive treatments are the destruction of the natural soil structure and the microbial community. The practice is also omnidirectional and results in the extraction of all elements available to the chelating agent, including essential plant nutrients.

The 'Garden Soil' project seeks to investigate different aspects of a recently developed soil washing procedure, able to extract over 90 % of the bioavailable trace metals (e.g. Pb, Cd, Zn, As), while working in a closed circuit without appreciable losses of both, process water and the chelating agent in use (EDTA). After several successful pot trials, the applicability of the remediation product can now be tested in an outdoor experiment, consisting of 18 raised beds (100x50x30cm). Two trace metal contaminated soils from Austria and Slovenia will be the research objects to examine the performance of the remediation procedure. Therefore, the trace metal bioavailability and plant uptake will be monitored over a 2-year period to determine possible trace metal remobilization processes e.g. due to a shift in the concentration equilibrium between the soil soluble- and mineral phase or due to the incomplete complexation of the remaining EDTA. Finally, the processed soil will be revitalized by applying different soil amendments (compost, biochar and mineral additives). This will be evaluated using micro- and molecular biologic techniques and the investigation of the nutrient cycle using plant material labeled with stable isotopes (¹³C, ¹⁵N).

IMPACTS OF NITROGEN DEPOSITION ON FOREST BIOGEOCHEMICAL PROCESSES USING ACROSS A TRANS-EUROPEAN GRADIENT INVESTIGATED USING A TOOL KIT OF STABLE ISOTOPE METHODS

Kathrin Schmittner¹, Andrea Watzinger¹, Markus Gorfer¹, Ulf Grandin², Nathalie Korboulewsky², Rob Rose², Jutta Stadler², Ika Djulic³, Thomas Dirnböck³, Rebecca Hood-Nowotny¹

¹Institute of Soil Research, Department of Forest and Soil Sciences University of Natural Resources and Life Sciences Vienna; ²ALTER-net-MSII Network; ³Ökosystemforschung und Umweltdatenmanagement, Umweltbundesamt GmbH, Austria.

Meta-data analyses and the model based hypotheses state that global soil C storage is controlled by microbial scale processes of fungal competition for available nitrogen (N). Global trends of increasing atmospheric N deposition and the continuing use of inorganic N fertilizer in both agriculture and forestry mean that the soils vital function as a carbon sink is potentially under threat. We set out to experimentally investigate these hypotheses across a Trans-European gradient of forest soils and provide reliable information on soil microbial responses to nitrogen inputs for predictive climate change models.

Changes in soil nutrient status could result in a chain reaction of interacting microbial mechanisms which in turn could lead to the shifts in underlying ecosystem biogeochemical process rates. Recent meta-analysis has shown that plant fungal symbiont community structure, exerts a greater fundamental control over soil C storage than temperature, precipitation or net primary production. Based on the hypothesis that plant associated fungi effectively scavenge all available organic and inorganic N leaving little N for the growth of the free-living decomposer microbial community and preventing further breakdown of soil organic matter (SOM).

We have set up an experiment in which a series of dual isotope labelled C and N in-growth beech litter bags have been incubating in-situ in the forest. Moreover the treatment plots have received additional inputs of inorganic nitrogen fertilizer over an eight year period. We have studied both nitrogen and carbon dynamics in these systems using a tool box of stable isotope techniques.

We observed a slight decline in the ¹³C signature of the bulk soil in all treatments, implying mineralisation and loss of the carbon litter added. Bulk pool analysis proved difficult. To tease out the dominant processes further more specific isotopic analysis of more constrained soil pools will be conducted: respired CO₂, microbial nitrogen and carbon, inorganic nitrogen, extracellular polymeric substances and permanganate oxidizable carbon.

Poster 4

KLASSIFIKATION VON BODENMONOLITHEN NACH DER ÖSTERREICHISCHEN UND INTERNATIONALEN SYSTEMATIK / CLASSIFICATION OF SOIL MONOLITHS AFTER AUSTRIAN AND INTERNATIONAL SYSTEMATICS

Christian Holzinger, Walter Wenzel, Franz Zehetner

Institute of Soil Research (IBF), Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna.

In den letzten Jahrzehnten wurden für Studienzwecke des Instituts für Bodenforschung 49 Bodenmonolithen erstellt. Das Ziel dieser Arbeit ist die vorhandenen Bodendaten zu erweitern, und die Bodenmonolithen über die neue Klassifizierung, in erweiterter Form für die Lehre zugänglich zu machen.

Seit der ersten Fassung der österreichischen Bodensystematik von 1969 gibt es eine neue Version, die österreichische Bodensystematik 2000. Diese wurde im Jahre 2011 revidiert und stellt die heutige aktuellste Form dar, welche eine der Grundlagen dieser Arbeit darstellt. Um den erhöhten Ansprüchen der Internationalisierung gerecht zu werden, ist ein Teil dieser Arbeit auch die internationale Systematisierung der Bodenmonolithen nach WRB (= World Reference Base for Soil Resources). Die Ergebnisse dieser Arbeit werden über frei zugängliche Kurzbeschreibungen im Institutsgebäude für Lehr- und Studienzwecke zur Verfügung stehen. Für die Zukunft ist ein Projekt anvisiert, in welchem eine Lern-App für Selbststudienzwecke der Studenten zum Thema "Bodenkunde" entwickelt wird. Ein weiterer Aspekt der Arbeit ist der Vergleich der damaligen durchgeführten chemischen Analytik an einigen Profilstandorten der Bodenmonolithen, und den heutigen - in Österreich - durchgeführten Standardmethoden.

THEORETICAL STUDY OF TRICHLOROETHYLENE DISSOCIATION ON ZERO-VALENT IRON NANOPARTICLES

Miroslav Kolos^{1,2}, Daniel Tunega¹, Frantisek Karlicky²

¹Institute for Soil Research, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna; ²Department of Physics, Faculty of Science, University of Ostrava, Czech Republic.

Degradation of toxic trichloroethylene (TCE) from ground water using conventional methods is very slow and expensive, so it is crucial to develop new effective methods for TCE removing. Zero-valent iron in a form of nanoparticles (nZVI) is very promising and reactive material having a capability to degrade TCE. However, nZVI particles are not very stable in water what decreases their surface reactivity. Chemical modification of nZVI nanoparticle surfaces (e.g. by sulfidization) can increase the surface stability without significant loss of reactivity with respect to TCE. We performed quantum chemical calculations (at density functional theory level, DFT) of interactions and reactions of TCE molecule with surface models of pure nZVI and mackinawite mineral (FeS), which is, according to experiments, formed on nZVI surface after the sulfidization. DFT calculations showed that nZVI can degrade TCE spontaneously with no energetic barrier. On the other hand, the calculations showed that theoretical dissociation of the first Cl atom from the TCE molecule on mackinawite (001) surface has an energetic barrier of about 54 kcal/mol and endothermic character. The barrier seems to be relatively high but it is about half less than the dissociation of the TCE in a gas phase.

Poster 6

SOIL FORMATION ALONG A CLIMOSEQUENCE IN RHYOLITIC TEPHRA ON ALCEDO VOLCANO, GALÁPAGOS

I Nyoman Candra¹, Franz Zehetner¹, Martin Gerzabek¹, Franz Ottner², Johannes Tintner³, Karin Wriessnig²

¹Institute of Soil Research, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna; ²Institute of Applied Geology, Department of Civil Engineering and Natural Hazards, University of Natural Resources and Life Sciences Vienna; ³Institute of Wood Technology and Renewable Materials, Department of Material Sciences and Process Engineering, University of Natural Resources and Life Sciences Vienna.

The Galapagos archipelago has attracted many researchers due to its peculiar geology, climate and flora and fauna. However, there have been few studies concerning soil formation in response to climatic conditions. The purpose of this research was to analyse soil formation along a climosequence on Alcedo volcano, which is the only volcano in the Galapagos archipelago that has erupted rhyolite materials rather than basalt. The samples were taken from three different sites, site 1 at 872 m asl (humid zone), site 2 at 621 m asl (dry zone) and site 3 at 377 m asl (very dry zone). No significant difference of pH (H₂O) was observed for those three sites. However, site 1 had a higher pH in NaF compared to the other two sites. Likewise, water retention and phosphate retention of site 1 were higher than for site 2, and the lowest values were observed for site 3. Those results correspond to organic carbon content, where site 1 contained the highest organic carbon and site 3 the lowest. Using optical microscopy, relatively high amounts of volcanic glass were observed at all sites, especially sites 1 and 2. From dissolution analysis supported by XRD, DSC, and FTIR, allophane and ferrihydrite were predominantly observed at site 1, whereas trace amounts of halloysite was found at site 2 and almost no clay minerals at site 3. This is likely a result of increasing soil moisture and leaching with increasing elevation on the volcano. Based on the WRB Soil Classification System, site 1 is borderline in terms of meeting the criteria for andic properties; at site 2, andic properties have not expressed, but it has vitric properties; and at site 3, neither andic nor vitric properties have expressed, but it has tephric materials.

THE EFFECT OF SOIL AGE AND CLIMATE ON PHYSICAL PROPERTIES OF AGRICULTURAL SOILS ON THE GALÁPAGOS ISLANDS

Matthias Strahlhofer, Franz Zehetner, Martin Gerzabek, Axel Mentler, Nicola Rampazzo

Institute of Soil Research, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna.

The Galápagos Islands constitute a fascinating ecosystem, with matchless geographical and biological conditions interesting for investigators of all disciplines. The unique flora and fauna once upon a time inspired Charles Darwin for writing his famous Evolution Theory. Nevertheless, the predominantly volcanic soils of the archipelago have still not been well studied till today and represent a focus of the ongoing investigation carried out by the Institute of Soil Research of the University of Natural Resources and Life Sciences Vienna in cooperation with the Galápagos National Park Management overseas. More specifically, the present Master Thesis focuses on the physical properties of the agricultural soils on the Galápagos Islands. The volcanic activity in the western part of Galápagos together with plate tectonics cause a south-eastward drift of the whole archipelago, resulting in a detectable soil age gradient between and within the islands. In addition, climate and especially precipitation regimes are observed to change with altitude, indicating an existing climate gradient. Therefore, physical soil parameters like the water-holding capacity and soil texture (just to name a few) are expected to change along these gradients or - at least - might show some particular distribution. The aim of the present thesis is to investigate the relationship between these two gradients and some chosen physical soil properties by means of statistical analyses and the interpretation of the cumulative dataset. The methodical approach and practical part concentrates on expanding the already existing dataset of the Islands, adding data of the accomplished texture analysis and water drop penetration time. Finally, the sought practical use and expected outcome of the present work is to provide data concerning the physical fertility of the agricultural soils on the Galápagos Islands for the first time in history, and to derive recommendations for irrigation and soil management practices in the context of a project by Ecuador's Ministry of Agriculture.

Poster 8

TOPSOIL MICROBIOLOGICAL CHARACTERISTICS IN RELATION TO SOIL AGE AND CLIMATE GRADIENTS ON THE GALÁPAGOS ISLANDS

Sebastian I. Socianu, Katharina Keiblinger, Franz Zehetner, Martin Gerzabek

Institute of Soil Research (IBF), Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences, Vienna.

The geologic and climatic environment of the Galapagos archipelago gives birth to one of the most admirable ecosystem of the Earth. Although geology, flora and fauna have been thoroughly studied, much less is known about the Galapagos soils' evolution, and even shorter is the list of studies conducted on microbiology.

The southern slopes of the islands of Galapagos have a pronounced climatic gradient, forming different biotopes in relation to the altitude (climosequence). In addition, the Galapagos Islands are formed by hotspot volcanism and the east-southeast movement of the Nazca plate allows the generation of new islands while the old ones are moving away from the volcanic hotspot. This generates a sequence of more weathered soils with increasing distance from the hotspot (chronosequence).

Nutrients' permanence and availability in soils depend on the degree of weathering; generally as a soil gets older its nutrient content decreases. Furthermore, climatic regime, vegetation type and soil organic matter play a role in the microbial activity, organic carbon and nutrient availability.

The aim of this research is (1) to comprehend how microbes are influenced by different bio-climatic zones through relating microbial parameters to soil properties like pH, organic carbon and nutrient contents, (2) to compare differences in enzymatic activities in order to gain insight into which nutrients might limit the growth and activity of microorganisms. (3) to examine if the soils' weathering degree plays a role on the nutrient cycle and, hence, on microbial activity.

INFLUENCE OF EXTREME WEATHER EVENTS ON GREENHOUSE GAS EMISSIONS FROM FOREST AND GRASSLAND SOILS

Eva Ecker, Eugenio Diaz-Pines, Sophie Zechmeister-Boltenstern

Institute of Soil Research, Department of Forest and Soil Sciences University of Natural Resources and Life Sciences Vienna.

Climate change projections forecast an increase in drought-rewetting events. However, there is a lack of knowledge how these events effect short living pulses of greenhouse gas (GHG) emissions from soils. Some studies admittedly address effects of carbon dioxide (CO₂) emissions but nitric oxide (NO), nitrous oxide (N₂O), methane (CH₄) and ammonia (NH₃) emissions are hardly described. We hypothesize that sparse precipitation events will provoke more NO and higher precipitation more N₂O pulses also a time-lag between the maximum emission of each of the trace gases. To follow the response of drying-wetting events of short living GHG pulses a lab incubation experiment with intact soil cores is conducted. Twenty-four intact soil cores were taken from each site, a managed grassland located in the pre-Alps region (Gumpenstein) and a beech forest site in Eastern Austria (Rosalia) in autumn 2017. While from forest site additionally forest floor and litter was sampled. The samples are incubated in the lab at 22°C, at almost dry conditions (average water content ~7%) for five days, following a re-wetting event of varying intensity (maximum water saturation with 25%, 50%, 75% and 100%) in four replicates. All gases measurements are based on a dynamic chamber approach, with a separate system for ammonia emissions. In addition, microbial C and N, ammonium and nitrate content are measured on a set of extra soil cores one day before, one day after and one week after re-wetting. Differences between study sites and treatments are observed and will be discussed.

Institute of Forest Ecology

Poster 10

DAS WACHSTUM VON EKTOMYKORRHIZAPILZEN AUF UNTERSCHIEDLICHEN STICKSTOFFQUELLEN

Victoria Gaupmann, Barbara Hofer, Douglas L. Godbold

Institut für Waldökologie (IFE), Department für Wald- und Bodenwissenschaften, Universität für Bodenkultur Wien.

In unserer Studie beschäftigten wir uns mit der Frage „Welche Ektomykorrhiza Pilzarten sich besser auf welchem Nährboden entwickeln“. Es wurden hierfür zwei Versuche im Labor mit Petrischalen durchgeführt. Bei Versuch eins wurden vier Ektomykorrhiza Pilzarten (*Rhizopogon roseolus* (Rr), *Suillus granulatus* (Sg), PAX in S33 (PAX) und *Amanita muscaria* (Am)) auf 3 verschiedene Nährböden (MMN, MMN-Glutamat, MMN- Nitrat) geimpft.

Versuch zwei bestand aus denselben vier Ektomykorrhiza Pilzarten, nur die drei verschiedenen Nährböden wurden ohne Malzextrakt hergestellt, um vorhandenen Stickstoff im Malzextrakt auszuschließen. Insgesamt wurden pro Versuchsreihe 60 Ektomykorrhiza Pilze, fünf Pilze je Pilzart auf insgesamt drei verschiedenen Nährböden, in einem Zeitraum von zirka 1 Monat gemessen.

Beim ersten Versuch stellte sich heraus, dass das Wachstum auf dem Nährboden MMN von allen, bis auf Rr, am stärksten zunahm und auf dem Nährboden mit Nitrat am geringsten war. Anschließend wurde Versuch eins mit Versuch zwei verglichen. Bei Versuch zwei wurde deutlich, dass das Wachstum bei *Suillus granulatus* und *Amanita muscaria* auf Nährboden MMN-NO₃ am größten war, bei PAX auf Nährboden MMN und bei *Rhizopogon roseolus* auf Nährboden MMN-G. Schlussendlich konnte so aufgrund unserer Auswertung festgestellt werden, dass das Ausschließen des Malzextraktes einen Unterschied hinsichtlich des Wachstums der Pilze verursacht.

LINKING LITTER DECOMPOSITION TO SOIL CARBON STOCKS UNDER NON-NATIVE AND NATIVE TREE SPECIES

Lisa Maria Bischofer, Torsten Winfried Berger, Mathias Mayer

Institute of Forest Ecology, Department of Forest Soil Sciences, University of Natural Resources and Life Sciences Vienna.

An increase in droughts and insect infestations threatens Norway spruce (*Picea abies*) stands across European forests. With a higher drought tolerance, Douglas fir (*Pseudotsuga menziesii*) and European larch (*Larix decidua*) became a suitable silvicultural alternative to Norway spruce. How tree species selection affects the forest soil carbon (C) cycle and litter decomposition processes is, however, still not fully understood. Therefore, this master thesis aims 1) to answer if Norway spruce, Douglas fir and European larch differ with regard to litter mass loss partitioning into CO₂ and leaching of dissolved organic C during decomposition, and 2) to link mass loss partitioning to soil C stocks. It is hypothesized that tree species with a higher partitioning into leaching of dissolved organic C have higher soil C stocks.

The study takes place in the Vienna Woods, Lower Austria and measurements will be conducted from April to early Winter 2018. Litter decomposition is analyzed by means of respiration measurements and lysimeters, allowing for an *in situ* partitioning into CO₂ efflux and leaching of dissolved organic C. Litter bags are used to study mass loss and biochemical litter processes/properties (e.g. microbial respiration, lignin content). The results of this thesis will help to improve our understanding of the impact of tree species selection on the forest soil C cycle. In order to lower the uncertainties of carbon sequestration estimates for the forestry sector, this information is very important. Furthermore, new insights into the complex process of litter break down and its connection to the soil C cycle will be provided.

Poster 12

**PROCESSES AFTER A SNOW AVALANCHE IN MOUNTAIN-PRIMEVAL-FOREST-ECOSYSTEMS
– USING THE EXAMPLE OF ROTHWALD**

Michael Brenn, Georg Gratzner

Institute of Forest Ecology (IFE), Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna.

Disturbances through snow avalanches are an important and natural element of mountain-forest-ecosystems. Recently, also through the diminishing effect of climate change on avalanches, there was less attention paid to this kind of disturbance as compared to other disturbances. In Rothwald, as part of the Wildnisgebiet Dürrenstein, snow avalanches are important as larger scale disturbance agent. In late winter 2009, a snow avalanche with great intensity occurred and extended an existing old avalanche track for more than 300 meters. In addition, a second snow avalanche occurred in the same year. These two snow avalanches disturbed more than 3 hectares of the old-growth-forest vegetation. This thesis analyses the tree regeneration ecology on the snow avalanche track since knowledge on regeneration after avalanches in primeval forests is scarce. In Summer 2017, 158 2 x 2 m research plots were studied using a fixed grid. Vegetation cover, functional groups, site and microsite characteristics, deadwood, and every tree seedlings were recorded. A result that emerges is that the specific situation of the disturbance has pronounced effects on the post disturbance regeneration processes: at the bigger avalanche, the vegetation was under a 2 m thick snow cover above which the avalanche came off, and so the most of the vegetation was protected in the snow layer, but bigger trees were broken and uprooted. The trajectory of the avalanche track differs in its ecology: in the upper part, the frequency of continued disturbance is higher and an avalanche track vegetation with krummholz of *Fagus sylvatica* established. Single trees get broken and uprooted, but some trees are just bent down and show branch layering (rooting of branches). In the middle section, where the frequency of the disturbance events is lower, the snow avalanche has removed all the individuals which emerged from the snow cover and reset the forest regeneration progress. In this section, grass cover is dense and reaches high cover percentages with competing effects on tree regeneration. The lower section and the second snow avalanche track had closed forest cover before the avalanche and show high litter decomposing rates. There, amounts of coarse woody debris are large and pioneer-tree-species establish.

NATURAL REGENERATION DYNAMICS OF MIXED OAK FORESTS IN THE ALENTEJO REGION, PORTUGAL

Julia Ritsche¹, Vanda Acácio², Klaus Katzensteiner¹

¹Institute of Forest Ecology, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna, ²Centre for Applied Ecology "Prof. Baeta Neves", University of Lisbon, Portugal.

The Alentejo region used to be home of evergreen oak forests of *Quercus suber* and *Quercus ilex*, utilized in the traditional silvipastoral *Montado* system. Overgrazing and intensive agriculture have caused severe soil degradation and partly the cork oak dominated stands have been transformed into eucalypt monocultures. Climate change adds additional threats like frequent drought and increased risk of fire for the forests in the semi-arid climate. Ecosystem recovery in areas abandoned by humans is extremely slow. Often the successional pathway seems to “get stuck” in an intermediate state of shrubland – a phenomenon that has been termed “arrested succession”. The current research project has been developed in collaboration with the eco-community Tamera, which has been working on land rehabilitation in the Alentejo region of Southern Portugal since 1994. The two main goals of our project are 1) to characterize and describe site conditions and the state of natural tree regeneration as a baseline for future restoration activities in Tamera and 2) to contribute to the understanding of natural regeneration dynamics of Mediterranean oak forests. In order, to better understand which factors affect natural succession processes of oak ecosystems, we surveyed 55 plots in actively managed and abandoned *Montados* and shrublands in Tamera and neighbouring estates. The plots were established in different topographic positions following a catena. Within the plots, we recorded stand properties and tree regeneration of all major local tree species. We also documented site variables including land use, vegetation and soil parameters, and light conditions using hemispherical photography. Using regression analysis and multivariate models we will analyse which site factors can explain presence and density of tree regeneration at our plots. We will produce a report on regeneration conditions at Tamera and outline recommendations on how to support the recovery of mixed oak forests in Southern Portugal.

Poster 14

EFFECT OF A WATER RETAINING POLYMER ON ROOT DISTRIBUTION AND MYCORRHIZATION UNDER SUMMER DROUGHT

Dunja Šustić, Boris Rewald, Hans Sandén

Institute of Forest Ecology, Dept. of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna (BOKU).

Newly planted tree seedlings do often not survive the first or second summer due to summer drought as their root system is still small which makes them sensitive to drought. To reduce costs of replanting and accomplish higher establishment rate there is an interest in adding hydrogel based on cellulose in the planting pit to increase the seedlings water availability during drought. The objective experiment was to test if two different hydrogels had positive effects on tree growth without any harmful effect on establishment of roots and mycorrhiza. The experiment was conducted in a greenhouse with four typical mountain region species: Beech (*Fagus sylvatica*), Larch (*Larix europea*), Norway spruce (*Picea abies*) and Douglas fir (*Pseudotsuga menziesii*). Two-year-old tree seedlings were planted in seven-liter pots and exposed to 3 different treatments: 1) control with only soil, 2) 2.5g synthetic polymers without nutrients and 3) 2.5g cellulose based polymer with nutrients. The hydrogel was placed in the planting pit before planting. Drought stressed trees grew less than water trees. However, above ground there was no effect of the hydrogels where root production tended to increase in the hydrogel zone without decreasing in the surrounding soil without hydrogel. Mycorrhiza abundance on root tips and in mycorrhiza bags did not indicate that the hydrogels would negatively influence the mycorrhiza. Thus, no negative effects can be found of the hydrogels but also no strong evidence that they improve seedling health.

ASSESSING THE ROLE OF INDIGENOUS AGROFORESTRY SYSTEMS IN ENHANCING LOCAL COMMUNITY LIVELIHOODS OF SOUTH-EASTERN RIFT- VALLEY LANDSCAPES, ETHIOPIA

Hafte Mebrahten Tesfay, Herbert Hager

Institute of Forest Ecology, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences, Vienna, Austria.

Agro-forestry is a source of improving the livelihoods of small marginal farmers by following products: such as, fruit and nuts, fuel wood, timber, medicine, fodder for livestock, green manure, gum, resins, spices and other diversified products. A study was conducted to identify the contribution of indigenous agroforestry on improvement of livelihoods of farmers with the emphasis on investigating the determinants of productivity in coffee-fruit tree-enset agroforestry system, assessing the significant economic benefits obtained from practicing coffee-fruit tree- enset agroforestry, assessing how coffee-fruit tree- enset agroforestry can enhance the overall livelihood of the rural households and to identify what challenges and problems the farmers face during the implementation of these agroforestry practices in the study area. The study was conducted in the south-eastern Rift Valley landscape in the Dilla Zuria district, Gedeo zone of the Southern Nations', Nationalities' and Peoples' Regional State (SNNPRs) of Ethiopia. For this study, four villages were selected and data were collected by using a standard structured questionnaire administered to 160 household heads through face-to-face interviews, key informants interviews and focus group discussions. Data were analyzed using IBM SPSS version 22 (SPSS Inc. 2010) and Microsoft Excel to generate descriptive statistics. The result revealed that total land holding is the most determinant factor for the productivity of the system and has a positive linear correlation. The decision making scenario for the profitability of the agroforestry system using benefit cost ratio (CBR) shows a positive return with value of 2.6. From the different income categories that contribute for the total annual revenue of individual households, crops were the most significant and following fruits. Therefore, agroforestry is significant in improvement of rural community livelihoods. Hence, the present study strongly recommends to intensify promotion of agroforestry practices and scaling up to other suitable areas.

Poster 16

EFFECTS OF DIFFERENT LEVELS OF DROUGHT STRESS ON ECOPHYSIOLOGY AND MORPHOLOGY OF SEEDLINGS OF TEMPERATE BHUTAN HIMALAYA TREE SPECIESDorji Gyaltshen¹, Andras Darabant², Georg Gratzner¹¹Institute of Forest Ecology, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna, ²Bhutan Climate Change and Adaptation Project.

Himalayan regions are highly vulnerable to climate change. The glacier retreats faster than in other regions and precipitation is mostly dependent on the seasonal monsoon. Severe and frequent drought occurrence is expected with change in monsoon pattern or with monsoon failure. This threatens not only agriculture productions but also forests and their ecosystem functions. Changes in water availability and drought stress vulnerability are critical for plant species which may respond differently to different precipitation events. This study aims at comparing the effects of different intensities of drought on growth, midday leaf water potential (Ψ_{Mid}), stomatal conductance (g_s) and photosynthesis (P_N) of seedlings of five different dominant tree species in the mountain forests of the Himalayas (*Abies densa*, *Tsuga dumosa*, *Pinus wallichiana*, *Picea spinulosa*, *Larix griffithiana*). Potted seedlings were raised in a poly house and were four years old. Three levels of drought stress were applied; no water stress, moderate water stress (80 % of the field capacity weight) and extreme water stress (no irrigation) in seven replicate individuals per treatment for each species, totaling 105 seedlings. A completely randomized design was executed for the experiment. The preliminary result from Ψ_{Mid} reveals that there is a significant treatment effect and species effect ($P > .05$), but no interactions effect were observed.

Institute of Silviculture

Poster 17

ANNÄHERUNG AN DEN „DAUERWALDGEDANKEN“ AM BEISPIEL EINES FORSTBETRIEBES IN KÄRNTEN (APPROACHING THE "PERMANENT FOREST IDEA" USING THE EXAMPLE OF A FORESTRY COMPANY IN CARINTHIA)

Dennis Malle, Patrick Lenhard, Hubert Hasenauer, Mathias Neumann

Institute of Silviculture, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna.

The age-group forest with its large-scale coniferous pure stands is the prevailing forest form of the 19th and 20th centuries in Austria. The existing and progressive removal of near-natural forest and the associated disadvantages such as lack of self-regulation, calamities and susceptibility to biotic and abiotic factors are just a few of the biggest challenges of today's forest management. Now the question arises whether a change of common forms of management and a change of the leitmotifs for forest enterprises represents a conceivable alternative. Which silvicultural options do forestry companies want from the "clearcutting" mode of operation? How can a change from the clear-cut management to a more natural form of silviculture be carried out? We write this work in together, our motivation for this subject area is the predominantly practical part and thus the opportunity to take more for the future career as a forester. The aim of this bachelor thesis is to implement the theoretically acquired silvicultural principles, to improve handling with literary sources and to work on a task or a defined scientific problem. In order to achieve this goal, a feasibility study is carried out, documented and illustrated using the example of a forestry company in Carinthia. The cooperation with the forestry company includes the provision of basic data of the company, the access to the forest and the permission to collect and process data on site. The work should develop into an informative, objective and scientifically correct presentation of the problem. Furthermore, practically feasible approaches for real forestry operations will be developed. These approaches relate to the transformation of the age-group forest into a forest as natural as possible. In order to generate a well-rounded solution concept, not only silvicultural aspects are considered, but also other essential parts such as timber harvesting, monitoring, random sampling and parts of forestry management. However, in order to stay with a silvicultural thread, our structure is based on the Leibundgut questions. First, we look at the past of the forest and its use. Then the actual state is described and then our and by the management desired state defined. Finally, a specific question should demonstrate the focus of the work and, moreover, should represent a realistic goal for the company to achieve.

Poster 18

ANALYSE DER BESTANDESENTWICKLUNG DES NATURWALDRESERVATS JOHANNSEKOGEL IM LAINZER TIERGARTEN

Gilbert Saxl, Maximilian Scheuer, Harald Vacik

Institute of Silviculture, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna.

Ziel unserer Arbeit ist es, die Bestandesentwicklung und Verjüngungssituation im Naturwaldreservat Johannserkogel, im Lainzer Tiergarten der Stadt Wien, zu dokumentieren und eine Prognose für eine zukünftige Entwicklung abzugeben. Für den Vergleich werden die Ergebnisse der Arbeit von TICHY (1978) herangezogen, da dieselben Aufnahmeflächen bei der Wiederholungsaufnahme aufgenommen worden sind. Dadurch kann die Bestandesentwicklung im Lauf der Jahre abgebildet werden. Auf den Aufnahmeflächen wurden sämtliche Altersklassen vom Keimlingsstadium bis zum Altholz erhoben. Aus den Ergebnissen unserer Aufnahmen konnte die Veränderung der Baumartenanteile in der Naturverjüngung und im Bestand sowohl anhand von Diagrammen, als auch durch Bestandesgrundrisse und Bestandesaufrisse analysiert werden. Unsere Arbeit erlaubt die Entwicklung der letzten 40 Jahre auszuwerten und den Stand der Entwicklung zu dokumentieren. Es hat sich gezeigt, dass sich der Eichenbestand in Zukunft nicht gegen die sehr konkurrenzstarke Buche behaupten wird können.

COMPARISON OF GUIDELINES FOR DEADWOOD MANAGEMENT IN SELECTED NATURA 2000 FOREST TYPES

Federico Ricci, Harald Vacik

Institute of Silviculture, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna.

Deadwood is nowadays considered a key element in forest ecosystems, and its presence is deeply related with the conservation of European habitats and the dependent fungi, animal and plant species. Natura 2000 is the European network designated to ensure the long-term survival of Europe's most valuable and threatened habitats and species, but there are few indications and thresholds regarding the minimum amounts of deadwood to be considered when managing Natura 2000 sites.

Based on quantitative and qualitative information from literature, this thesis collects and compares the different guidelines and values suggested by the Member States of the European Union about the deadwood amounts in several habitats described in the Habitat Directive. More ambitiously, it aims at defining a framework to guide decision-making about deadwood management with regard to Natura 2000 management plans.

The comparative survey includes estimates about the deadwood amount in European forests, (included or not considered in Natura 2000 network), and both managed and unmanaged forests.

It is analyzed how Member States define different goals and apply different thresholds, hence making it difficult to provide a comprehensive framework for Natura 2000 management. The results of the survey and the identified thresholds are then compared with the aims of different deadwood assessment methods.

A framework will highlight the differences in the guidelines and propose solutions and thresholds for different situations and goals.

Poster 20

EISBRUCHAUFNAHME IM NATIONALPARK THAYTAL

Anna Schrötter, Markus Tonner, Harald Vacik

Institute of Silviculture, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna.

This thesis deals with the aftermath of ice calamity at the National park Thayatal in the year 2014. The goal was to establish a snapshot of the current conditions on the affected areas, to study the natural succession after a big disturbance without human interference on behalf of the National park administration. The information gathered are, status and quantity of tree rejuvenation, stock that's still alive and the tree type and progress of decomposition of reclined deadwood. Originally we wanted to mimic the sample points of the "Naturrauminventur", which was carried out in 2012, to gather comparable information. We achieved the stand investigation via a fix circular sample with an area of 300 m² and the natural rejuvenation was counted in rectangular sub-areas of summed up 16m², four square meters per cardinal point, furthermore we classified four different sizes of rejuvenation to get a feeling for the chronological order of appearance. The deadwood investigation has been carried out with a line-intersect method on 625 m² (25mx25m). Additionally we want to look into, whether or not tree or locations types were favoured.

Institute of Forest Growth

Poster 21

VERJÜNGUNGSMONITORING MITTELS DROHNENÜBERFLUG

Clemens Maria Hofer, Jürgen Richter, Arne Nothdurft

Institute of Forest Growth, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna.

Das Ziel der vorliegenden Bachelorarbeit war es mittels Orthofoto und händischer Aufnahme der Verjüngung auf der Vergleichsfläche ein Verfahren zu entwickeln, welches das Erkennen der Jungbäume ermöglicht. Die erste Idee war es dies durch einen Vergleich der NDVI-Werte, also der Verhältnisse Rot/Infrarot, der Pixel des Orthofotos zu machen.

Zu Beginn unserer Arbeit wurde eine Verjüngungsfläche im BOKU-Lehrforst im Rosaliengebirge mit Fichtenverjüngung ausgewählt. Im Sommer 2017 legten wir 6 Probekreisen auf dieser Fläche fest und vermarkten diese. Wir konnten aber die händische Aufnahme nicht durchführen, da es die Vegetation nicht zuließ. Schließlich konnten wir im September 2017 nach dem gemulcht wurde die händische Aufnahme der Verjüngung durchführen. Die Fichten wurden mittels einer Laservermessungsstation mit Computer und ein dazugehöriger Reflektor eingemessen.

Zu Testzwecken führte das WAFO bereits im Frühling 2017 einen Drohnenflug auf dieser Fläche durch. Der Quadkopter war mit einer Parrot-4-Kanal-Kamera und dazugehörigem GPS-Empfänger ausgestattet. Es wurden mehrere separate Flugrouten auf der Fläche abgeflogen, die die ganze Fläche abdecken sollten. Die Kamera zeichnete während des Fluges in einem bestimmten Zeitabstand mit fünf verschiedenen Linsen gleichzeitig jeweils ein Bild auf.

Eigentlich war im Herbst 2017 nach unserer Aufnahme ein endgültiger Flug geplant, dieser konnte aber nicht durchgeführt werden, wegen Zeit und Wetterproblemen. Deshalb beschlossen wir, nach Rücksprache mit dem WAFO, einen Versuch mit den Fotostrecken des Testfluges durchzuführen. Das WAFO stellte uns einen leistungsstarken Computer zur Verfügung und wir versuchten diese Fotos mittels der Software für photogrammetrische Operationen „Agisoft“ zu einem Orthofoto zusammenzufügen. Wir konnten einen Großteil der Bildstrecke zusammensetzen, jedoch zu keinem ganzen Orthofoto. Wir fanden immer wieder Lücken, Wülste und unscharfe Bereiche. Wir scheiterten auch daran die verschiedenen Bildstrecken aneinander zulegen. Somit stellten wir fest es ist unmöglich mit diesen Fotos ein Orthofoto zu erstellen.

Aufgrund der bereits investierten Zeit und Arbeit wurde uns bewusst, dass das ursprüngliche Thema den Rahmen dieser Bachelorarbeit sprengen würde. Darum wurde nach Rücksprache mit dem WAFO unser Thema abgeändert und die Arbeit sollte nun als „Manual für zukünftige Drohnenflüge“ am WAFO dienen.

Dieses Manual besteht aus den Vorbereitungen, der Auswahl sowie Handhabung von Drohne bzw. Kamera, dem Drohnenflug und den Nachbereitungen. Erstellt wurde sie im Zuge des letzten Drohnenfluges im März 2018 mit der Hilfe von DI Lederbauer.

Poster 22

KLIMA-SENSITIVE MODELLIERUNG DES DICKENZUWACHSES VON BÄUMEN IN REIN- UND MISCHBESTÄNDEN AUS EICHEN UND KIEFERN, FICHTEN UND BUCHEN, SOWIE BUCHEN UND LÄRCHEN AUF DER BASIS VON JAHRRING-ZEITREIHEN AUS BOHRKERNEN UND UNTER BESONDERER BERÜCKSICHTIGUNG DER KONKURRENZ (CLIMATE SENSITIVE MODELLING OF RADIAL INCREMENT)

Andreas Tockner, Arne Nothdurft, Sonja Vospernik, Markus Engel

Institute of Forest Growth, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna.

Empirical studies revealed that productivity of forests may benefit from a tree species mixture. However, existing analyses are mainly based on repeated measurements on long-term observation plots. Thereby, the longer time span between two consecutive measurements generally hinders the development of precise growth models that properly address the influence of a varying climate. As an alternative, the annual radial increment can be analyzed more precisely by means of year-ring width measurements on sample cores or stem disks. For this master thesis, a few hundred sample cores were collected in forest stands that differ with respect to their species composition. In addition, high resolution 3D point cloud data was collected using a terrestrial laser scanning system.

The major goal of this study is to develop a climate-sensitive regression model for the radial stem growth that takes simultaneously into account interaction effects related to the above-ground competition among trees. A further focus of the study lies on the evaluation of possible effects through the mixture of different tree species.

ACCURACY AND INTER-OBSERVER-BIAS OF CROWN PLUMBING IN DENSE STANDS WITH OVERLAPPING CROWNS

Florian Peter Brunner^{*}, Raphael Michael Kostjak^{*}, Tim Ritter

Institute for Forest Growth, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences, Vienna; ^{*}authors contributed equally.

The crown is an important component of the tree and an indicator for its social position in the stand. Thus, accurate measurement of the crown projection area (CPA) is of special importance for forest research and precise forest management. However, measuring the CPA is often difficult and imprecise, because many measurement errors may occur. In the literature, many possible recording methods are proposed. In this study, the Tangential-Lookup-Method was used, and eight radii were independently measured for each tree by three different observers. For the calculation of the CPA, the methods alpha convex hull, convex hull, polygon, mean squared radius and the mean radius were used. Existing terrestrial laser scanning (TLS) data were used as a reference. Results of the CPA calculation with the different methods were compared by one-factor analysis of variance with repeated measurements. The correlation coefficient, the root-mean-squared deviation (RMSD) and the systematic deviation (bias) were calculated between the independent measurements. While two observers yielded very similar results, a remarkable bias between these two observers and the third observer occurred. Moreover, nearly all calculation methods yielded significantly lower CPA estimates than the TLS data. Furthermore, TLS based measurements turned out to be more productive than the manual recording.

Institute of Forest Engineering

Poster 24

EINFLUSS DER VOLLMECHANISIERTEN HOLZERNTTE AUF DEN WALDBODEN HINSICHTLICH VERDICHTUNG UND EROSION

Peter Hinteregger, Tobias Robisch, Ewald Pertlik

Institute of Forest Engineering, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna.

Im Zuge dieser Bachelorarbeit soll die Thematik rund um die mit der vollmechanisierten Holzernte verbundenen Beanspruchung des Waldbodens hinsichtlich der Verdichtung und der folgenden Erosion durch schwere Forstmaschinen erläutert werden. Vorab soll ein Überblick über die geschichtliche Etablierung dieser Holzerntemethodik in der Forstwirtschaft gegeben werden um die Problematik besser verstehen zu können. Es werden die Einsatzkriterien solcher Erntetechniken auf suboptimalen Standorten erarbeitet, sowie Möglichkeiten zur Verringerung des Einflusses durch modernen Technikeinsatz besprochen. Ein Augenmerk liegt auch auf Optimierungsmöglichkeiten hinsichtlich der Organisation und der Planung solcher Einsätze, besonders hervorgehoben werden die technischen Hilfsmittel zur Bodenschonung. Sowohl ökonomische als auch ökologische Überlegungen über die Sinnhaftigkeit von vollmechanisierten Holzerntesystemen unter verschiedensten Aspekten werden getätigt.

UNTERSUCHUNG DER EINSATZTAUGLICHKEIT EINER WIRELESS-KRANLASTWAAGE IM RUNDHOLZTRANSPORT

Dominik Lindschinger, Karl Stampfer, Franz Holzleitner

Institut für Forsttechnik, Department für Wald- und Bodenwissenschaften, Universität für Bodenkultur Wien.

Die Abschätzung der Zuladung beim Rundholztransport auf Österreichs Straßen vor Fahrtantritt unter Einhaltung der gesetzlichen Rahmenbedingungen und gleichzeitiger optimaler Auslastung stellt für den verantwortlichen Fahrer eine schwierige Aufgabe dar. Die Firma Epsilon Kran GmbH, welche mit dem schwedischen Unternehmen „Tamtron Timber“ zusammenarbeitet, entwickelte für die Unterstützung bei der Gewichtsermittlung im Rundholztransport eine Wireless-Kranlastwaage. Hierbei wird mittels Hydraulikdruck beim Anheben der Last ein gewichtsabhängiges Signal an die Bedieneinheit gesendet und mittels Display dem Fahrer angezeigt. Die Verwiegung kann dynamisch oder statisch während des Ladevorgangs erfolgen und die anschließende Summenbildung der Gewichte wird durch einen manuellen oder automatischen Modus erzielt. Ziel dieser Arbeit ist es, diese Wireless-Kranlastwaage im Rundholztransport hinsichtlich Einsatztauglichkeit, Genauigkeit sowie deren Unterstützung für den Fahrer zu evaluieren.

Die Datenerhebung für die Gesamtladungen erfolgt einerseits durch den Fahrer mittels Fahrtenbuch, in dem die einzelnen Ladegewichte beginnend mit einer Gewichtsschätzung des Fahrers, über das Umladen auf andere Ladungsträger bis hin zur Werksübernahme erhoben werden. Zusätzlich erfolgen noch Vor-Ort-Erhebungen mittels Wiegeprotokoll für einzelne Greifer-Ladungen, um die Genauigkeit der unterschiedlichen Wiege-Modi der Wiegeeinheit zu erfassen. Die erzielten Ergebnisse sollen einerseits potenzielle Interessenten bei der Entscheidung für eine Anschaffung einer Wiegeeinheit unterstützen. Andererseits können diese aber auch als Rückmeldung für die Hersteller der Technik und als Grundlage für deren Weiterentwicklung dienen.

Poster 26

TROCKNUNGSVERLAUF DER ROBINIE (*ROBINIA PSEUDOACACIA* L.) IN ABHÄNGIGKEIT VOM AUFARBEITUNGSGRAD

Christian Steindl, Karl Stampfer, Gernot Erber

Institute of Forest Engineering, Department of Forest and Soil Sciences University of Natural Resources and Life Sciences, Vienna.

The aim of this study was to create a model which describes the moisture content of *Robinia pseudoacacia* L. dependent on various influencing factors. Parameters applied to the model are: season (summer/winter), degree of cutting, past time after felling and numerous weather data. It was possible to calculate statistical significance between the degree of cutting, season and past time after felling. Furthermore, in the period of July 2016 and June 2017 each month two trees were felled to describe the moisture content throughout the year. In summer the biggest moisture difference was measured in logs of *Robinia pseudoacacia* L., which were felled without any cutting after two weeks past felling. After ten weeks logs with the same degree of cutting had the lowest moisture content. In winter a moisture difference between the different degrees of cutting was not measurable until ten weeks after felling. The lowest moisture content was determined in logs which were felled and cut in four meter pieces.

WASSERGEHALT IM FORSTSTRAßENKÖRPER UND DESSEN AUSWIRKUNG AUF DIE TRAGFÄHIGKEIT UND INSTANDHALTUNG

Michael Fritz, Karl Stampfer, Franz Holzleitner

Institut für Forsttechnik, Department für Wald- und Bodenwissenschaften, Universität für Bodenkultur Wien.

Für die Tragfähigkeit von LKW-befahrbaren Forststraßen empfiehlt die internationale Literatur aktuell einen Richtwert von mindestens 45 MN/m² zu erreichen. Ob dieser Wert tatsächlich erreicht wird, und in welcher Form der Wassergehalt im Forststraßenkörper die Tragfähigkeit beeinflusst, ist bis dato wenig bekannt. Die Zielsetzung dieser Arbeit besteht darin, den Einfluss des Wassergehaltes im Straßenaufbau und in Abhängigkeit von Wetterdaten zu modellieren.

Dazu wird in einem ausgewählten Forstbetrieb im Waldviertel auf dem zu untersuchenden Straßenabschnitt eine Wetterstation vor Ort installiert. Der Wassergehalt des Straßenkörpers wird mittels seitlich eingebauter Spezielsensoren parallel zu den Wetterdaten erhoben. Zusätzlich erfolgen Tragfähigkeitsmessungen in Abhängigkeit von Wetterereignissen mittels dynamischen Lastplatten-versuchs und die Validierung der Feuchtigkeitssensoren im Straßenkörper mittels Darrschrank-methode.

Als Ergebnis soll ein Ampelsystem für die schonende Befahrung von Forststraßen entwickelt werden. Dies könnte in Zukunft auftretende Schäden durch unsachgemäße Befahrung im Zuge des Holztransportes reduzieren und somit den damit einhergehenden Instandhaltungsaufwand so gering als möglich halten. Dies würde sich für den Forstbetrieb als zusätzliche Entscheidungshilfe für den richtigen Zeitpunkt der Holzabfuhr anbieten.

Poster 28

LAUFWÄGEN FÜR DIE HOLZERNTEN IN EUROPA

Michael Hainzl, Karl Stampfer, Martin Kühmaier

Institute für Forsttechnik, Department für Wald- und Bodenwissenschaften, Universität für Bodenkultur Wien.

Für die Holzernte im nicht befahrbarem Gelände ist die Seilbringung das am häufigsten eingesetzte System. In Europa haben aufgrund der Geländebeziehungen Seilbringungssysteme eine lange Tradition. Diese wurden durch ständige Weiterentwicklungen und Automatisierungen zu einem wirtschaftlichen interessanten Holzernteverfahren. Seilbringungssysteme mit einem Tragseil benötigen zum Transport der Last von der Beladestelle zur Entladestelle einen Laufwagen. Das Ziel der Diplomarbeit soll eine Literaturrecherche über Systeme, Funktionsweisen und typischen Einsatzbereichen sowie eine Quantifizierung der am häufigsten verwendeten Laufwägen durch Rückfrage bei Maschinenherstellern und Ernteunternehmen in ganz Europa sein.

Im Zuge einer Literaturrecherche werden alle in Europa produzierten Laufwägen beschrieben. Die Laufwägen werden zur Vergleichbarkeit einerseits unterschieden für welches Tragseilsystem (stehendes Tragseil, Lauftragseil, absenkbares Tragseil), andererseits für welches Arbeitsverfahren sie geeignet sind (Gravitations-, Allterrainverfahren). Die Technischen Daten, Kosten und Verkaufszahlen werden durch die Rückfrage bei den Herstellern erlangt. Anschließend werden die Technischen Daten der Laufwägen über eine deskriptive Statistik verglichen.

Folgende Ergebnisse werden erwartet:

- Gliederungssystematik für Laufwägen
- Technischer Stand der europäischen Laufwägen
- Überblick über die in Europa produzierten Laufwägen sowie deren unterschiedlichen Einsatzbereiche
- Quantifizierung der am häufigsten eingesetzten Laufwägen in Europa
- Deskriptive Statistik von den Technischen Daten

Institute of Forest Entomology, Forest Pathology and Forest Protection

Poster 29

EVALUATION OF THE MODEL PHENIPS-TDEF FOR SIMULATING NORWAY SPRUCE DROUGHT STRESS AND BARK BEETLE DEVELOPMENT IN THE WILDERNESS AREA OF DÜRRENSTEIN, AUSTRIA

Maria von Rochow¹, Sigrid Netherer¹, Helmut Schume², Christa Schafellner¹

¹Institute of Forest Entomology, Forest Pathology and Forest Protection, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna; ²Institute of Forest Ecology, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna.

PHENIPS - a combination of the words Phenology and Ips - is a model for predicting annual swarming start, development rate, and potential number of generations of *Ips typographus*, Europe's most important bark beetle species. It is combined with a hydrological model (TDEF) developed to simulate transpiration deficits of the host tree *Picea abies*.

This master study aims to validate PHENIPS-TDEF by running the model at four sites in the wilderness area Dürrenstein (Hundsau), Lower Austria and comparing the simulated results to actual measurements. In particular, the concurrence of beetle swarming times with periods of increased disposition for infestation due to drought periods is of interest. For this purpose, the water balance model TDEF is applied based on climate data from a nearby meteorological station as well as soil and forest inventory data (provided by the Austrian Federal Forests (Operat, ÖBf)). The seasonal course in soil water content and the potential transpiration deficits are simulated. The model requires specific input such as soil texture and depth, stone content, site index, proportion of Norway spruce, tree age, stand density, and leaf area index. At each site, the specific conditions are recorded. Model output is compared to actual, periodically measured soil moisture values. Automatic bark beetle traps are set up and regularly controlled over three months at the study sites. Trap trees allow for a control of bark beetle breeding progress in comparison to development rates predicted by the model.

Poster 30

DOES DROUGHT INFLUENCE INSECT FEEDING DAMAGE ON TWO OAK TREE SPECIES IN BHUTAN HIMALAYA?

Rinzin Dorji¹, Georg Gratzner², Axel Schopf¹

¹Institute of Forest Entomology, Forest Pathology and Forest Protection (IFFF), Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna. ²Institute of Forest Ecology (IFE), Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna.

As a mountainous country in the Himalayas, the vitality of Bhutan's vegetation depends on the monsoon rain resulting from wet air blowing inland from the Indian Ocean. A failure in monsoon system due to climate change could be detrimental to the vegetation, particularly the species that grow in the transitional zones. Studies revealed that the Bhutan Himalaya experienced warmest period in the first decade of the 21st century. There are two species of oaks that form a distinct forest type with both attaining the dominant crown in the transitional zone at 1860 –2540 m a.s.l., a transition zone from subtropical to temperate forests. The dry west Himalayan evergreen, *Quercus lanata* and deciduous east Himalayan broad-leaved, *Quercus griffithii*. Trees in this zone are limited by soil moisture content of less than 20 percent for down-slope extension and by soil temperature of -1°C for upslope extension. Drought is one of the abiotic stressors that affects the plant survival. Studies indicated increased tree mortality from climate-induced physiological stress and its interactions with other climate-mediated processes such as insect outbreaks. Drought affects plant growth, development and productivity and also influences the plant's defense mechanism against herbivores. The predicted increase in the occurrence of severe droughts in Bhutan Himalaya is the topic of a multidisciplinary study on the influence of drought as natural predisposing stressor for Himalayan oak forests. In frame of this study, we investigate the effect of artificially induced drought on the infestation rate of the two oak species, *Q. lanata* and *Q. griffithii*, by defoliating insects.

Therefore, sample trees were selected from roofed and unroofed study plots. From these trees we collected damaged leaves and from enveloped branches also undamaged leaves at different times of the season to assess both, the intensity of foliage feeding damage and the type of damage (margin feeding, hole feeding, etc.). Additionally, special traps were used to collect the falling insect faeces from these trees in order to record also indirectly the feeding intensity of the insect community of these trees.

Other BOKU Institutes and External Organizations

Poster 31

VERWENDUNG VON MULTI-TEMPORALEN SENTINEL-2 SZENEN FÜR DAS MONITORING VON WALDVERÄNDERUNGEN IM BIOSPHÄRENPAK WIENERWALD

Jonas Ellecosta, Jens Michael Moroder Demetz, Markus Immitzer

Institut für Vermessung, Fernerkundung und Landinformation (IVFL), Universität für Bodenkultur Wien.

Durch die Erfassung von großen Flächen und die hohe Wiederholrate der Aufnahmen sind aktuelle Erdbeobachtungssatellitenmissionen für das Monitoring von Wäldern prädestiniert. Mit dem Start von Sentinel-2 im Zuge des europäischen Copernicus Programmes stehen seit 2015 Daten in bisher nicht bekannter räumlicher, spektraler und zeitlicher Auflösung kostenfrei zur Verfügung. Ziel dieser Arbeit war das Potential dieser Daten für die Erkennung und Charakterisierung von Veränderungen im Wald zu untersuchen. Dazu wurden, basierend auf einer Literaturrecherche, unterschiedliche Vegetationsindices ausgewählt und unter Verwendung der Sentinel-2 Kanäle für unterschiedliche Zeitpunkte berechnet. Durch die damit verbundene Change detection Analyse wurden Veränderungen im Biosphärenpark des Wienerwaldes im Zeitraum 2015 bis 2018 lokalisiert und weiter analysiert. Dabei wurde das Hauptaugenmerk auf forstliche Eingriffe und deren Nutzungsstärke gelegt. Für die Analysen standen die Nutzungsdaten der österreichischen Bundesforste AG (ÖBf AG) als Referenz zur Verfügung. Neben forstlichen Eingriffen (Vornutzung und Endnutzung) wurden auch biotische und abiotische Störungen untersucht, wobei bekannte Eisbruchereignisse und die aktuelle Eschenproblematik primär betrachtet wurden. Für die Analysen wurden verschiedene Kennwerte basierend auf den Indizes berechnet und deren Eignungen für die Erkennung und für die Charakterisierung (natürliche Veränderung, Nutzung und deren Stärke) durch statistische Analysen untersucht. Mit der Arbeit konnte das große Potential der Fernerkundung für das Waldmonitoring eindrucksvoll bestätigt werden.

Poster 32

INTERACTION BETWEEN MICROORGANISMS AND SECONDARY METABOLITE PRODUCTION OF MEDICINAL PLANTS

Cintia Csorba

Austrian Institute of Technology GmbH, Center for Health and Bioresources, Unit Bioresources.

My PhD program is part of the MARIE SKŁODOWSKA-CURIE ACTION Innovative Training Network Project MICROMETABOLITE. The leading topic is Microbial Enhancement of Bioactive Secondary Metabolite Production in Plants. In MICROMETABOLITE, we aim to explore the interactions between plants and microorganisms influencing the metabolism of plants. We investigate their involvement in the production of secondary metabolites with the aim to introduce novel ingredients in pharmaceutical and cosmeceutical industry. The microorganisms in the end of the study will be integrated in plant production systems, and protocols needed for efficient implementation in industry will be elaborated.

My objectives are to study the succession of root-associated microbial communities of Boraginaceae plant species during plant development and to identify taxa that correlate with altered secondary metabolite production, to study root-associated microbiomes associated with Boraginaceae plant species and to correlate microbial community structures and plant genotype with metabolome characteristics as well as to screen microbial endophytes for increasing metabolite production and plant growth. I intend to develop and assess DNA extraction methods. The analysis of microbial communities will be carried out via culture-independent approach, using molecular methods and New Generation Sequencing (NGS) tools. Comparison of microbiome in different plant species, at different developmental stages, sampled at distinct tissues and parts of each plant will be investigated. In the last stages endophyte strain screening will be carried out for desired effects on plant metabolites production and growth and selected for plant production systems.

POTENTIALE IN DER NACHHALTIGEN BEWIRTSCHAFTUNG FORSTLICHER GENRESSOURCEN DER ÖBF AG

Markus Sallmannshofer¹, Thomas Geburek²

¹Universität für Bodenkultur Wien, ²Institut für Waldgenetik, Bundesforschungs- und Ausbildungszentrum für Wald, Naturerfahren und Landschaft, Wien.

Schlecht angepasste Bestände und rasche Klimaveränderungen mit vermehrten Extremereignissen fordern neben Naturverjüngung eine ausreichende Versorgung mit forstlichem Vermehrungsgut hoher Qualität und Herkunftssicherheit. Die ökologische Stabilität künftiger Bestände ist die Basis für den zukünftigen forstwirtschaftlichen Erfolg und wird maßgeblich von der Genetik beeinflusst. Die ÖBf AG trägt dabei als größter österreichischer Waldbewirtschafter eine besondere Verantwortung. Das Ziel der Forschungsarbeit ist es, innovative Vorschläge zum praktischen Umgang und zur Behandlung von Saatguterntebeständen der ÖBf AG als Ergänzung zu bestehenden Projekten zu liefern. Sie umfasst die Evaluierung von Beerntungsmethoden sowie die waldbauliche Behandlung von Saatguterntebeständen und beschreibt Kriterien und Verfahren zur Qualitätssicherung. Zur Abschätzung der Eignung des genetischen Materials in Abhängigkeit des Standortes werden mögliche Monitoringverfahren für Aufforstungen vorgestellt. Mögliche Synergien von Saatguterntebeständen mit Generhaltungsmaßnahmen werden diskutiert. Es werden zudem knapp 2000 ein- oder mehrfach als Saatguterntebestände zugelassene ÖBf-Waldorte aus Forsteinrichtungsdaten hinsichtlich ihres aktuellen Bestehens über das Alter, Nutzungsmengen und Orthofotos analysiert und mit dem Nationalen Register abgeglichen. Eine Evaluierung in Abhängigkeit verschiedener möglicher Managementvarianten und des Saatgutverbrauchs zeigt Handlungsspielräume und –bedarf. Über GIS- und SAP-Daten der Waldorte und Ihrer Umgebung werden besonders zu berücksichtigende zugelassene Bestandeskomplexe von hoher Bedeutung herausgearbeitet.

Index of contributors

Acácio	48	Hipfinger	5, 16
Albrecht	6, 26	Hofer, B.	45
Bajraktarevic	36	Hofer, C.M.	56
Berger	16, 46	Holzinger	39
Berthold	10	Holzleitner	27, 60, 62
Bischofer	46	Hood-Nowotny	5, 8, 10, 38
Brenn	47	Hösch	10
Bruckner	10	Huber	31
Brunner	58	Immitzer	66
Buchacher	6, 28	Kanzian	25, 26
Candra	41	Karlicky	40
Csorba	67	Katzensteiner	15, 48
Darabant	51	Kaufmann	6, 30
Daudin	18	Keiblinger	12, 36, 43
Deltedesco	5, 12	Kidd	23
Diaz-Pines	44	Kirnbauer	6, 25
Dinter	5, 13	Kolos	40
Dirnböck	38	Korboulewsky	38
Disep	6, 34	Kostjak	58
Djulic	38	Kühmaier	24, 63
Dorji	65	Landl	5, 11
Echevarria	22, 23	Lechner	6, 32
Ecker	44	Leitner	10
Ellecosta	66	Lenhard	52
Engel	57	Lestan	37
Erber	61	Lindschinger	60
Ette	6, 29	Machinet	22
Formayer	10	Malle	52
Friedel	17	Maschek	32
Friedl	12	Mayer	46
Friesl-Hanl	37	Mentler	36, 42
Fritz	62	Michelsen	11
Gamper	5, 17	Moroder Demetz	66
Gaupmann	45	Murer	10
Geburek	68	Netherer	64
Geitner	15	Neumann	52
Gerzabek	13, 21, 36, 41, 42, 43	Noller	37
Gindra-Vady	6, 31	Nothdurft	28, 29, 34, 56, 57
Godbold	45	Oburger	18
Gorfer	12, 38	Ottner	41
Grace	12	Pertlik	59
Grandin	38	Pousek	6, 31
Gratzer	5, 14, 15, 47, 51, 65	Puschenreiter	13, 19, 20, 22, 23
Grollnigg	6, 33	Rampazzo	42
Gyaltshen	51	Reichenauer	21
Hager	50	Reiter	5, 20
Hainzl	63	Resch	10
Halmschlager	32	Rewald	2, 49
Hasenauer	30, 52	Ricci	54
Heiling	10	Richter	56
Hinteregger	59	Ridard	5, 23

Riegler.....	6, 27	Stampfer.....	24, 25, 26, 27, 60, 61, 62, 63
Ritsche.....	48	Steindl.....	61
Ritter.....	6, 29, 58	Strahlhofer.....	42
Robisch.....	59	Strobel.....	13
Roschitz.....	5, 18	Summer.....	5, 21
Rose.....	38	Šustić.....	49
Rosenkranz.....	23	Tesfay.....	50
Rowlings.....	12	Tintner.....	41
Sallmannshofer.....	68	Tockner.....	57
Sandén.....	5, 49	Tognacchini.....	5, 22
Santner.....	18	Tonner.....	55
Saxl.....	53	Tunega.....	40
Schafellner.....	33, 34, 35, 64	Vacik.....	31, 53, 54, 55
Scheer.....	12	van der Ent.....	22
Scheuer.....	53	Vilsmeier.....	6, 24
Schiefer.....	5, 19	von Rochow.....	64
Schmittner.....	38	Vospernik.....	29, 57
Schopf.....	65	Wagenhofer.....	10
Schrötter.....	55	Watzinger.....	5, 8, 10, 37, 38
Schüler.....	28	Weltin.....	10
Schume.....	64	Wenzel.....	17, 18, 19, 20, 39
Simon.....	5, 15	Wieser.....	6, 35
Socianu.....	43	Wriessnig.....	41
Spiridon.....	5, 10	Zechmeister-Boltenstern.....	11, 12, 44
Stadler.....	38	Zehetner.....	13, 36, 39, 41, 42, 43

Acknowledgments

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 and guests for their interest in our research. The support by Ms. Victoria Iby and DI Martin Wresowar from the Institute of Forest Ecology was essential organizing the event.

