University of Natural Resources and Life Sciences, Vienna

Department of Forest and Soil Sciences

9. WABO Student Conference 2024: **Advancing Forest and Soil Sciences**

Book of Abstracts

20. June 2024, Vienna

This student conference is the final student colloquium and
comprises the following BOKU courses (2024S):
Bachelor's thesis seminar 910110,
Master's thesis seminar 910301, and
Doctoral seminar 910400.

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9. WABO Student Colloquium 2024: Advancing Forest and Soil Sciences - Book of Abstracts. A. Holzinger (Ed.). University of Natural Resources and Life Sciences, Department of Forest and Soil Sciences, Vienna.

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Program

Welcome WABO colleagues!
The "9th WABO Student Conference 2024 (LV 910110, 910301, 910400): Advancing Forest and Soil Science" takes place on Thursday, **June 20, 2024 (09:00 – 17:30 CEST) at the BOKU main building (Mendelhaus), 3rd floor (3. OG), Festsaal (MENH-03/01)**.
Presentations are given LIVE - in presence.

Oral presentations: Presenters are kindly asked to briefly check their presentation before the conference or during breaks with the chair for functionality. Before the session starts, please introduce yourself briefly to the chair. Computers will hold Windows and PowerPoint. Both pptx and pdf files can be displayed.
A **maximum of 15 minutes** is allocated per slot – incl changing speakers.
If the presentations are shorter, there will be time for questions within the 15-minute time frame – but **do NOT exceed the 15 minutes timeframe!**
Presentations are collected via a BOKU-Box (presenters are directly contacted via e-Mail) and be available up-front, but presenters are advised to also have their presentations on a USB-stick.

Please keep the given time limits strictly!

Poster presentations: Poster size max. A0, "portrait" (discuss design and plotting with your supervisors!). Each poster presenter is responsible for the design of the poster. Posters can be placed from 08:30 on the prepared poster boards at Festsaal (MENH-03/01), following the numbering. Needles/pins are provided. Please put them in place until 10:45 at the latest. During the poster sessions (coffee breaks and lunch break), please be close to your poster to allow visitors to ask questions. Please take the posters down at the end of the conference, **we need to leave the poster boards empty.**

We are looking forward to a great WABO-Student Colloquium!

In case of any questions please contact: andreas.holzinger@boku.ac.at

Oral Presentations

Session 1 – Festsaal (MENH-03/01)

Chair: Andreas Holzinger

Time	Presenter	Title
09:00	**Eugenio Díaz-Pines**	Keynote: Long-Term Ecological Research in Lehrforst Rosalia: Past, Present and Future
09:30	**Neil Ashworth**	Assessing Carbon Sequestration Potential in Maize and Wheat Cropping Systems: Comparing Biochar, Compost, and Fertilizer Amendments in both, in addition to Crop Management Practices in wheat
09:45	**Paul Reif**	Wildfire Risk, Tourism and Climate Change in the Rax/Schneeberg Region from a Stakeholder Perspective
10:00	**Armin Bajaktarevic**	Development over time and current status of soil parameters on arable land in the agri-environmental programme 2015 – 2022 (ÖPUL)
10:15	**Alexander Buchelt**	Autonomous Drones and their application in Forestry
10:30	**Nicolaus Erich**	Testing Enhanced Weathering in forest areas. Examining the comparability and homogeneity of Vegetation on survey plots
10:45-11:15	**Coffee Break with Poster session**	Festsaal / hallway (coffee-walk-talk)

Oral Presentations

Session 2 – Festsaal (MENH-03/01)

Chair: Eva Oburger

Time	Presenter	Title
11:15	**Alfred Eisner**	Management concept for the AMAG forest. Biodiversity and nature conservation
11:30	**Michael Haberl**	Maintenance with the TH 3.8 road maintenance device
11:45	**Lan Hangyu**	Cold temperature growth and freezing resistance of ectomycorrhizal and Saprotrophic fungi
12:00	**Damjan Orepic**	Effect of land use change on the nutrient status and microbiology of a young volcanic soil in Galápagos
12:15	**Elisabeth Autischer**	The Role of Drones in Forestry: An Analysis of Current Practices and Future Opportunities
12:45	**Benjamin Böhm**	Effects of parasitization and photoperiod on the respiratory activity of the spongy moth, Lymantria dispar (Lepidoptera: Erebidae)
12:45-14:00	**Lunch break with Poster session**	Festsaal / hallway (eat-walk-talk)

Oral Presentations

Session 3 – Festsaal (MENH-03/01)

Chair: Katharina Keiblinger

Time	Presenter	Title
14:00	**Henning Schwalm**	Root exudation patterns of barley, faba bean, potato and sweet potato-cultivars in different European soils
14:15	**Theresa Strobl**	Estimating soil properties under different moisture conditions using Vis-NIR-SWIR reflectance spectroscopy
14:30	**Lionora Suss**	Effects of forest management on great tits in the Wienerwald Biosphere Reserve - focus on immune response and food provisioning activity
14:45	**Esparza-Robles**	Greenhouse gas fluxes after 40 years of crop residue management in an Austrian cropland: do emissions increase with larger soil carbon storage?
15:00	**Cecilie Foldal**	Blow up - Scaling up spatial and temporal N2O emissions from agricultural soils in Austria
15:15	**Jerneja Harmel**	Seed stand characteristics' effect on silver fir seed quality
15:30	**Coffee Break with Poster Session**	Hallway (coffee-walk-talk)

Oral Presentations

Session 4 – Festsaal (MENH-03/01)

Chair: Arne Nothdurft

Time	Presenter	Title
16:00	**Timm Horna**	Drought stress adaptations of different (inner-) alpine silver fir (Abies alba) stands in Western Tyrol, Austria
16:15	**David Lee**	The effect of smoke water on seed germination success of Central European species
16:30	**Maximilian Mittendorfer**	Investigating the Sustainability of Timber Harvesting Operations from an Economic Perspective
16:45	**Uxue Otxandorena-Ieregi**	Decomposition dynamics and partitioning between the plant-soil-microorganism interphase of (eight naturally occurring) phytosiderophores
17:00	**Melanie Studera**	Effectiveness of mycoinsecticide products containing different strains of Beauveria bassiana and Beauveria brongniartii against the European cockchafer Melolontha spp. (Coleoptera, Scarabaeidae)
17:15	**Gergely Toth**	The effect of fertilisation in organic farming on microbial biomass and necromass

Poster Sessions – Festsaal (MENH-03/01)

Poster Chair: Stefan Schweng

The poster sessions will take place during the coffee breaks and the lunch break, the motto is "eat-walk-talk". Please make sure that the responsible poster presenter is directly at the poster during these times.

Note: Only the corresponding authors of the posters are mentioned here.

Poster#	Contribution
P01	**Maximilan Behringer** On the role of earthworms for the recovery of soil structure in skid trails
P02	**Stefan Blaß** Mid- and long-term impacts of drought and heavy rainfall cycles on forest soil and microbial communities
P03	**Sofia Colombo** Effects of drought on root morphological traits and root exudate patterns of two faba bean genotypes grown in different soils
P04	**Simon Eppinger** Impacts of different land management strategies on the ultrasonic soil aggregate stability (USAS) of flood control dikes
P05	**Stella Ertl** Implications of the European Union in Sustainable Forest Management
P06	**Jorling Espinoza** Phytosiderophore Release of Different Grass Species Under Moderate Iron Deficiency
P07	**Jonathan Feichter** TannenGen: Development of molecular SNP markers for the selection of climate-adapted silver fir provenances
P08	**Dylan Goff** Impact of Drought and Rewetting Cycles on Soil Greenhouse Gas Fluxes across an N Deposition Gradient in Austrian Forests
P09	**Lena Großauer** Comparison of functional leaf traits along Mongolian steppe-forest transitions
P10	**Qiwen Guo** Above and belowground phenology and production of four tree species with contrasting root and leaf traits
P11	**Markus Jäggle** Photoperiodic induction of reproductive diapause in the oak lace bug, Corythucha arcuata (Heteroptera: Tingidae)?
P12	**Almer Jaros** Microbial C:N:P stoichiometry in hydromorphic organic soils under agricultural use in Austria

P13	**Kumaravel Karthikeyan** Efficacy of Fish Amino Acid (FAA) organic manure compared to mineral fertilizer on wheat crop in sandy soil
P14	**Patricia Leszkovics** Silvicultural studies on stand structure and productivity of coppice with standards using the example of the Urbarialgemeinde Zagersdorf
P15	**Cora Ena Löwenstein** Under what conditions are Austrian forest managers and owners willing to implement the SDGs in their forest operations?
P16	**George McCaughan** Organic Carbon Fractions of Innovative Management Practices: a comparison of soil metrics as influenced by differing soil management schemes
P17	**Constantin Müller** - Microplastic and Heavy Metal Contamination - an Analysis of Vienna's Gardens
P18	**Iris Oberklammer** Preserving European Forests: The Vital Role of Seed Monitoring in the Face of Climate Crisis
P19	**Maximilian Mario Oschmann** Life cycle assessment of timber harvesting with chainsaw, cable yarder and processor
P20	**Aurelia Ossmann** Influence of the photoperiod on the development of Glyptapanteles liparidis in Lymantria dispar
P21	**Benjamin Pauser** A field survey for overwintering hosts of the spongy moth parasitoids Glyptapanteles liparidis and Glyptapanteles porthetriae
P22	**Jannik Renner** Oviposition and egg development of the nine-spotted moth, Amata phegea (Lepidoptera: Erebidae)
P23	**Fabian Scandella** - Rockfall hazard in Schattwald, Montafon
P24	**Anna Schneider** Effects on establishment by different fertilizers applied at planting of tree seedlings
P25	**Anton Singer** Development of a spatial model for sustainability assessment of timber harvesting
P26	**Kevin Tenne** Evaluation of a temperature-based phenology model for the development of the oak lace bug Corythucha arcuata (Heteroptera: Tingidae) in the field
P27	**Jonathan Thon** Effects of Rhizosphere Interactions on Phosphorus Uptake Efficiency in Upland Rice

P28	**Michele Vannini** Effects of Soil Amendments on Mycorrhizal Colonization and Seedling Survival in Austrian Reforestation Efforts
P29	**Franziska Weinreich** Managing soil health in the field: Useful methods and visualisation of soil health
P30	**Timothy Zinnecker** Temperature-dependent effects of Verticillium nonalfalfae-isolate Vert 56 on symptom development on Ailanthus altissima
P31	**Sebastian Aigner** Taper curve modeling in R using PLS data
P32	**Felicitas Masser** Collection of additional information using automatic speech recognition in digital laser-based forest inventories
P33	**Elias Kimmel** Comparison and evaluation of PLS-, ALS- and photogrammetric-based inventory methods in the Sparbach Nature Park
P34	**Josef Alois Oberlindober** Laser-assisted hardwood measurement for volume calculation and classification as well as for deriving a possible market value of the formed logs
P35	**Felix Brader** Socket shape modeling based on PLS data
P36	**Antonia Cavallar** Assessment of wildlife visibility using laser scanning
P37	**Raphael Andreas Katzenschlager** Calculation of the center of mass of the above-ground biomass of individual trees using terrestrial laser scan data and Quantitative Structure Models (QSM)
P38	**Martina Perzl** Participatory systemic perspectives for overcoming future tree seed shortages in the climate crisis: The Austrian system of seed-tree stands
P39	**Max Albers** Automated segmentation of forest stands using Airborne- and Personal Laser Scanning data
P40	**Alexander Prskavec** Airborne Laser Scanning (ALS) and Unmanned Aircraft System (UAS) supported harvest planning in cable yarding operations
P41	**Christian Daniel Marquard** Analysis of the infestation of fir canker (Melampsorella caryophyllacearum) and fir mistletoe (Viscum album ssp. Abietis) in the Bregenz Forest: influence of exposure, altitude and diameter class

P42	**Carl Orge Retzlaff** Integrating AI in Simulating Cable Corridors Based on Terrestrial LiDAR Data
P43	**Alvin Gitau Kiarie** Revisiting Climate Change Mitigation Potential in Smallholder Farming Systems in Kenya

Abstracts

Keynote Presentation

Long-Term Ecological Research in Lehrforst Rosalia: Past, Present and Future

Eugenio Díaz-Pines

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Abstract:

The Lehrforst Rosalia (Rosalia Forest Demonstration Centre) is a key BOKU infrastructure. The forest, owned by the Östererichische Bundesforste (Austrian Federal Forests) is used by BOKU for teaching and research purposes since many decades. Among several scientific activities, in situ monitoring of ecosystems processes and investigation of the forest response to disturbances has a long tradition at the Lehrforst. The site is part of the international long term ecological research (LTER) network and, in this frame, features a state-of-the-art instrumentation where multiple ecosystem components (geosphere, hydrosphere, atmosphere and biosphere) and their interactions can be investigated under real conditions. In addition to the long-term ecosystem monitoring, the investigations involve active manipulation simulating future climate conditions, to better understand and quantify the effects of global change. Currently, the Lehrforst Rosalia is undergoing a process of further upgrade and digitalization of the infrastructure and is deeply involved in the creation and development of the European LTER Research Infrastructure, a pan-European, in-situ research infrastructure network combined with high-level central facilities. In this talk, I will take you on a journey through the history of the Lehrforst, showcasing key achievements, emphasizing its significance to the academic and scientific community and society, and offering insights into its future outlook.

Oral Presentation

Assessing Carbon Sequestration Potential in Maize and Wheat Cropping Systems: Comparing Biochar, Compost, and Fertilizer Amendments in both, in addition to Crop Management Practices in wheat.

Neil Ashworth[1*], Rebecca Hood-Nowotny [2]

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Abstract:

The rise in global greenhouse gas (GHG) emissions, particularly carbon dioxide (CO2), demands urgent mitigation strategies. Despite the growth of renewable energy, fossil fuel use persists, intensifying climate challenges (Emissions Gap Report, 2023). Climate change impacts agriculture through altered temperatures, precipitation, and CO2 levels, threatening food security (Hatfield et al., 2011). Below-ground carbon inputs, such as root biomass and rhizodeposition, are critical for soil carbon dynamics (Hirte et al., 2018b). Enhancing soil carbon through sustainable agricultural practices can contribute to long-term carbon sequestration and support food security.

An EOM field experiment with silage maize was conducted at the AGES experimental station in Grabenegg, Lower Austria. Six treatments were applied in a randomized plot design (5x8m plots, 4 plots per treatment): (i) control, (ii) NPK fertilizer, (iii) compost, (iv) NPK + biochar, (v) compost + biochar, and (vi) bio-digestates.

Root characteristics were analysed using Rhizovision. Significant differences in root length, network area, volume, and surface area were observed between treatments. Biochar did not significantly enhance these metrics compared to other treatments. NPK and bio-digestates showed greater root growth metrics than compost and control treatments.

Kruskal-Wallis test indicated significant differences in median harvest yields, but pairwise comparisons did not reveal statistically significant differences between specific treatments. Thus, treatments did not significantly impact harvest yield. Significant differences in nitrogen uptake among treatments were detected, with NPK showing higher uptake than control. Biochar appeared to immobilize nitrogen, affecting root growth and above-ground yield. Magnesium and Sulphur uptake also showed significant differences, but further analysis is needed. Cover crop management preceding maize planting influenced fine root distribution, particularly in the upper soil layer, highlighting their role in preventing soil loss.

Biochar's role in nutrient immobilization and long-term carbon storage needs further exploration to optimize carbon sequestration in cropping systems.

Oral Presentation

Wildfire Risk, Tourism and Climate Change in the Rax/Schneeberg Region from a Stakeholder Perspective

Paul Reif[1*], Arne Arnberger[1]

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Abstract:

The southeastern region of Lower Austria is one of the areas most affected by forest fire risk in Austria. Increasing dryness and prolonged heat periods, as well as rising visitor pressure, further exacerbate these conditions. The major wildfire that occurred in 2021 in the Rax/Schneeberg recreation area garnered significant media attention, but little is known about the general perception of forest fire risk in the region among the relevant stakeholders.

This study applies Mayring's qualitative evaluation research to investigate stakeholders' perceptions of forest fire risk in the region. A series of qualitative interviews were conducted, and a total of eleven semi-structured, problem-centered interviews were held with individuals from the fields of local recreation use, tourism services, tourism management, forestry, and fire fighting. These interviews followed a systematically developed, standardized guideline to gather their assessments. Using qualitative content analysis, specifically the structuring technique, the general perception and differences among the individual stakeholder groups were captured, compared with existing literature, and critically analyzed.

The investigation reveals that climatic changes, particularly the increasing dryness in the Region, are perceived equally by all individuals. However, the processing of this information can vary significantly and is dependent on the context of the respective individuals. Existing studies support the theory that individuals who deal with the issue for professional reasons, assess the risk much more severely than those who live in the region and/or use it for recreational purposes. Furthermore, the perception of whether, and to what extent, measures are taken to reduce this risk also depends on the same aspects.

These divergences suggest that future prevention measures must not only be technically adapted to the region's needs but also that tailored communication strategies to raise awareness among the general population are key aspects for effective prevention work.

Oral Presentation

Development over time and current status of soil parameters on arable land in the agri-environmental programme 2015 – 2022 (ÖPUL)

Armin Bajraktarevic[1*], Martin Gerzabek[2], Adelheid Spiegel[1], Gernot Bodner[3]

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Abstract:

This decade will be for farmers a challenging venture. From the soil monitoring law over the agri-environmental programme 2023 to the farm to fork strategy, where farmers must decrease their fertilizer use up to 20%. For this it is adequate to have a solid database, where past and present soil data is not only analysed over time, but also more precisely at farm or municipality level. The AGES analyses every year approximately 13.000 – 18.000 soil samples over Austria since the 90es. In this doctoral thesis, the data from AGES and AGRANA were analysed on a chronological and farm level of arable land. The soil parameters (SOM, plant available P-K-Mg, pH and trace elements) where linked to the farm business information number (LFBIS) and the agricultural production area. By connecting to LFBIS, the soil parameters can be linked to the following farm data: Management (organic/conventional), agri-environmental programme (groundwater protection, reduced tillage etc.), farm type (e.g. cash crop, livestock farm) and crop content (cereals, root crops, fodder etc.). The first results from the agricultural production area North-Eastern Plain and Hills will be presented at this colloquium. The most important result is that the patterns were only understood after a year of intensive data analysis. Therefore, the data should never be interpreted independently of the location. This is because some municipalities dominate, and this can lead to incorrect interpretations. In the Marchfeld, for example, significant differences in phosphorus content were observed between organic and conventional areas. However, a separate analysis at municipality level did not reveal any significant differences and the organic data set had a larger proportion of the municipality of Weiden an der March, which has low phosphorus levels. Further observations were, the nutrient contents have moved into the optimum range, humus contents have increased, and the zinc content has fallen significantly (25% deficiency).

Oral Presentation

Autonomous Drones and their application in Forestry

Alexander Buchelt[1,3*], Christoph Gollob[2], Alexander Adrowitzer[3], Karl Stampfer[2], Andreas Holzinger[1]

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Abstract:

The doctoral thesis delves deeply into the intricacies of enabling autonomous drone flights within forest environments, with a specific focus on supporting forestry tasks such as LiDAR imaging and facilitating communication with robotic platforms. One of the major hurdles confronted in this pursuit is the creation of accurate digital representations of forest roads, which pose a challenge due to their extensive network and intricate layout.

Realizing this goal involves developing AI systems that can autonomously navigate through dense forest environments, circumventing obstacles in real-time while contending with limitations such as GPS signal loss beneath the tree canopy. Additionally, complex flight planning and computer vision pose further hurdles in enabling seamless autonomous flight.

Despite these challenges, the potential benefits of such technology in forestry applications are immense. From aiding in forest protection and management to supporting search and rescue missions and firefighting efforts, autonomous drones equipped with AI capabilities offer unprecedented opportunities for enhancing efficiency and effectiveness in forestry operations.

Moreover, the research endeavors to explore the broader potential of AI in forestry, particularly in the context of combating climate change by preserving CO2-absorbing forests. Drones are identified as ideal platforms for integrating AI into forestry practices due to their versatility and adaptability. By leveraging LiDAR scans and establishing a robust 3D modeling pipeline, the project aims to test various AI algorithms such as Proximal Policy Optimization (PPO) and Soft Actor Critic (SAC) within the Unity 3D environment.

Preliminary results demonstrate promising advancements in enabling drones to navigate forest roads autonomously. However, ongoing research is essential to ensure the robustness and reliability of these algorithms across a wide range of environmental conditions and scenarios.

In summary, the thesis serves as a comprehensive framework for evaluating AI-guided drone navigation in forests, showcasing successful algorithms while underscoring the imperative need for continued refinement and innovation to seamlessly integrate AI into forestry practices.

Oral Presentation

Testing Enhanced Weathering in forest areas. Examining the comparability and homogeneity of Vegetation on survey plots

Nicolaus Erich[1*], Mathias Neumann[1]

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Abstract:

Through chemical weathering of silicate rocks, 1.1 GT of CO2 is absorbed annually and stored as bicarbonate, mainly in the oceans. By accelerating this natural process, the increasing Concentration of CO2 in the atmosphere caused by rising anthropogenic emissions can be counteracted. Enhanced weathering refers to the acceleration of the natural weathering process by spreading ground silicate rock material, such as basalt, to increase the weathering rate. The aim is to bind CO2 from the atmosphere and store it as bicarbonate in the oceans in the long term, which also counteracts the acidification of the seas. If the rock material is applied to terrestrial soils, the increased release of cations (Mg, Ca...) also increases the availability of nutrients for plants. The company Carbony is working together with the University of Natural Resources and Life Sciences, Vienna, on a small-scale trial in the municipality of Dietach (Upper Austria) to test the effects of enhanced weathering. As part of the trial, two forest areas, a young, recently planted stand and an older stand (20-40 years old), are sprayed with basalt sand. In order to examine possible changes in the vegetation, a status survey was carried out as part of this work. The focus is on the current condition of the two areas with regard to ground vegetation and Tree Vegetation. The aim is to check whether the areas are homogeneous in terms of the parameters surveyed in order to create a database that can be used to measure possible changes caused by the application of basalt. To this end, soil and vegetation were measured in the field and analysed in the laboratory. The information obtained was used to evaluate the condition and quantify possible differences within the areas by means of statistical analyses.

Oral Presentation

Management concept for the AMAG forest. Biodiversity and nature conservation

Alfred Eisner

Institute of Silviculture, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna (BOKU), Vienna, Austria

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Abstract:

The Austrian Metal AG (AMAG) is Austria's largest aluminum group. The AMAG owns 171,8 hectares of forest surrounding the factory premises in Ranshofen, Upper Austria. The aim of this thesis is to develop a concept to improve and foster forest biodiversity as integral part of a management plan for the AMAG forest. For this purpose, a stand level inventory was carried out where for the current thesis the focus was on stand attributes such as deadwood and tree-related microhabitats. Current state of deadwood in the forest is 11,25 m³ per hectare and for tree-related microhabitats 313 per hectare. Based on the current state of deadwood, microhabitats on living trees and tree species diversity in the stands operational measures to improve and foster biodiversity as related to deadwood, microhabitats and tree species diversity has been developed for stand development stages of three main stand types (pure Norway spruce stand type, conifer dominated stand type with admixed broadleaves, a broadleave dominated stand type with admixed conifers).

Oral Presentation

Maintenance with the TH 3.8 road maintenance device

Michael Haberl[1], Karl Stampfer[2], Ferdinand Hönigsberger[3], Stephan Knapp[4]

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Abstract:

Regular maintenance is necessary to ensure good and permanent trafficability of forest roads. Existing ruts, depressions, potholes, washouts, and vegetation on the road surface of forest roads reduce trafficability, water drainage and road safety (Stampfer, 2018). One maintenance option can be carried out using attachments for agricultural tractors. In this study, maintenance was investigated using the 'TH 3.8 road maintenance device' in combination with the 'Fendt 724 Vario' agricultural tractor.

On the one hand, the investigation involved measuring 32 roof profiles before and after the maintenance measures, which were compared, illustrated, and statistically analysed for significant differences or improvements with a specified standard profile. Overall, the investigated forest road came closer to a standard profile and the calculated T-tests showed a significant improvement.

Secondly, the condition of the road surface and drainage ditch was classified using a decision tree developed by the KWF working group (2023), both before and after the measure. After the maintenance, all roof profiles surveyed were in the best condition class.

The calculation of the costs resulted in a value of 0,08 € per metre of forest road.

Oral Presentation

Cold temperature growth and freezing resistance of ectomycorrhizal and Saprotrophic fungi

Hangyu Lan[1], Markus Gorfer[2], Burenjargal Otgonsuren[3,4] Douglas L. Godbold[1,4]

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Abstract:

Ectomycorrhizal fungi (EM) and saprotrophic fungi in soils are subject to low or freezing temperatures over winter. Depending on the snow depth winter soil temperatures can be around 0 C or below -10 C. Using 40 ectomycorrhizal and wood degrading saprotroph isolates obtained from mountain regions either in Austria, Mongolia or Slovenia, the effect temperature on radial growth was assessed at 22, 15 and 4 C, and the effect of freezing at -4 and -18 C. In addition, root ectomycorrhizas were collected from high elevation stands and subjected to freezing. Metabolic activity in both in vitro cultures and root tips was estimated using the reduction of triphenyl tetrazolium chloride (TTC). Saprotrophic fungi had higher growth rates than ectomycorrhizal fungi, although within both habits there were considerable differences between taxa. Taxa with the highest growth rates showed the greatest sensitivity to temperature, and had the highest TTC reduction. Low temperatures and freezing resulted in an increase in the specific dry weight of the fungal colonies (mg cm-2). This was due to both a thickening hyphal mat also due to an increase in dry mass of the hyphae. This occurred even during the 3-month period the fungi were frozen. Freezing decreased the TTC reduction in root tip ectomycorrhizas. In in vitro cultures, both ectomycorrhizal and saprotrophic fungi appear to be metabolic active even during freezing. The cold sensitivity of fungi is not clearly related to the expected soil temperatures at the source of origin.

Oral Presentation

Effect of land use change on the nutrient status and microbiology of a young volcanic soil in Galápagos

Damjan Orepic[1*], Franz Zehetner[1], Christoph Rosinger[2], Katharina Keiblinger[1], Martin Gerzabek[1]

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Abstract:

The Galápagos Islands have over recent decades experienced a large increase in both inhabitants and tourists. Consequently, natural forests have been converted into agricultural land to satisfy the growing requirement for agricultural produce. In this study, we assessed the effects of land-use change on the young (1500 years old) volcanic soil [Eutric Histosol (Protoandic)] on Isabela Island, the biggest island of the Galapagos. At the study site, we compared nutrient status [pH, Soil Organic Carbon (SOC), Dissolvable Organic Carbon (DOC), Total Nitrogen (TN), ammonia, nitrate, Olsen phosphorus, Total Sulphur (TS)] and microbiology [microbial biomass carbon (C_{mic}), nitrogen (N_{mic}) and phosphorus (P_{mic}), extracellular enzyme activities (β-Glucosidase, N-acetylglucosaminidase, leucine aminopeptidase, phosphatase and arylsulphatase), basal respiration (qCO2), and Carbon Use Efficiency (CUE)] of soils under three adjacent land-use types: agricultural (ca. 18 years of pasture and one year of horticulture since conversion from forest), buffer (predominantly grassland), and forest (part of Galápagos National Park); all of which have the same scoriaceous parent material. Forest land-use showed the highest SOC, TN, ammonia, DOC, and N_{mic}, the highest C_{mic} / P_{mic} and N_{mic} / P_{mic} ratios, and the highest CUE and bacterial growth while having the lowest soil C/N ratio, nitrate content, and β-Glucosidase activity. Agricultural land-use showed the highest fungal growth, soil C/N ratio, nitrate and Olsen P content, while having the lowest pH, N_{mic} content, N_{mic} / P_{mic} ratio, N-acetylglucosaminidase and arylsulphatase activity and qCO2. Finally, buffer land-use showed the highest pH and qCO2 and the highest activities of β-Glucosidase, leucine aminopeptidase and phosphatase, while having the lowest CUE, Olsen P, and the lowest C_{mic} / P_{mic} ratio. Notably, there was not any significant difference in C_{mic} and P_{mic} amounts between the different land-use types. This study highlights the resilience and stoichiometrical flexibility of young volcanic soil under land-use change and phosphorus limitation.

Oral Presentation

The Role of Drones in Forestry: An Analysis of Current Practices and Future Opportunities

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Abstract:

Drones offer enormous potential for various applications in forestry. This master's thesis examines their suitability for forestry tasks, analysing necessary sensor equipment and deployment scenarios. The focus is on exploring the latest research findings, addressing scientific questions and practical applications, and identifying new possibilities and trends.

The methodology is based on a literature review of research since 2019, selecting studies directly related to the use of drones in forestry and containing information on carrier platforms and sensors. A case study was also conducted. In the past five years, drone technology for forestry applications has significantly advanced. Research now focuses on fine-tuning data evaluation methods rather than verifying feasibility. By adjusting flight design, drones can generate high-resolution data at the individual tree level and efficiently map large forest areas. They bridge the gap between satellite-based remote sensing and terrestrial measurements, enabling detailed maps. The primary application area is providing remote sensing data for estimating stand parameters, vitality assessment, and early detection of pest infestations or diseases. Drones monitor changes in forest cover and provide current images of damage events. Time series from regular flights help identify areas with decreasing forest cover. Additionally, drones support terrain mapping, forest road planning, soil deformation assessment, and search and rescue missions in difficult terrain. Beyond serving as sensor platforms, drones are also used for reforestation tasks. In alpine, steep areas, they efficiently transport seedlings, optimizing limited human resources for planting.

This work shows that drones are already a valuable complement to traditional forestry methods. Despite significant progress and multiple use cases, limitations remain, such as limited energy supply, regulatory restrictions, and restricted suitability for certain forest structures.

Oral Presentation

Effects of parasitization and photoperiod on the respiratory activity of the spongy moth, *Lymantria dispar* (Lepidoptera: Erebidae)

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Abstract:

Lymantria dispar (Lepidoptera: Erebidae), the spongy moth, is a widely distributed pest insect in oak forests. The koinobiont braconid wasp *Glyptapanteles liparidis* (Hymenoptera: Braconidae) is a major natural enemy of *L. dispar*. The wasp larvae develop in the haemocoel of caterpillars. The effect of parasitization on the host's metabolic activity and the sensitivity of *G. liparidis* larvae for photoperiodic responses are two of many unresolved issues regarding the complex parasitoid-host interactions. As a key factor for diapause induction, photoperiod regulates the metabolic activity of many insects. A simple and useful measure for the metabolic activity of parasitized and unparasitized caterpillars is their respiration rate.

Parasitized and unparasitized caterpillars were maintained at 20 °C under long-day (16:8, L:D) and short-day (8:16 L:D) conditions to determine the influence of photoperiod on development and metabolic activity. Oxygen consumption was measured using a volumetric microrespirometer. Measurements were taken three times per week throughout endoparasitic development.

Compared to unparasitized control caterpillars, the respiratory activity of parasitized caterpillars increased significantly on day 0 (ANOVA, $p = 0.004$) and day 14 (ANOVA, $p = 0.011$) after parasitization, while no effect was observed on days 2-13. Under short-day conditions, the respiration rate was significantly lower than under long-day conditions on days 4 (ANOVA, $p = 0.036$) and 7 (ANOVA, $p = 0.045$) after parasitization. Considering the endoparasitic development, the data showed a significant effect of parasitism (ANCOVA, $p < 0.001$) and a strong negative correlation between respiratory rate and body weight (Pearson $r = -0.71$), but no significant effect of photoperiod (ANCOVA, $p = 0.4$). Due to a significantly lower body weight of caterpillars at short-day photoperiod and a small sample size on some measurement days, the results must be interpreted with caution and further studies are needed to substantiate these findings.

Oral Presentation

Root exudation patterns of barley, faba bean, potato and sweet potato-cultivars in different European soils

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Abstract:

Root exudates mediate the cross-talk between plant roots, soil and the root associated microbiome in the rhizosphere, affecting plant growth performance. Recent studies provide detailed insights into exudate metabolite diversity of certain crop species under specific growth conditions, however, basic information about exuded quantities of total carbon (C), nitrogen (N), and main exudate compound classes is often limited despite offering valuable insights into plant resource partitioning.

This study aims to assess the effect of soil and genotype on exudate quantity in different crops. Four genotypes of each crop were grown in pots in three contrasting European soils under controlled environment conditions. Root exudates were collected using the soil-hydroponic-hybrid approach. In addition, plant material for the analysis of biomass and root morphology was collected on the sampling day. Total dissolved C and N concentrations were assessed with liquid TOC-analyser. Concentration of carbohydrates, amino acids and phenolics were measured spectrophotometrically.

The three contrasting soils affected root exudation patterns in barley, faba bean, potato and sweet potato. Additionally, genotypic differences within the species (except of barley) affected root exudation rates of the investigated compound classes. Moreover, a negative correlation between released exudate quantities and plant growth was found for most species (except for potato).

Our results deliver important insights into soil and genotype specific root exudation patterns of different crops improving our understanding belowground resource partitioning.

Oral Presentation

Estimating soil properties under different moisture conditions using Vis-NIR-SWIR reflectance spectroscopy

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Abstract:

Predicting soil properties using (Vis-NIR-SWIR) reflectance spectroscopy has gained importance in the last decades. Vis-NIR-SWIR is hereby referring to a wavelength range of 350-2500 nm on the electromagnetic spectrum. The method is based on the principle that certain soil constituents (e.g., Fe-oxides, organic carbon) absorb energy, resulting in a lower reflectance in specific wavelength regions. This information can then be used to predict soil properties such as soil organic carbon (SOC), or clay content for instance. Its key advantages over traditional wet chemistry methods are the low costs, rapid and non-destructive measurements as well as the possibility of simultaneous assessment of multiple properties. The technology is especially interesting for precision farming applications or the assessment of carbon stocks. The aim of this study is to investigate the prediction of soil properties (SOC, clay, $CaCO_3$, PO_4) under various moisture contents using hyperspectral data. Soil surface reflectance of 75 samples was measured in the lab with a spectroradiometer (Spectral Evolution PSR 2500) and analysed in R using multivariate statistical methods (MLR, PLSR, PCR). Results show a moderate prediction of SOC content (%) with an R^2 of 0.58-0.74 and a $RMSE_{test}$ ranging between 0.45-0.61, using the raw spectra and variable/wavelength selection based on literature. However, the models appear to underestimate soils with higher SOC values, which is most likely due to the SOC distribution in the data set. Excluding the nearly water-saturated treatment from the data set improves the models. The analysis thus far indicates that reflectance spectroscopy holds a lot of potential for soil survey, however, due to the high variability of soil and especially when dealing with moist soil, multivariate models using raw data do not deliver results satisfactorily enough. Data transformations and specific knowledge about relevant wavelengths are needed.

Oral Presentation

Effects of forest management on great tits in the Wienerwald Biosphere Reserve - focus on immune response and food provisioning activity

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Abstract:

Forest types determine the availability of resources for birds and thus the occurrence of parasites. It is assumed that the risk of infection can be influenced by human management in the breeding areas of great tits (*Parus major*). We took blood samples from chicks of the great tit in the Wienerwald Biosphere Reserve to decipher the relationships between forest types, management types and haemosporidian parasites. In addition, we investigated the food provisioning activities of the parents depending on the forest type using camera traps. A total of 40 nesting boxes were installed. The study area was divided into beech and mixed deciduous forest types, and into core and non-core zones, the latter having been withdrawn from human use. The blood samples can be used to detect haemosporidia and count leukocytes to measure the heterophil to lymphocyte ratio (H/L-ratio) to assess the immune response of each individual.

We hypothesise that infected great tits have a higher H/L-ratio than healthy individuals, regardless of the forest structure. Due to the different availability of resources, we assume that great tits in beech forests show a stronger immune response than in mixed deciduous forests. A lower H/L-ratio is to be expected in core areas. Regarding foraging, it can be assumed that a mixed deciduous forest offers a richer food supply for great tits than a beech forest stand. We therefore expect a higher foraging activity, in mixed deciduous forests. We also hypothesise that higher foraging activity in mixed deciduous forests should lead to higher chick weights than in beech forests. Our final hypothesis is that higher foraging activity in mixed deciduous forests should lead to a better immune response of chicks to avian haemosporidia than in beech forests. We believe that the results of our study will make an important contribution to understanding how human use of the forest affects birds and their parasites.

Oral Presentation

Greenhouse gas fluxes after 40 years of crop residue management in an Austrian cropland: do emissions increase with larger soil carbon storage?

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Abstract:

Most cropland soils rely on crop residues as their sole source of carbon, especially in cereal production. In the context of climate change mitigation, incorporating these residues into the soil (instead of removing them) represents a popular soil management strategy to enhance the carbon input on agricultural land.

Usually, it is observed that crop residue incorporation leads to higher soil organic carbon (SOC) stocks. However, enhanced SOC levels may also modify the N_2O and CH_4 fluxes, since these gases are produced by microbial processes mediated by carbon availability. The effect of residue management on non-CO_2 GHG fluxes has not been comprehensively assessed, what prevent us from estimating the overall effect of management strategies on the soil greenhouse gas (GHG) balance.

Here, we monitored GHG fluxes from a long-term experiment in the Marchfeld, a productive agricultural area in east Austria, where two crop residue management strategies have been compared since 1982: removal of residues vs incorporation.

We used static manual chambers to estimate CO_2, CH_4 and N_2O fluxes between cropland and atmosphere. In parallel, soil environmental conditions and soil nutrients were monitored. We captured flux information between over a 30-month period with a temporal resolution of approximately 3 weeks. Within this period the crop rotation involved winter wheat, sorghum, and triticale.

We observed a large interannual variability in N_2O fluxes, from no effect to higher emissions following incorporation of residues. Cumulative N_2O emissions were enhanced by incorporating residues compared to the removal treatment. Nevertheless, this amount is relatively minor compared to the currently higher SOC stocks in the first 25 cm after 40 years of residue incorporation. Our case study illustrates a trade-off scenario between GHG fluxes and SOC storage in temperate croplands, but this trade-off represents a small fraction of the long-term climate mitigation benefit by incorporating crop residues.

Oral presentation

Blow up - Scaling up spatial and temporal N_2O emissions from agricultural soils in Austria

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Abstract:

The atmospheric concentration of the greenhouse gas nitrous oxide (N_2O) is increasing at more than 1% per year. In nature, N_2O is produced by microbial activity in the soil, and agriculture is the largest single source of N_2O emissions. There is a gap in our knowledge of the emission patterns of cropping systems under different environmental conditions. Here, we systematically scale up past and future N_2O emissions from field to region and from daily to decades of arable and grassland production in several Austrian regions using the process-based ecosystem model LandscapeDNDC. The results describe a significant difference between regions and, to our surprise, grassland soils show higher N_2O emission rates than arable soils, while the variability of annual N_2O emissions is higher in arable soils, even under the same management. We show that reducing nitrogen fertilisation in arable crops by 15% and 25% reduced N_2O emissions by 22% and 39% on average, while reducing yields by 5% and 9%. In comparison, the same crops grown in the organic system emitted 60% less N_2O, but yield was reduced by 23% on average. Furthermore, climate projections suggest even greater regional differences with implications for both future N_2O emissions and biomass production. This highlights the importance of region-specific measures to reduce soil N_2O emissions, which in turn need to be in line with farmers' interests to facilitate successful implementation of targeted nitrogen management.

Oral Presentation

Seed stand characteristics' effect on silver fir seed quality

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Abstract:

Challenges to seed production are continuing to grow: 1) climate warming and weather extremes may be affecting seed development, pollination efficiency, and predator satiation; 2) tree population fragmentation is increasing and with it, the limitation to gene flow; 3) novel pest and disease occurrence is on the rise; 4) research and investments in seed quality testing, processing, and storage have been neglected. As a result, the quality of seed used for afforestation and restoration is declining, and along with it, the need to safeguard tree seed production, which primarily means maintaining seed sources (seed stands and seed orchards) with desired provenance, genetic diversity, and gene flow.

In recent years, silver fir has been increasingly planted in Austrian forests. As a deep-rooted tree, it copes relatively well with windstorms and drought and is essential for establishing climate-resilient forests. However, Austrian tree nurseries have reported a declining relative quantity and quality of silver fir seed in recent years, manifesting as a lower rate of full seeds per cone and a lower germination capacity. We hypothesize that the reason behind diminishing seed quality lies in unsuitable seed stand and landscape characteristics. Small and fragmented populations might be at risk of declining genetic diversity due to limitations to gene flow, leading to inbreeding and declining seed quality.

We examined seed lots from 70 seed stands and orchards across Austria to determine the germination capacity of their seed. Our preliminary results show that stand age and abundance of conspecifics, surrounding seed stand, significantly influence the quality of their seeds. Moreover, seeds from orchards have demonstrated a notably higher quality compared to those from seed stands. Our research aims to develop recommendations for harvesting practices and seed stand characterization to support the provision of quality seed.

Oral Presentation

Drought stress adaptations of different (inner-) alpine silver fir (*Abies alba*) stands in Western Tyrol, Austria

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Abstract:

Silver fir is an economically and ecologically significant tree species in Austria. Widely present as an admixed species with spruce and beech, it has been found to show a high potential for adaptation to the expected climate change in Europe.

In this dendroecological study, tree cores and plant material were extracted from 200 silver firs, in addition to biometric and stand information at four different sites in Western Tyrol, Austria to investigate for adaptations to drought. Two sites are located in the dry Upper Inn Valley (Landeck) while the other two sites are situated near the alpine edge (Reutte), experiencing higher precipitation.

Drought years were selected using ring width (pointer years) and climatic data (SPEI). When years identified by climatic data coincided with years identified by tree ring width data, these years were investigated further. Lloret's indices, indicating response to stress, were used to quantify each tree's response to drought.

Microsatellite markers were used for analysis of neutral genetic differentiation and population structure. Genetic differentiation was relatively low between all populations (< 0.015), with clear distinction between the F_{ST} values of the alpine edge and Upper Inn Valley populations, supported by PCoA and Bayesian clustering indicating differences between the two regions.

GLMMs were then used to model the relationships between the trees' drought reactions, drought intensity and timing, genetic diversity and biometric properties, as well as competition to neighboring trees for recent drought years.

A clear relationship between crown length and higher resilience after drought years was indicated, while other biometric variables (tree diameter, height) had no significant influence on drought response. Climate sensitivity was similar across all four sites (0.17 ± 0.02 - 0.19 ± 0.03), with lower sensitivity at alpine edge sites.

An extension of this project is already underway, identifying genes relevant to drought adaptation using SNPs and genotype-phenotype association analysis.

Oral Presentation

The effect of smoke water on seed germination success of Central European species

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Abstract:

Wildfires are important factors in the evolution of plant traits. Many plants show specific adaptations to wildfire, not only to increase their chances of surviving fire, but also to increase their chances of establishing offspring after fire. Seed treatment of smoke water extracts has been shown to improve plant growth, root regeneration and seed germination success. It has been proposed that certain chemicals in smoke promote the dormancy release of seeds. Studies of the smoke's physical effect on the seed coat has also suggested the improved permeability for gas exchange on the outer cuticula. Moreover, these positive effects have been found even in none-fire-prone species. Despite many studies on this topic, more research is needed to elucidate the mechanism of the beneficial effect of the smoke water (SW). So far, the application of improved germination success can be seen in horticulture, habitat restoration, and weed control. We believe this effect may also be benefitial for forestry, therefore, for our experiment, we test the effect of SW on 5 common central European tree species and one North American, fire adapted species: *Pinus sylvestris*, *Pinus nigra*, *Picea abies*, *Abies alba, Larix decidua*, and *Pseudotsuga menziesii*. To our knowledge, no such investigation has been conducted previously in central Europe. Although forest fire in central Europe is not the dominant disturbance, we expect some effect on the species we've chosen, especially the pine species, which are known to be fire-adapted.

In total, two SW extracts were tested on the six tree species derived from two litter materials: pine needles and oak-leaves. Litter material was smoldered in an oven at 350 ℃, and the smoke generated was continuously pumped into ultra-pure water for 45 min. Two concentrations of the SW are applied. In total, four treatments (leaf and needle litter in high and low concentration) plus one control group are tested. The seeds were primed with the respective treatment solution according to the assigned treatment for 24 hours before the germination test. After the imbibition of SM, the seeds were laid out into Patri dish replicates in the climate chamber and germination success is documented every 7 days for three weeks. The smoke water will be analyzed for the active substances (Karrikins) using mass spectrometry methods. Results will be analyzed and ecological implications as well as potential practical applications will be discussed.

Oral Presentation

Investigating the Sustainability of Timber Harvesting Operations from an Economic Perspective

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Abstract:

Timber harvesting is an important part of forestry. Almost 20 Mio m³ will be harvested every year in Austria. Therefore, it is relevant to investigate the impact of harvesting operations on sustainability and to identify differences between the most common harvesting systems. The objective of this study is to evaluate the sustainability of timber harvesting processes, with a specific focus on economic criteria considering productivity, harvesting costs, and fuel consumption. The study aims to identify and evaluate suitable indicator values and parameters which are influencing the performance of the indicators for each criterion and the most common machinery categories through a comprehensive literature review.

The collected data was cleaned and standardized into a spreadsheet program to be evaluated for statistical analysis. All relevant data between the categories and parameters were compared, and tests were conducted to determine if there were any statistically significant differences. Additionally, to improve the understanding of the data and results, they were also presented graphically.

Based on the collected data, a comparison of the mean values for each machine category was conducted. For example, the average costs of chainsaws and harvesters, and the average fuel consumption of forwarders and skidders, were analyzed to create descriptive statistics. Overall, the sample size ranged from around 35 to over 100 samples for each machine category. Nearly all categories showed no significant differences according to the Shapiro-Wilk test. The logical next step was a comparison between the categories using the Mann-Whitney U-Test. The results of this test were also not significant across most categories. Further interpretations were therefore made graphically, as the statistical values did not remain significant even when the parameters were taken into account.

These results were consistent across all categories. Although some correlations are visually noticeable in the graphical representations, they are not statistically significant. The main challenge in this case study was the data inconsistency caused by variation in data collection methods, economic differences between continents, and production techniques. A larger, more standardized data set would likely yield more meaningful insights.

Oral Presentation

Decomposition dynamics and partitioning between the plant-soil-microorganism interphase of (eight naturally occurring) phytosiderophores

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Abstract:

Low concentrations of micronutrient (e.g. Fe, Zn, Cu) in cereals is a major factor driving micronutrient malnutrition in humans. In grass species (*Poaceae*) secretion and re-uptake of metal chelating phytosiderophores (PS) by roots is considered to significantly contribute to improved micronutrient plant uptake. However, PS are susceptible to microbial decomposition which will decrease their ability to mobilize micronutrients. To date, eight naturally occurring PS have been identified: mugineic acid (MA), hydroxymugineic acid (HMA), epi-hydroxymugineic acid (epi-HMA), hydroxyavenic acid (HAVA), deoxymugineic acid (DMA), hydroxydeoxymugineic acid (HDMA), epi-hydroxydeoxymugineic acid (epi-HDMA) and avenic acid (AVA). The effect of microbial decomposition on PS half-life in soil and therefore on their metal mobilization efficiency is not well understood. Using in-house synthetised ^{13}C-PS, we studied the decomposition dynamics and incorporation of all eight PS into microbial phospholipid fatty acids (PLFAs) in barley rhizosphere and bulk soil across three different soils. We found that the decomposition dynamics of the PS were compound-specific being mainly dependent on the western fraction of the PS molecule. The compounds HMA, HDMA, epi-HMA and epi-HDMA were decomposed faster than MA, DMA, AVA and HAVA. The incorporation of ^{13}C-PS into microbial PLFA was in line with the decomposition data, showing higher ^{13}C incorporation for the faster-degraded molecules. *Firmicutes* and unspecific gram-negative bacteria incorporated the largest portion of ^{13}C-PS into their biomass, irrespective of the specific PS molecule. Understanding the decomposition dynamics and microbial incorporation of all eight PS could be a significant step towards deciphering the impact of PS exudation in plant micronutrient uptake.

Oral Presentation

Effectiveness of mycoinsecticide products containing different strains of *Beauveria bassiana* and *Beauveria brongniartii* against the European cockchafer *Melolontha* spp. (Coleoptera, Scarabaeidae)

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Abstract:

The fungus *Beauveria* spp. (Hypocreale: Cordycipitaceae) shows entomopathogenic properties and can be utilized as control agents against insect pests. Several strains of *B. bassiana* and *B. brongniartii* have been formulated as mycopesticides and are available for the control of insect pests, including scarab beetles. While *B. brongniartii* infects selectively scarab beetles, *B. bassiana* has a broader host range. The European cockchafer, *Melolontha melolontha* and *M. hippocastani* (Coleoptera: Scarabaeidae) are important grassland and agricultural pest beetles. They spend most of their life as larvae feeding on plant roots. Isolates of *B. bassiana* and *B. brongniartii* can differ in their biology, host range and specificity and thus perform very differently even on the same host.

In this thesis, I isolated five *B. bassiana* strains (GHA, ATCC 74040, R444, PPRI 5339, BOV1) and one *B. brongniartii* strain (BIPESCO 2) from formulated products and prepared conidia suspensions. Two products are registered for underground use against *Melolontha* spp. larvae, while four products are registered for above-ground use against leaf feeding pest species.

Through isolation, the effectiveness of the fungal strains can be evaluated without the influence of additives, adapted to the intended application. The different strains are evaluated for their growth effectiveness on two agar media (Sabouraud-2%-glucose agar, potato dextrose agar) at five temperatures in the thermal range for fungal colony growth and the environmental conditions during field application (10-30°C). A bioassay is then performed to compare the virulence of the *Beauveria* strains. Second-instar *Melolontha* spp. larvae are collected from infested, untreated field sites in Austria and kept isolated to avoid contamination due to any existing infections. After a four-week quarantine, conidia suspensions are pipetted onto the larvae and checked daily to calculate mortality effects. The data will reveal differences between the fungal species and among isolates, and their performance on the same host.

Oral Presentation

The effect of fertilisation in organic farming on microbial biomass and necromass

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Abstract:

Agriculture relies on inputs to meet crop nutritional needs, with phosphorus being crucial but mostly unavailable in soil. Some commercial fertilizers are allowed in organic agriculture and include a mixture of inorganic constituents and biostimulants that enhance phosphorous acquisition in crops. Soil microorganisms are recognized for their contribution to soil and crop health. With the increasing sustainability challenges organic agriculture faces, and with the emergence and advancements of novel fertilizer products, it is ever more important to study the response of the soil microbiome under different management practices. To this end, this study aimed at evaluating the effect of AKRA biofertilizers on microbial biomass and necromass on two organically managed farms in Austria for two years. Soil samplings were performed on two occasions at both sites, first, in June 2023, and then in March 2024. Critical soil parameters (including pH, electric conductivity (EC), dissolved organic carbon (DOC), total dissolved nitrogen (TDN) and bulk density) were analysed together with microbial biomass, necromass and ergosterol. We did not find the AKRA fertilizer to have a significant effect on any of the measured parameters. Ergosterol contents were unchanged, while microbial biomass and necromass concentrations showed some minor differences, outpowered by the natural variations in observations as an effect of the spatial heterogeneity of soils. Observations from the two sites differed markedly, as revealed by principal component analysis, which was driven by variation in environmental rather than microbial parameters. Unlike the treatment, the timing of sampling showed a difference in DOC and the magnitude of bacterial relative to fungal necromass, indicating seasonal influence on microbial residue turnover. Results of this study have implied that while the impact of AKRA fertilizer on microbial biomass and necromass might be minor relative to seasonal variations, increased replication could improve the statistical power and reliability of the findings.

Poster

On the role of earthworms for the recovery of soil structure in skid trails

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Abstract:

With Central European winters getting warmer, timber harvesting operations often happen under suboptimal conditions on wet, non-frozen soils. This increases the susceptibility of soils for compaction. Fine textured soils in skid trails often stay compacted for decades. In a controlled experiment in the Vienna woods, we assessed the effects of different harvesting technologies on the degree of soil compaction and the impairment of soil functions. To measure the recovery potential of soils in skid trails after ground-based logging, we compared trails compacted 1 and 18 years ago. The soil structures under and next to the skid trails were evaluated with CT-scans of undisturbed soil cores collected at two depth levels (2.5-7.5 and 12.5-17.5 cm). We measured soil hydraulic properties at the same cores. This information was linked to earthworm data collected in a similar plot design. Earthworms were sampled with a combination of mustard extraction and hand-sorting and identified to species level. We detected five different species at the site (*Aporrectodea rosea, Dendrobaena platyura, Dendrodrilus rubidus, Lumbricus rubellus, Octolasion lacteum*). Preliminary results suggest a recovery of the earthworm population in skid trails within 18 years, following a stark decline or near eradication post harvesting. It is expected that earthworms help improving the macropore structure of compacted soil. However, we assume that the upper biologically more active soil layer recovers quicker than the deeper soil, where compaction is more persistent.

Poster

Mid- and long-term impacts of drought and heavy rainfall cycles on forest soil and microbial communities

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Abstract:

The climate crisis is the great challenge of our time with Europe being the fastest heating continent of the world. The warming of the atmosphere contributes not only to higher temperatures, but also significantly impacts precipitation patterns. In central Europe, the amount of precipitation is expected to increase during winter and decrease over the summer, leading to an extension of dry periods with more frequent heavy rainfall events. While the effects of drought on soils have already been broadly studied, a clear understanding of how drought and rewetting cycles affect soil and its microbial communities over different timescales remain uncertain.

This thesis aims to provide information of mid- and long-term impacts of simulated drought and heavy rainfall events on various forest soil parameters and microbial communities, taking advantage of active long-term manipulation experiments in Lehrforst Rosalia. Soil samples are taken from sites experiencing recurrent moderate and severe soil drought and rewetting events over multiple years in a beech forest, with and without increased atmospheric nitrogen deposition rates. To assess the mid- and long-term effects, all soil samples are incubated under uniform conditions before analysing, in order to minimise possible short-term fluctuations due to different conditions in the experimental sites. Key parameters analysed are soil carbon, nitrogen and pH to evaluate changes in soil organic matter and nutrient cycles. Additionally, microbial biomass and community composition are examined to understand microbial responses to varying drought intensities and times.

The findings provide valuable insights into how prolonged drought and rewetting events affect forest soil health and microbial dynamics, which can be of great value for effective future land management under changing climatic conditions.

Poster

Effects of drought on root morphological traits and root exudate patterns of two faba bean genotypes grown in different soils

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Abstract:

Grain legumes are globally used for food and feed and their demand is increasing due to the shift towards non-animal protein sources. Water stress is one of the primary causes of yield and quality loss in grain legumes. Hence, there is an urgent need to enhance drought resistance of legumes to ensure global food security amid climate change. Root morphology is known to play an important role in drought resistance. Additionally, plant-root-soil interaction driven by root exudates have the potential to beneficially mitigate environmental stresses like drought, however our understanding of genotype specific response of these root traits to drought in different soil substrates is limited.

In this study, we aimed to investigate root traits and exudate composition of two faba bean genotypes (*Zoran* and *Lynx*) under drought. The genotypes were cultivated under optimum and limited water supply for 21 days in transparent acrylic columns filled with three distinct soil types from different regions in Europe: Bullionfield (UK), Arvalis (France), and PTUJ (Slovenia). Prior to harvest, we collected root exudates using the soil-hydroponic-hybrid approach and biomass, shoot nutrient concentrations, root morphological traits (WinRhizo), as well as major root exudate compound classes (total C & N, sugars, amino acids, and phenolic compounds) were determined. The outcomes of this study will offer a better understanding of how faba bean root traits change under water-limiting conditions when grown on different soil types, thus offering insights into drought stress adaptation strategies.

Poster

Impacts of different land management strategies on the ultrasonic soil aggregate stability (USAS) of flood control dikes

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Abstract:

In 2006, a strong flooding event destroyed many parts of the existing flood control dikes on the Morava and Thaya rivers and caused severe damage in adjacent agricultural and residential areas. The dikes were restored and grassland was established on their flanks in order to protect the dikes sustainably. The grasslands are managed in various ways, differing e.g. in the number of cuttings and export of the hay vs. mulching. To avoid other disasters, it is essential to study the effects of the land management strategies on the stability of the dikes. An important parameter in this context is the ultrasonic soil aggregate stability (USAS). Comparing USAS will show how the different strategies affect the stability of the soil and which of them are the best to prevent the destruction of the dikes. 4 soil samples were collected on both flanks (water-side and land-side) of the dikes at 20 sites along 60 km. Thus, 160 samples have been gathered. First, they were air-dried and sieved between 1 000 and 2 000 µm. Then, aggregates will be dispersed through ultrasonic vibrations using a specific energy. To this end, soil aggregates suspended in deionised water will be exposed to defined ultrasonic vibrations at a constant amplitude of 1 µm for 1 minute. After the physical dispersion, samples will be wet-sieved. Next, they will be chemically dispersed with 25 mL of pyrophosphate (0,1 mol/L) and wet-sieved again. The mass fraction of macroaggregates (250 – 1000 µm) and microaggregates (63 – 250 µm) will be measured and the USAS determined. Statistical analyses will be conducted to highlight significant differences between the land management strategies.

Poster Presentation

Implications of the European Union in Sustainable Forest Management

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Abstract:

As the importance of sustainable forest management (SFM) has rapidly increased throughout the last century, political institutions have made it their concern to act accordingly. This thesis illuminates the most important documents presented by the EU on SFM. To better understand the matter treated, you will first come across a short history of how SFM and the EU came to be. Subsequently, the main characteristics of Europe's Forests will be presented. The study then delves into key EU policies, such as the European Forest Strategy and the Biodiversity Strategy. The primary goal is to offer a holistic understanding of the EU's official resources for implementing SFM.

This thesis is literature based and was conceived in an unempirical manner. In order to assure the quality of the paper, an effort was made to use primary sources provided by the European Union. If not possible, supplementary publications written by specialists were used.

The key finding of this paper is, that although endeavors were made by the EU to offer a concise, comprehensible framework on SFM (and on a larger scope, forestry regulations), they have fallen short. The EU offers various resources to promote SFM, but navigating these documents is challenging for non-experts. In future, the EU should envisage to create a comprehensive tool so that a citizen can easily understand the implications of the EU in SFM.

Poster

Phytosiderophore Release of Different Grass Species Under Moderate Iron Deficiency

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Abstract:

Micronutrient malnutrition is a major global health concern, particularly in developing countries, with iron (Fe) and zinc (Zn) being the most common mineral deficiencies. This is mainly due to inadequate dietary intake and crop production on soils with low Fe and Zn phytoavailability. The selection of micronutrient-efficient cultivars not only increases agricultural yields but also micronutrient concentration in edible produce, potentially alleviating the so-called hidden hunger. In grass species, iron uptake is mediated by the root exudation of chelating compounds derived from the mugineic acid family, known as phytosiderophores (PS). We investigated the effect of moderate Fe deficiency in the release of PS and micronutrient uptake of six graminaceous cereal crops: barley (*Hordeum vulgare* L.), oat (*Avena sativa*), rye (*Secale cereale*), wheat (*Triticum aestivum*), maize (*Zea mays* L.) and sorghum (*Sorghum bicolor*) grown in a calcareous soil. Root exudates were collected using a soil-hydroponic-hybrid method and assessed to determine PS, total dissolved organic carbon, soluble carbohydrates, amino acids, and phenolics compounds. The results showed that, unexpectedly, the Fe starvation treatment had no effect on both composition and quantity of exudate compounds across all species. We observed that PS release was species-specific and significantly different among the examined species. Furthermore, no treatment effect was found in either biomass development or micronutrient shoot accumulation further supporting that grass crops are less susceptible to Fe deficiency than dicots. Overall, our findings offer new insights into PS driven Fe acquisition and demonstrate that in a moderately Fe deficient soil, no upregulation of the PS pathway was required to meet the species-specific Fe demand.

Poster

TannenGen: Development of molecular SNP markers for the selection of climate-adapted silver fir provenances

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Abstract:

Abies alba, the silver fir, is less vulnerable to the effects of climate change than other native conifers and could replace the dominant Norway spruce in many places in the future. Climate change is happening faster than local populations can adapt to the new conditions. Assisted migration of provenances adapted to our future climate can help counteract the resulting maladaptation and has received much attention in the last decade. New genomic methods allow the identification of pre-adapted provenances on the basis of their genomic profile, which would save an enormous amount of time compared to traditional, and still essential, provenance trials. For conifers, this potential has been largely untapped because their large and complex genomes make such efforts difficult. The TannenGen project aims to establish molecular biological tools to support the selection of climate-adapted fir provenances. Preliminary results provide insight into the first range-wide resequencing of silver fir as a basis for the development of high-resolution SNP panels. A genome-wide association study (GWAS) with 20,000 single nucleotide polymorphism (SNP) markers, dendroecological resilience components and anatomical-morphological needle traits is used to identify climate-sensitive candidate genes in a provenance trial. The GWAS is complemented by an environmental association analysis (EAA) of allele frequencies and provenance source climate using latent factor mixed models (LFMM). Based on the results of the association analysis, candidate SNP markers will be developed for high-throughput sequencing, allowing many thousands of individuals to be screened for these variants.

Poster

Impact of Drought and Rewetting Cycles on Soil Greenhouse Gas Fluxes across an N Deposition Gradient in Austrian Forests

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Abstract

Climate change has increased the frequency and intensity of extreme weather events such as drought periods and heavy rainfall in large areas of the world, including Central Europe. Despite decreasing nitrogen deposition rates in this region, forests are still subjected to high N deposition rates from agricultural and industrial sources. These disturbances affect fundamental biogeochemical processes and likely alter greenhouse gas fluxes in forest soils. However, the full impact of N deposition on the response of forest soils to increasing extreme weather events is still unknown.

In this project, our approach combines the use of active manipulation simulating drying-rewetting (DRW) cycles on a natural gradient over three representative Austrian broadleaf-forest sites with detailed field GHG observations, microbial laboratory analyses and process-based modelling. The DRW plots received the long-term averaged rainfall concentrated in three single extreme precipitation events and were excluded from rain the rest of the vegetation period. N-addition plots received extra N at a rate of 50 kg N ha^{-1} y^{-1}. Soil GHG fluxes were measured with automated chambers at a high temporal resolution on all plots. Soil samples were taken before and after each irrigation event to measure microbial responses to drying and rewetting and the abundance of methanotrophic bacteria. Measurements were conducted in 2021 and 2022. The effect of DRW on temperature and moisture dynamics was examined by fitting temperature and moisture curves to GHG fluxes.

Results show reduced soil CO_2 fluxes, extremely reduced N_2O fluxes, and increased CH_4 uptake under DRW treatments compared to natural environmental conditions. Natural drought conditions led to a convergence of N_2O emission levels in the DRW and control plots. N addition had only modest effects on GHG fluxes. Soil moisture and temperature measurements from lower soil depths were found to increase the fit of curves to GHG fluxes under DRW conditions.

Poster

Comparison of functional leaf traits along Mongolian steppe-forest transitions

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Abstract:

Mongolia is primarily characterized by steppe vegetation. Furthermore, seven percent of the country is covered by forest. Especially, the transition zone between these two vegetation types is of high floristic interest. To increase our understanding on the responses of plants to environmental gradients, for example along transitions between vegetation types, functional traits can be investigated. However, the data on plant functional traits show a strong geographical bias: a lot more data is available for North America, Western Europe, South Africa and Australia than for species from other regions of the world such as Mongolia.

The focus of this bachelor thesis was the comparison of functional leaf traits of four herbaceous plant species (*Achillea asiatica, Fragaria orientalis, Geranium pseudosibiricum, Sanguisorba officinalis*) and *Betula pendula subsp. mandshurica* which were priorly collected along steppe-forest transitions from two sites in North-East Mongolia. We measured leaf area and leaf dry mass in the laboratory from which the specific leaf area (SLA) was calculated. Our data was compared to plant functional leaf traits along transitions from forests to open landscapes globally and potentially available data from Mongolia and/or surrounding countries.

Our results show that specific leaf area was higher when the canopy cover was denser. This result is consistent with previously observed transitions from forests to open landscapes globally. There was no significant difference found within leaf area and dry mass. For Mongolia, there was no data on functional leaf traits previously published for the here studied plant species or even their genera. Furthermore, little data could be found from geographical proximity.

It can be concluded that there is a strong geographical knowledge gap on leaf functional in Mongolia and a need for (future) research projects which make data publicly available.

Poster

Above and belowground phenology and production of four tree species with contrasting root and leaf traits

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Abstract:

Turnover of fine roots and mycorrhizal turnover is a major source of necromass for formation of soil organic matter. Although much is known about the phenology of leaves, little is known about the phenology of roots, and which factors drive this, or how above and belowground phenology interact. Knowledge of the length of the growth period and lifespan of fine roots is critical for estimates of necromass inputs to soils. In this study we are following the phenology of leaves and roots and the development of mycorrhizal hyphae on four tree species (*Carpinus betulus*, *Quercus robur*, *Tilia cordata* and *Acer platanoides*) growing in both monocultures and mixtures at the B-tree experimental site in Austria. Root growth is being followed using 96 rhizotron tubes installed at the site in March 2021. To estimate the growth of mycorrhizal hyphae ingrowth bags were buried in early March 2023. The onset of root growth in 2023 occurred in February. Monoculture showed clear peaks of growth in July. The root production of mixture QrCb and All occurred peaks in July, and ApTc occurred two peaks in July and August.

Parallel to the belowground measurements, an investigation of leaf phenology is being carried out, capturing the progression of leaf growth and senescence. During non-rainy days, every 7 days, images were captured with the camera of an iPhone 13 smartphone, placed approximately 10cm above the ground, oriented horizontally, and aimed at the tree canopies above the rhizotron tubes. Subsequently, the acquired images were processed using CAN-EYE software to quantify the number of green pixels. The budbreak in 2023 occurred approximately at the end of March for Carpinus betulus and Acer platanoides, the middle of April for Quercus robur, the end of April for Tilia cordata, and was thus later than the onset of root growth.

Poster

Photoperiodic induction of reproductive diapause in the oak lace bug, *Corythucha arcuata* (Heteroptera: Tingidae)?

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Abstract:

The multivoltine oak lace bug, *Corythucha arcuata* (Heteroptera: Tingidae), is native to North America and invasive in Europe. Nymphs and adult lace bugs suck the cell sap of oak leaves and severe infestations cause the leaves to turn pale and drop prematurely. Adult females and males overwinter on the tree trunks. Depending on the weather conditions in spring and summer, the insect has 2-3, largely overlapping generations per year. As the number of generations increases, there is an enormous population build up and thus increasing damage to the host trees.

This bachelor thesis investigates the effect of photoperiod (daylength) on generation development, i.e., whether adults enter a reproductive diapause (delayed/no oviposition) under decreasing daylengths in preparation of winter. The effects of three photoperiods at constant temperatures (23°C) on lace bug development and female oviposition are tested in the laboratory at (i) 16 hours of light/8 hours of darkness (corresponding to natural conditions in mid-June), (ii) 14 hours of light/10 hours of darkness (corresponding late August), and (iii) 12 hours of light/12 hours of darkness (corresponding late September).

For the experiments, egg clusters on oak leaves from infested trees were collected in Stammersdorf/Vienna at the end of May, placed on moist filter paper in Petri dishes and kept under long-day photoperiod (16L:8D) at 23°C in a climate chamber until hatching. In total, 75-100 neonate nymphs were then distributed across the three photoperiods. The nymphs are checked three times per week until adult eclosion. Young female adults will be selected and kept individually on oak leaves for 30 days to lay eggs. The dates for the start and end of oviposition as well as female longevity are recorded. The results will show whether decreasing daylengths lead to delayed or absent oviposition as a sign of reproductive diapause in the oak lace bug.

Poster

Microbial C:N:P stoichiometry in hydromorphic organic soils under agricultural use in Austria

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Abstract:

In Austria, around 45,000ha of hydromorphic organic soils, such as bogs or fens, are being used as agricultural land. These soils store large amounts of carbon (C) in the form of soil organic matter (SOM), which is subject to increased microbial degradation under changing hydrological conditions associated with agricultural use. This study will attempt to define microbial indicators regarding potential nutrient limitations and the degree of SOM degradation. It will be based on the C:N:P stoichiometry of microbial biomass and potential C-, nitrogen (N)- and phosphorus (P)-acquiring enzymatic activities. Around 19 soil profiles were sampled from various locations in Austria, differing in soil type, land-use intensity and other pedoclimatic variables. Microbial biomass for C and N was determined via the CFE (chloroform-fumigation-extraction) method and microbial P with the malachite green method. To identify potential enzymatic activity, six hydrolytic enzymes (β-1,4-glucosidase, β-D-1,4-cellobiosidase, β-1,4-xylosidase, β-1,4-N-acetylglucosaminidase, leucine aminopeptidase and acid phosphatase) and one oxidative enzyme (phenol oxidase) were measured using fluorometric and photometric enzyme assays, respectively. Relative nutrient limitations will be calculated with vector analysis of the enzyme activity, whereas microbial elemental homeostasis and imbalance will be based on calculations using microbial biomass and SOM C:N:P ratios. To ascertain the degree of SOM decomposition, we will base calculations on the ratio of hydrolytic to oxidative enzymes. We expect the C:N:P ratio of soil microbes to remain largely homeostatic, although N or P nutrient limitations are to be expected in such highly organic soils. Expected results might show variances along the soil depth, type, land-use intensity or other pedoclimatic variables. This study hopes to determine microbial indicators to describe nutrient limitations and their environmental controls in hydromorphic soils under agricultural use and to hopefully also add supporting insights to potential discussions about wetland restoration in Austria.

Poster

Efficacy of Fish Amino Acid (FAA) organic manure compared to mineral fertilizer on wheat crop in sandy soil

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Abstract:

In recent years, numerous interconnected global crises have significantly impacted sectors including agriculture, fertilizer, and food industries, affecting global food security. Chemical fertilizers are widely used to replenish soil nutrients, depleting soil health and increasing contamination. This study investigates the potential usage of Fish Amino Acid (FAA), an organic manure made from fish waste and jaggery in a 1:1 ratio, as a sustainable alternative to mineral fertilizers. A controlled randomized pot experiment was conducted with Triticum aestivum (wheat) grown in nutrient-poor sandy soil. The treatments were added at weekly intervals, including (i) FAA, (ii) mineral fertilizer, (iii) mix of FAA and mineral fertilizer (1:1), and an unfertilized control. Two destructive samplings for plant and soil were conducted after 4 and 8 weeks of planting. Phenotypical characteristics, root and shoot biomass, available N forms, and Nitrogen Use Efficiency (NUE) were investigated. Results show that FAA and mixed treatments support comparable plant growth to chemical fertilizers. The root-to-shoot ratio suggests preferential root development in the early growth phases of FAA-treated plots. The shoot biomass was highest in the mineral fertilizer treatment and not significantly different from the mixed treatment. FAA-treated plots also resulted in higher available soil nitrogen in the form of amino acids in the early stages of growth. The N concentration in above-ground biomass of the mixed treatment resulted in the highest NUE, likely due to the synergy between nutrient uptake and utilization by the plant. The below-ground NUE of FAA shows the highest effect indicating a well-developed root system. These findings show trade-offs between maximized plant production and NUE, while the mixed treatment had high potential to sustain high yields. Thus, a large fraction of chemical fertilizers can be replaced using FAA, a strategy for sustainable agriculture reducing dependence on chemical fertilizers and controlling their footprint in soils.

Poster

Silvicultural studies on stand structure and productivity of coppice with standards using the example of the Urbarialgemeinde Zagersdorf

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Abstract:

The Urbarialgemeinde Zagersdorf manages a 150 ha forest in northern Burgenland since 1869. Over the past 15 years, the Urbarialgemeinde has aimed to increase growing stock value by converting coppice system into coppice with standards system. This study analyses the changes in tree species diversity, forest structure as well as productivity. Furthermore, ecological and economic sustainability of these measures are assessed, including afforestation and black locust stand conversion.

The silvicultural studies are based on a re-survey of selected sample plots resulting from the 2013 inventory (artificial growth series), where the main development stages were included as stand (WZP, threshold: 8 cm), thicket and regeneration. Thus the study provides insights into the forest's condition and development.

The preliminary results show following changes in number of stems, basal area, and growing stock across different age classes (AKL). Stem number per ha increased in AKL 1 (1-10 y) from 805 to 912 stems/ha, decreased in AKL 2 (11-20 y) and in AKL 4 (31-40 y) for example from 918 to 599 stems/ha. Basal area increased across all AKLs, for instance, from 10.8 to 17.5 m²/ha in AKL 1, from 16.3 to 24 m²/ha and from 30.3 to 34 m²/ha in AKL 4. Growing stock generally increased, such as from 92 to 138 Vfm/ha in AKL 2. However, in AKL 4, it decreased from 238 to 188 Vfm/ha due to harvesting operations.

Further analyses of relevant structural characteristics (diameter structure, tree species distribution and type of reproduction) as well as individual tree-related quality characteristics are planned.

Poster

Under what conditions are Austrian forest managers and owners willing to implement the SDGs in their forest operations?

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Abstract:

The world, threatened by multiple crises, needs a holistic approach to sustainable development. To this end, the United Nations has published the 2030 Agenda with 17 interlinked Sustainable Development Goals (SDGs). These are intended to provide a framework for action that can be implemented at different scales and in different sectors. As forests are essential for the provision of many ecosystem services, the forest sector also has an important role to play in the sustainable transition of the society. Austria, a country with a forest cover of 48%, therefore has great potential to work on the most pressing issues such as climate change mitigation and biodiversity conservation, as well as on the provision of social services. As most forests in Austria are privately owned, the aim of this study is to determine the general attitudes of private forest owners and managers in Austria towards sustainable forest practices and the conditions under which they would be willing to implement such measures in their own forests and businesses. To this end, an online survey was conducted on the topics of carbon sequestration, biodiversity conservation and social services, as well as on some of the SDGs that can be implemented in general business management. Since private persons are generally difficult to reach, sampling methods included convenience sampling through a contact list of forest companies, and snowball sampling through selected contacts who would distribute the invitation to participate in the survey to other contacts and forest-related organisations. The results show that while most participants consider forests to be relevant for climate change mitigation and biodiversity conservation, they are mainly opposed to entirely leaving forests unmanaged for these purposes. Therefore, the most popular strategies are to intensify forest management for products with a long lifespan for carbon sequestration and to integrate biodiversity conservation measures into managed forest (land sharing). The provision of forest land for social services was slightly more popular. Monetary incentives play an important role in the provision of ecosystem services, while non-monetary incentives are generally considered less important. From the non-monetary incentives, intrinsic motivation ranked highest. With regard to the overall implementation of the SDGs in forest enterprises, the interest of the participants is rather low. Nevertheless, the most widely agreed upon actions were SDG 3 as a whole, tackling educational poverty in SDG 1 and non-discrimination in SDG 5, while tackling financial poverty (SDG 1) and other actions to promote women's equality were mostly rejected. The results therefore provide an interesting insight into the actual trends in the private forest sector with regard to achieving the SDGs.

Poster

Organic Carbon Fractions of Innovative Management Practices: a comparison of soil metrics as influenced by differing soil management schemes

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Abstract:

The stability of soil organic carbon (SOC) has recently been postulated as an important factor for SOC sequestration in arable soils, with fine (<53 µm), mineral-associated organic matter being more stable as compared to coarser (>53 µm), particulate organic matter. These fractions are also suggested to be related to several aspects of soil fertility, such as soil aggregate stability (SAS) or nutrient turnover.

To date, it is still not clear how conservation management practices affect different SOC fractions; thus, more testing is needed. By using an on-farm approach from Austrian sites varying in pedo-climatic conditions, this study examines the results of different agricultural management practices on SOC fractions and other indicators such as total nitrogen (N) or aggregate stability (SAS). We compared common modern agriculture ('Standard'), conservation agriculture principles ('Pioneer'), and soils not under agriculture ('Reference') at three different depths (0-5, 5-20 and 20-35 cm)- through ultrasonication (~3 J/mL) and fractionation via wet sieving to obtain three distinct fractions (<53 µm, 53-250 µm, >250 µm), followed by elemental analysis of C and N by dry combustion.

This study's results show significant differences in the mean values of SOC and N between Reference and Pioneer and between Reference and Standard soils for all fractions, but not when comparing Standard and Pioneer soils. SAS was not significantly different across the soil depths or between management systems in the 10 sites examined in this study. N varied by depth, with higher mean concentrations, at 0-5 cm samples and at 20-35 cm in Reference soils. Comparisons of SOC by depth shows the surface soils are significantly different than the other depths in Reference soils only. This is an indication that soil tillage may have eradicated depth effects in the farming systems.

These results show a lack of differentiation between Standard agriculture soils and those under Pioneer agriculture, suggesting that Pioneer agriculture practices do not manifest in fractions of differing stability.

Poster

Microplastic and Heavy Metal Contamination - an Analysis of Vienna's Gardens

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Abstract:

Urban gardening allows people to enjoy growing their own vegetables and herbs for private use, while living in a densely populated city. With gardening in the urban context comes the problem of pollution, because most gardening sites are close to high-traffic areas and/or on ex-brown field sites. In this citizen science project, we look at 10 urban gardening sites in Vienna where we took soil samples both in the surrounding area of the garden and the garden plots themselves. The aim is to determine the level of contamination of both heavy metals (Pb, Cd, Zn) and microplastics. To that end, we will analyse the soil for total heavy metal content via *aqua regia* extraction and for the mobile heavy metal concentration after extraction with 1M NH_4NO_3. In addition, radishes were planted in the 10 gardens to determine the transfer of the above-mentioned heavy metals into plant biomass. Lastly, the microplastic content will be analysed with the help of both optical identification and attenuated total reflection infrared (ATR-IR) spectroscopy. This study aims to further improve knowledge on contamination on heavy metals and microplastics in the gardens of Vienna as well as to provide the gardeners with information on the state of their plots.

Poster

Preserving European Forests: The Vital Role of Seed Monitoring in the Face of Climate Crisis

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Abstract:

The 3 Billion Trees Pledge of the European Green Deal 2030 combined with an increase in disturbances and the trend for assisted migration results in high demand for tree seeds. Many of the required species show masting behaviour, that is intermittent seed production with high spatial synchrony. While this phenomenon is well understood in some species, we lack information on reproduction in many others. Monitoring their seed production will result in an increased understanding of their biology and the drivers underlying masting behaviour. Furthermore, we might be able to support the tree seed system via forecasting of seed production, provide an early warning system for the public health sector, as well as anticipate climate-change-induced alterations in tree reproduction. The latter may be crucial, as the adaptive capacity of plants ultimately depends on their ability to produce offspring. Therefore, monitoring changes in tree reproductive behaviour is essential for proactive measures within forestry and conservation.

Poster

Life cycle assessment of timber harvesting with chainsaw, cable yarder and processor

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Abstract:

Changing environmental conditions due to climate change and the expected future scarcity of fossil fuel resources have brought sustainability and environmental protection issues to the forefront of political and public attention. For some time now, this trend has also found its way into the forestry sector. The aim of this thesis is to analyze the environmental impact of timber harvesting in steep terrain using cable yarders, processors, and chainsaws. To achieve this, a life cycle assessment (LCA) according to ISO standards will be conducted using data collected from existing studies worldwide. The freely available software OpenLCA and the Ecoinvent database will be used for the assessment. The main processes to be analyzed next to felling, processing and extracting timber is the machine manufacturing and transfer and the fuel and lubricant production and supply. Global warming potential and human toxicity are the two impact categories which will be analyzed. A comparison with existing research will also be made to identify differences between fully mechanized and the aforementioned partially mechanized harvesting system. The focus will be probably on fuel savings and minimizing CO_2 emissions. In this context, the whole-tree method and the cut-to-length method will be explicitly compared. A key factor in the analyses will be the productivity of the respective harvesting methods. The results may be of important for machine manufacturers and entrepreneurs but also for forest owners and timber harvesting companies who are interested in more ecological approaches. A side effect that should not be neglected is the expected saving of fuels and lubricants, which would enable more economical operation. The issue of pollution in the workplace also plays an important role in everyday forestry work. The results relating to human toxicity could therefore be used to provide impetus for improving workplace conditions and reducing pollutants. Finally, the findings of this work can lay the foundation for further research in this field.

Poster

Influence of the photoperiod on the development of *Glyptapanteles liparidis* in *Lymantria dispar*

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Abstract:

Lymantria dispar (Lepidoptera: Erebidae), the spongy moth, is a polyphagous forest pest, especially in oak forests. The koinobiont braconid wasp *Glyptapanteles liparidis* (Hymenoptera: Braconidae) is a widespread and important parasitoid of the spongy moth. We investigate the endoparasitic development of *G. liparidis* in spongy moth caterpillars under long-day conditions (16 h light / 8 h darkness) and short-day conditions (8 h light / 16 h darkness), respectively. Caterpillars of *L. dispar* are reared at a constant temperature of 20°C, with two groups being parasitized by *G. liparidis* in the third instar. Two control groups remain unparasitized. The groups are then exposed to the varying photoperiods. The caterpillars are fed with wheat germ diet, the weight gain is documented three times weekly and all moults are recorded. As an indicator for metabolic activity, once a week the respiratory activity (µl O_2-consumption/mg bodyweight/h) of selected caterpillars from each group is measured in a volumetric micro-respirometer. After the larvae of *G. liparidis* have egressed from *L. dispar* and spun a cocoon, cocoons are separated from parasitized long-day and short-day individuals and three respiration measurements are carried out within a week. After the adult wasps have emerged, the number of wasp larvae per host caterpillar is determined. The central question of this bachelor's thesis deals with the potential influence of the photoperiod on the endoparasitic development of *G. liparidis* in *L. dispar* caterpillars and what effects this may have.

Poster

A field survey for overwintering hosts of the spongy moth parasitoids *Glyptapanteles liparidis* and *Glyptapanteles porthetriae*

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Abstract:

The oligophagous koinobiont parasitic wasps *Glyptapanteles liparidis* and *Glyptapanteles porthetriae* (Hymenoptera: Braconidae) are two major natural enemies of the spongy moth, *Lymantria dispar* (Lepidoptera: Erebidae). Their larvae develop in the haemocoel of the host caterpillars, where they also spend the winter. However, the spongy moth overwinters in the egg stage, so *G. liparidis* and *G. porthetriae* must utilize alternate hosts for overwintering. Despite extensive research, the overwintering hosts of both wasp species are still unknown. Literature reports and experiences from laboratory experiments suggest that taxonomically and morphologically closely related species of the spongy moth that overwinter as larvae serve as hosts for the braconid wasps.

In April 2024, we conducted field surveys for overwintering caterpillars in four oak forests in Lower Austria (Ebergassing, Eggenburg, Auersthal) and Burgenland (Klingenbach) before the spongy moth larvae hatched. All sites have experienced spongy moth outbreaks in the past and are known to have high abundances of *G. liparidis* and *G. porthetriae*. The focus was on members of the lepidopteran families Erebidae, Lasiocampidae, Nolidae and certain subfamilies of Noctuidae and Notodontidae.

Caterpillars were searched for along forest paths, in the leaf litter, under loose bark and in the herbaceous and canopy layers using beating nets and landing nets. The collected caterpillars were identified morphologically and kept in 250 ml plastic boxes under laboratory conditions (20°C, 16 hrs light, 8 hrs dark). They were fed fresh leaves and checked for parasitoid emergence two to three times per week. Although neither *G. liparidis* nor *G. porthetriae* emerged from the field-collected caterpillars, we collected valuable data on the lepidopteran species composition of overwintering caterpillars in Austrian oak forests.

Poster

Oviposition and egg development of the nine-spotted moth, *Amata phegea* (Lepidoptera: Erebidae)

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Abstract:

The nine-spotted moth, *Amata phegea* (Lepidoptera: Erebidae: Arctiinae), is mainly distributed in southern Europe, but also occurs in central Europe up to northern Germany. It prefers dry areas sparsely covered with trees and shrubs as well as forest edges. Adult moths are important flower pollinators and serve as a food source for birds and other insectivores. The caterpillars of *A. phegea* feed primarily on herbaceous plants, including *Taraxacum* sp., *Rumex* sp., *Galium* sp. and *Plantago* sp.. Although *A. phegea* has no direct relevance in forestry, it is one of the most abundant caterpillars in Austrian oak forests in winter and early spring. It has important ecological functions, for example it may serve as an overwintering host for parasitoids of forest pests such as the spongy moth, *Lymantria dispar* (Lepidoptera: Erebidae). However, a prerequisite for this is the presence of suitable developmental stages for parasitism. While extensive phenological data are available for the flight period of *A. phegea*, there are only few phenological data for the appearance of young caterpillars. Therefore, we investigated oviposition and egg development of *A. phegea*.

We used adult moths obtained from larvae collected in Lower Austria and Burgenland in spring 2024. Ten pairs of female and male moths were kept individually in small wooden cages at room temperature and natural light conditions in May. For oviposition, the moths were provided with water, honey water, and fresh dandelion leaves. The lifespan of the adult moths was recorded. Eggs were collected and counted periodically to determine the number of eggs per female and then distributed across three temperatures (15°C, 20°C, 25°C) with 16 hrs light and 8 hrs darkness. The eggs were regularly checked during hatching to examine the influence of temperature on embryonic development.

Poster

Rockfall hazard in Schattwald, Montafon

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Abstract:

The aim of this bachelor's thesis is to provide an overview of the rockfall hazard in the Schattwald (Montafon). The following research questions were addressed: "How is the rockfall hazard in the Schattwald to be assessed? How is the forest to be assessed with regard to rockfall? Is there sufficient young growth to ensure protective effectiveness in the future?" The data were collected as part of the forest inventory of the Stand Montafon in 2021.

The project area is located in Silbertal in Vorarlberg and covers approximately 130 hectares, over which a 175-meter grid with possible inventory points was laid. The forest inventory data were collected using both a fixed sample plot and the Bitterlich sampling method, an inventory method with a fixed angle of sight to select trees based on their stem diameter. The site data and rock sizes were visually recorded and noted using pre-prepared recording sheets and subsequently evaluated. Additionally, thicket, deadwood, and young growth were recorded.

The main goal of the thesis is to assess the rockfall hazard in the Schattwald and to determine the protective effectiveness using the collected inventory data. The results regarding rockfall hazard, protective effectiveness, etc., were classified into three different evaluation categories, which are meant to represent the condition of the project area. These categories were then visually represented on a map using three different colors.

Poster

Effects on establishment by different fertilizers applied at planting of tree seedlings

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Abstract:

Due to rising temperatures and changing climate conditions, drought stress has become a major cause of tree seedling mortality. This project focuses on a field trial to study the effect of two fertilizers in challenging dry, south-exposed areas.

Spruce and larch trees were selected due to their importance for reforesting deforested areas. Two types of fertilizers are tested: a slow-release NPK complex from Basaplex and an organic fertilizer with amino acids from ArGrow® which were compared to a control without fertilizer. The effects on mortality, growth rate, and average height, as well as correlations with tree species and area-specific conditions, were analyzed.

The research is conducted in two regions: Styria with 10 plots at altitudes of 800 to 1400 meters in the Northern Randalpen - eastern part, and Carinthia with 6 plots at altitudes of 1500 to 1800 meters in the Subcontinental Inner Alps - eastern part. Each plot contains 80 seedlings per treatment and tree species, with repeated site visits to collect relevant data.

Initial results indicate that the impact of fertilizers varies significantly based on the nutrient availability of the location. In nutrient-poor areas, the application of fertilizers has shown a positive effect, enhancing tree growth and reducing mortality. Conversely, in nutrient-rich areas, some treatments have led to negative effects, possibly due to nutrient imbalances or excessive nutrient availability.

The project data suggests that while the fertilizers did not significantly affect mortality rates, they had varying impacts on tree growth. Specifically, the BP treatment showed a clear positive effect on tree growth in Styria, and Larix decidua generally performed better than Picea abies in growth metrics. Site-specific conditions played a role in the effectiveness of treatments, particularly for Larix decidua with ArGrI.

These findings highlight the importance of customizing fertilization strategies for the specific conditions of each planting site to optimize tree health and survival rates.

Poster

Development of a spatial model for sustainability assessment of timber harvesting

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Abstract:

Sustainability, which has its roots in 18th-century forestry to combat deforestation, is essential for maintaining the functions of forest ecosystems such as resource supply, habitat protection, welfare effects, and protection against natural hazards (Volz, 2006; BMNT, 2018). Sustainable timber harvesting should focus on economy, ecology, and social compatibility. However, in reality, comprehensive analyses are rare, with research usually emphasizing cost efficiency and ecological aspects such as machine-soil interaction and emissions. Only about 1% of studies consider all three dimensions together (Grünberg et al., 2023), despite the importance of a holistic approach (Nemestóthy, 2023). Austrian forestry, with its alpine terrain, faces unique timber harvesting challenges (BMLFUW, 2006). Effective forest management requires the inclusion of spatial planning, achievable through the integration of Geographic Information Systems (GIS). To date, little research has been conducted into how spatial data representing sustainability criteria can be incorporated into the planning of timber harvesting operations and which data bases are available for this purpose. The aim of this thesis is to provide an overview which spatial data is available to be used for sustainability assessment of timber harvesting and how these data can be integrated into a GIS system. For this purpose, it is necessary to check which spatial parameters influence sustainability criteria for timber harvesting, which data is available and how can the criteria be transformed in a GIS. The sustainability criteria for timber harvesting are taken from Grünberg et al. (2023). The first focus will be a literature review of input parameters relevant for spatial assessment. The availability of spatial data will be examined using datasets from various sources (e.g. Open Government Data). The aim is to analyze the various data sources that provide spatial data and determine which of these can be used for timber harvest planning. Afterwards the collected data will be combined with data sets of two Austrian forestry enterprises and integrated into a GIS.

Poster

Evaluation of a temperature-based phenology model for the development of the oak lace bug *Corythucha arcuata* (Heteroptera: Tingidae) in the field

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Abstract:

The oak lace bug, *Corythucha arcuata* (Heteroptera, Tingidae), was introduced from North America to Italy in the year 2000. Since then it has spread quickly across Europe and was first found in Austria in 2019. It is an insect with a high potential to damage oak trees, since all European *Quercus* spp. are used as host trees. Both nymphs and adults sit on the underside of leaves and suck the cell sap. Heavy infestations can cause premature leaf drop. Under favourable weather conditions the oak lace bug produces 2-3 generations per year. Adults overwinter in bark crevices or in leaf litter on the ground. Human transport routes, railways, trucks and cars enable the insect to spread even faster.

The IFFF has established a phenology model from development data of lace bugs reared at six constant temperatures between 15°C and 36°C in the laboratory. The lower development threshold was calculated to be 12.4°C and the thermal sum for one generation (preoviposition period, oviposition, nymph development, adult eclosion) was 470 degree-days. In this study we want to evaluate the model generated from laboratory data with data from the semi-field.

Oak leaves with egg clusters were collected from infested oaks in Lower Austria in mid-May and inspected daily to document nymph hatching. Five to ten neonate nymphs were then transferred to an oak leaf on moist filter paper in a Petri dish and marked with the date and number of nymphs therein. The development of approximately 80-100 nymphs, including moulting, are recorded until adult eclosion and the start of egg laying. The petri dishes containing the insects are kept outdoors, but protected from rain and direct sunlight. Temperature and photoperiod are recorded with data loggers. The experiment will be repeated in mid-July with oak lace bugs of the second generation.

Poster

Effects of Rhizosphere Interactions on Phosphorus Uptake Efficiency in Upland Rice

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Abstract:

Upland rice cultivation on Japanese Andosols is commonly limited by low availability of inorganic phosphates due to their prevalent precipitation and sorption. Identifying rice varieties that are capable of efficiently mobilizing phosphorous (P) from these soils is considered a key strategy to increase yields without increasing P fertilizer application. In this study, 11 rice genotypes differing in P uptake were grown in a Japanese Andosol under low (LP) and high phosphorus (HP) fertilization. 33 (all 11 genotypes) and 54 (4 genotypes only) days after germination (DAG), root exudates were collected and analysed for total dissolved organic carbon (DOC), carbohydrates, phenolics and amino acids and carboxylates. In addition, the expression of three phosphate transporter genes in the root was determined via qPCR, with *OsPT1* and *OsPT2* serving as P starvation markers and *OsPT11*, a peri-arbuscular transporter, used as a proxy for mycorrhization. At 33 DAG, no differences in DOC, carboxylates and amino acids exudation rates were observed but the relative expression of *OsPT11* as well as the exudation of sugars and phenolic compounds were higher under LP compared to HP. This difference was more pronounced in genotypes with low P uptake suggesting a minor contribution of both exudation and mycorrhization in high P uptake. The expression of *OsPT2* increased more severely in genotypes with high P uptake under LP indicating a beneficial role of increased transporter activity. At 54 DAG, expression of *OsPT11* was still enhanced under LP compared to HP while root exudation was decreased suggesting a stronger impact of mycorrhization in P acquisition at later plant developmental stages. Taken together our results suggest a minor direct contribution of root exudates in enhanced P uptake, with P uptake transporter upregulation and, at later plant developmental stages, mycorrhization playing a more important role in efficient P acquisition in upland rice.

Poster

Effects of Soil Amendments on Mycorrhizal Colonization and Seedling Survival in Austrian Reforestation Efforts

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Abstract:

Reforestation is critical for biological carbon dioxide (CO_2) sequestration and mitigating the adverse effects of climate change. A successful reforestation hinges on the use of soil amendments such as hydrogels and fertilizers, in conjunction with the development of healthy soils that are rich in mycorrhizal diversity. This approach is essential for combating extreme drought events caused by global warming. This study examines the effects of specific soil amendments on ectomycorrhizal colonization of the soil surrounding the rooting system of the seedlings, as well as the survival and growth of three commonly planted tree species in Austrian mountainous forests *(Picea abies, Larix decidua*, and *Quercus petraea)* across various reforestation sites. Our findings indicate that while certain amendments enhance ectomycorrhizal communities and improve seedling health, others negatively impact it and increase mortality rates. While the ectomycorrhizal colonization of the soil behaved similarly with *Picea abies* and *Larix decidua* seedlings, those of *Quercus petraea* showed relevant differences. It is possible that biotic factors and soil conditions on the study sites may have impacted the results. These findings indicate that the careful application and appropriate concentrations of certain soil amendments could significantly enhance tree resilience, thereby supporting climate change adaptation efforts.

Poster

Managing soil health in the field: Useful methods and visualisation of soil health

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Abstract:

Soil health is a currently discussed topic in society, science and politics. The EU Soil Health Directive, including a Soil Monitoring Law, intends to achieve healthy soils in the EU by 2050. In order to reach this goal, suitable soil health indicators and useful methods to measure soil health are needed. This contribution shows an outline of a doctoral project aiming at the design and development of different field methods for measuring important soil microbiological, chemical and physical parameters and the visualization of soil health.

Concerning soil microbiology, a field method for measuring microbial activity in arable soils is evaluated. The method is based on the colour change of a pH-indicator during the reaction with CO_2 that is released during soil respiration in a closed system. The colour change is then evaluated by means of RGB-data and validated with GC-measurements of basal respiration. As soil chemical parameters, POxC (labile C-fraction) and NaOH-extracts (stable C-fraction) are analysed with colorimetric field methods and compared to photometer measurements for further validation of the methods. The methods are tested on a dataset including market gardening fields as well as agricultural sites and semi-natural reference strips. The combination of this methods each aiming at different C fractions in the soil also gives an insight on the C fluxes in the topsoil. For evaluating soil physical characteristics, soil structure in particular, a digital spade test will be developed. The aim is to replace the visual assessment of a spade test by means of computer vision in order to assess soil structure.

Finally, the visualisation of soil health plays an important role. Therefore, graphical presentation of soil health in different ways in order to describe soil health in an appealing, clear and straightforward way is tested.

Poster

Temperature-dependent effects of *Verticillium nonalfalfae*-isolate Vert 56 on symptom development on *Ailanthus altissima*

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Abstract:

The highly invasive species *Ailanthus altissima* originates from areas within China and northern Vietnam (Maschek & Halmschlager, 2017). The species inhibits the growth of native species due to its minimal soil and climatic requirements, alongside its allelopathic abilities and its rapid youth growth (Lechner et al., 2022). Research on the biological control of Tree of Heaven has been conducted at the IFFF BOKU, Vienna since 2011 utilizing an isolate (Vert 56) of the wilt fungus *Verticillium nonalfalfae*.

The aim of this study is to examine the influence of temperature (hot-day versus spring-day conditions) on symptom development on *A. altissima* after infection with *V. nonalfalfae*. For this purpose, three-month-old seedlings were artificially inoculated with a conidial suspension of *V. nonalfalfae* isolate Vert 56, using two different concentrations (1 x 10^6 and 5 x 10^6 conidia/ml). Seedlings were then incubated in two separate phytotrons for 8-12 weeks, one simulating hot-day conditions whilst the other simulating spring-day conditions. Symptom development was evaluated weekly using an ordinal scale ranging from 0 (healthy) to 5 (dead), and photographic documentation was made of wilt progression on selected seedlings.

Results indicate that high temperatures negatively impact the efficacy of *V. nonalfalfae* against *A. altissima*: Hot-day conditions are observed to diminish the pathogen's performance and functionality, whereas wilt and mortality were readily achieved under spring-day conditions. This indicates a clear correlation between the prevailing temperature regime and the efficiency of *V. nonalfalfae*. Furthermore, re-isolation of the pathogen was successful from all inoculated plants grown under spring-day conditions, whereas the fungus could not be re-isolated from 2 out of the 20 inoculated seedlings of the hot-day variant. In contrast, concentration of conidial suspension had no effect on symptom development.

Poster

Taper curve modelling in R using PLS data

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Abstract:

Large scale forest inventories like the Austrian National Forest Inventory (ÖWI), are important tools for forest monitoring. However, traditional sampling methods for forest inventories are time consuming, and thus attempts are being made to increase efficiency by automating measurement tasks, using modern sensors like terrestrial laser scanners (TLS) and personal laser scanners (PLS). These technologies make it possible to estimate diameters in upper tree parts in a non-destructive manner and can also capture much more diameters per stem compared to traditional forest inventory methods. In contrast to the older TLS-systems, the PLS can record necessary 3D data sets of the forest stands in less time.

This thesis investigates whether data obtained from a PLS-system can be analysed in such a way that realistic taper curves can be created to subsequently estimate the volume. An algorithm in the statistical computing language R was developed, that automatically filters and processes data generated by the PLS-system “GeoSLAM ZEB-HORIZON”.

15 cm thick cross-sections were extracted from the individual 3D trees every 0.5 m. After a density-based clustering for noise reduction, circles were fitted to the cross-sections. To counter interfering influences in upper parts of the trunk, a linear model was fitted based on the xy centre points of the former circle fitting. This linear model predicts the centre of the trunk over the height. This makes a second clustering and circle fitting step much more accurate. Finally, a mixed, semi-parametric regression model was fitted to the diameters along the stem using the R package “TapeR” to create three different versions of taper-curve-models. The taper-curve-model (2) proved to be the most suitable. For this, estimated diameters from the second clustering were filtered again in three steps and outliers were sorted out.

Poster

Collection of additional information using automatic speech recognition in digital laser-based forest inventories

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Abstract:

In many forestry operations, forest management is used as a central management tool. The most important core parameters are timber stocks, growth and tree species distribution. Despite numerous modern tools, the personnel and time required for these surveys is still high.

In recent years, laser scanning technology has proven to be a practicable and very promising technology. This creates a 3D model of the test circle (digital twin). With the help of an additional camera mounted on the laser scanner, it is possible to record sound at the same time as the scanning process. This allows the point cloud generated by the laser scanner to be supplemented with additional verbal information.

In the course of this work, an attempt was made to record the tree species of a sample point using audio recordings and subsequent speech-to-text algorithms with the aid of a person-carried laser scanner (PLS) in conjunction with a camera. The basis for this was 15 points from the educational forest inventory where the tree species are known. The data recording was carried out independently by three people per inventory point. While walking along the point with the PLS, the tree species were pronounced at the shortest distance when encountered and thus recorded on the audio track of the camera. After the data was recorded, three different speech-to-text algorithms were used to convert the camera audio into text. These three results were compared with the original video and the reference tree species list to find out which speech-to-text algorithm worked best and which problems could occur during the field recordings.

The speech-to-text algorithms proved to be essentially practicable and robust. However, loud ambient noise and unclear pronunciation meant that some tree species could be recorded incorrectly or not at all using automatic speech recognition.

Poster

Vergleich und Evaluierung von PLS-, ALS- und photogrammetrisch gestützten Inventurmethoden im Naturpark Sparbach

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Abstract:

Advancing digitalization has transformed many areas of life, including forest inventory, which traditionally relied on manual methods and laborious fieldwork. This progress is also necessary, as sustainable forest management requires high-resolution and small-scale information on forest resources. In the course of the development of new remote sensing technologies, the use of ground-based and airborne LIDAR sensors and photogrammetric calculations from aerial images in particular have become established. The market launch of the forest management product "Palos" by Forest Mapping Management GmbH (FMM) provided an opportunity to evaluate various current inventory methods in terms of their accuracy and thus provide information on future potential uses.

As a data basis, a contiguous forest area with an area of 54 ha in the Sparbach Nature Park was fully digitized using a "GeoSLAM ZEB Horizon" personal laser scanner (PLS). The point clouds were analyzed using algorithms from the Institute for Forest Growth (WAFO) for tree positioning, segmentation, diameter, height and volume estimation. In addition, the tree species of around 10,600 individual trees were manually classified using field surveys. In the mixed deciduous and coniferous stands, automated machine learning models for tree species recognition and tree measurement were used on the basis of 16 tree species in order to create a highly accurate basis for comparison. In addition, FMM carried out a traditional forest inventory in the same area, which was based on random samples and supplemented with individual tree data from photogrammetric aerial image evaluations. Recent aerial surveys with airborne laser scanning (ALS) by RIEGL Laser Measurement Systems GmbH will also be used for comparison.

Initial results show that the inventory data from "Palos" show similar results in comparison with the reference data from the PLS images. Larger deviations can only be recognized at a smaller level (stand or partial area), where the number of stems in the lower BHD range in particular varies. The ALS aerial survey data should clarify the extent to which these fluctuations are due to missing information from the aerial photographs.

Poster

Laser-assisted hardwood measurement for volume calculation and classification as well as for deriving a possible market value of the formed logs

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Abstract:

In Austria, hardwood timber is often traded between forest owners and timber merchants or sawmills directly on the forest road. The already formed logs are measured on site with a tape measure and clamp and documented in writing. The classification is determined on the basis of bark characteristics, knot attachments and trunk characteristics and then the price per cubic meter is negotiated and recorded according to the price list or, in the case of special pieces, separately. The purchased log is then marked with a stop plate and a consecutive log number.

Instead of the measuring block, tablets are also used to store and immediately process the measured timber data. The question now arises as to whether timber measurement on the forest road can be completely digitized and what advantages this would have. An Apple iPad or similar devices with a Light Detection and Ranging (LiDAR) sensor can be used for this purpose. The digital twin of the log obtained by scanning should provide the diameter, length, quality and possible suggestions for pricing the log on the spot using an algorithm. The added value for the customer and the timber trader lies in the fast, accurate and transparent transfer and evaluation of hardwood.

The aim of the work is to develop a workflow in R that uses the digital twin to calculate the volume and examine the log for knots, curvature, growth ring structure and other quality-determining parameters.

The data basis for the development of the R-algorithm are point clouds, which were recorded at the timber submission of the Upper Austrian Forest Association in St. Florian near Linz. Around 150 logs were recorded with a GeoSLAM ZEB-Horizont personal laser scanner (PLS) and around 100 logs with an iPad Pro.

Poster

Socket shape modeling based on PLS data

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Abstract:

Forest inventories are traditionally carried out manually using a clamp and relascope, which is associated with high personnel, time and material costs. Person-carried laser scanners make it possible to reduce the measurement effort, but optimization of these systems still requires further development, especially in the area of diameter adjustment and shaft modelling in upper trunk segments. In order to calculate the stem wood volumes of trees, these are recorded with laser scanners (in this case with the GeoSLAM ZEB Horizon system) as 3D point clouds. Due to incomplete and noisy point clouds, especially in the crown area, stem shape modeling reaches its limits, especially for individuals with a high number of branches. In order to solve this problem, this work attempts to develop a model that divides the stem into 2D cross-sections that are easier to process. The segment cross-sections have a thickness of 15 centimeters. The quality of the segmental cross-section modeling is checked on the basis of circle adjustments and the resulting circle centers. The position of the circle centers is classified as plausible or implausible depending on the position of the circle centers in the previous sections and the cross-section modeling is aborted if the circle centers deviate too much. This is to be accomplished using regression analyses and heuristic conditions, among other things. As a data basis, 87 scanned conifers, provided by the Institute of Forest Growth, are available.

Poster

Assessment of wildlife visibility using laser scanning

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Abstract:

The maximum safe shooting distance when hunting red deer (Cervus elaphus L.) in forest environments is critically dependent on visibility conditions. The aim of this work is to develop a visibility model based on 3D point clouds obtained from personal laser scanning (PLS) and terrestrial laser scanning (TLS), that allows for an objective assessment of sighting conditions and an optimized positioning of hunting stands.

3D point clouds were obtained by TLS and PLS for 30 sample plots, representing different stand densities and tree species compositions.

The stationary scanner FARO Focus3D X330 was mounted on a tripod positioned above the center of the sample plot at a height of 1.70 meters. Four reference spheres were placed north, east, south, and west of the center at a distance of 20 meters each. Additional scans were taken one meter from the center in each of the four cardinal directions, to ensure comprehensive data collection.

Furthermore, a GeoSLAM ZEB Horizon portable laser scanner was used. The setup of the reference spheres of the terrestrial laser scanner was adopted. The scanner was set up on a tripod at breast height (1.30 m) facing north. After the start, the scanner was removed from the tripod and the path around the sample circle was walked according to a fixed pattern.

A visibility panel according to Griesberger et al. (2022) was used as a reference. The panel corresponds in its dimensions to the area of a red deer's body without neck, and head in a side view and is divided into 32 fields. At every sample plot, photos of the panel were taken in all four cardinal directions and at distances of 10 m, 30 m and 50 m, using a Canon EOS 5D Mark lll camera with a Tamron SP 150-600mm lens. The visibility was then manually assessed by counting the visible fields on the panel.

Poster

Calculation of the center of mass of the above-ground biomass of individual trees using terrestrial laser scan data and Quantitative Structure Models (QSM)

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Abstract:

3D laser scanning technology is increasingly the subject of forestry research projects. It is also increasingly being used in practice, for example in forest inventories or in the assessment of combustible material for forest fires. Due to the constant further development of the devices and intensive examination of the potential of this technology, new applications are regularly emerging. One of the greatest advantages is probably the non-destructive data collection. The aim of this work is to calculate the center of mass of standing individual trees with the aid of terrestrial laser scan data and quantitative structure models (QSM). A QSM reconstructs the entire structure of the tree represented in the 3D point cloud with the help of adapted cylinders and contains important information such as diameter or volumes.

After a thorough literature research and basic considerations about the procedure, two QSM algorithms (TreeQSM for MATLAB and aRchi for R) were compared. In order to determine the performance of the two algorithms, the optimal setting parameters were determined and the results visually assessed. After adjusting the parameters, TreeQSM delivered very satisfactory calculations of 55 oak trees, which were scanned in the Vienna Woods and manually segmented in the point cloud.

If a density is assigned to the cylinders of the QSM, the individual centers of gravity can be calculated. The resulting total force of the above-ground biomass is the sum of the individual forces. If the sum of all resultants around any reference point is now formed, the coordinates of the resultants can be derived on a two-dimensional plane. This information helps to understand where the center of gravity of a tree is located.

Knowing the position of the center of gravity is an important basis for the felling direction of the tree during timber harvesting. If this is misjudged, uncontrolled felling can occur. This can lead to serious damage or accidents at work. However, the center of gravity calculation can also be used in conjunction with the "digital twin" of the forest stand created in the forest inventory to determine a cutting order and thus ensure efficient timber harvesting.

Poster

Participatory systemic perspectives for overcoming future tree seed shortages in the climate crisis: The Austrian system of seed-tree stands

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Abstract:

The Austrian forestry sector faces a significant challenge in restoring and converting forests to be more resistant to climate change. This challenge is due to the need for high-quality reproductive materials and tree seeds for planting species that have not been previously prioritized in Austria. However, there are predictions of shortages in the seeds of these particular tree species due to declining seed quality.

The study aims to examine the complex social-ecological system of seed-tree stands as a crucial source of tree seeds in Austria by focusing on the actor's mental models involved in the tree seed production in Austria. Through a facilitated group model-building process, a causal loop diagram methodologically rooted in system dynamics offers systemic perspectives for overcoming current and future national shortages of tree seeds by (1) characterizing the system's dynamics by identifying its elements and the interlinkages among them and (2) identifying interventions to enhance the current system.

Workshop participants identified two central system dynamics: harvesting and stand management. Only stand management influences harvesting. The two dynamics differ regarding the time horizon, which is crucial when setting interventions for change. Using technology and innovation in harvesting, promoting networking and exchange, and sharing knowledge and expertise can create more intentional system change. Short-term interventions like subsidies do not integrate into the system loops.

The CLD identified by system actors represents only reinforcing loops. This suggests that the mental models guiding the workshops' conversations align with the economic ideologies of the Austrian forestry system, which posit no limits on growth. This might cause the system's behavior to overshoot or collapse over time.

These findings again highlight the importance of revealing hidden systemic limiting factors that might block sustainable change and opt for long-term interventions focused on fostering the seed-tree stands' social capital.

Poster

Automated segmentation of forest stands using Airborne- and Personal Laser Scanning data

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Abstract:

Forest stand segmentation is a time-intensive process and, due to human interpretation and ambiguity in the definition of 'forest stand', prone to much subjectivism. Light Detection and Ranging (LiDAR) poses a realistic solution to this problem by allowing for objective quantification of forest structure.

The aim of this work is to develop an automated algorithm using full-cover Airborne Laser Scanning (ALS) data and Personal Laser Scanning (PLS) plots to quantify forest structure parameters and automatically delineate (and classify) individual forest stands.

In the study area of Brixen im Thale (Tyrol, Austria), full-cover ALS data (2020) and PLS point-clouds on 148 individual inventory plots (2023) are available.

The raw point-clouds from both sources are used to calculate a variety of forest structure parameters using open-source R packages. In a next step, Random Forest regression between ALS- and PLS-derived parameters at plot-level is applied. The output of this regression is a prediction model which allows for a full-cover prediction of PLS-derived parameters ("within-forest structure") using ALS data. After initial trials, it has been found that a set of 21 ALS-derived parameters can predict the lower- and upper understory vegetation percentage with an R^2 of 0.55 and 0.67 respectively. The expectation is that the predictive quality of these and other parameters will increase after having solved discrepancies between how the maximum height of ALS- and PLS-point clouds are derived. The combined ALS- and PLS-derived parameters (full-cover raster) are then used in a second regression using manually delineated forest stands, which serve as training data. The variation in values of ALS- and PLS-derived parameters between different forest stand categories ('Bestandeskategorie') will finally be used as input in four different raster-based automated segmentation methods: Region Growing (RG), Cellular Automaton (CA), Simulated Annealing (SA) and Self-organizing Map (SOM).

The final automatically-segmented forest stands (polygons) will be statistically compared to manually-segmented forest stands within the Brixen im Thale study area. Additionally, an expert opinion will reveal the strengths and weaknesses of the automatically-segmented stands for practical forest management. To assess the generalisability of the algorithm, a similar segmentation will take place in second study area Flirsch (Tyrol, Austria).

Poster

Airborne Laser Scanning (ALS) and Unmanned Aircraft System (UAS) supported harvest planning in cable yarding operations

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Abstract:

The implementation of precise organization and planning are essential factors for successful and cost-efficient timber harvesting in steep terrain. Forest management planning and remote sensing are important pillars in the first steps of planning. In this way, data such as the growing stock as well as terrain characteristics can be derived. Technological progress, particularly in the field of drones and their add-on modules, is opening up new areas of application in forestry.

This Master's thesis examines the extent to which the use of airborne laser scanning drones (ALS drones) can facilitate harvest planning. The implementation of this new technology aims to increase efficiency by optimizing the planned timber harvest in cable yarding terrain. The study areas are located in the Lavanttal on the Koralpe on the estate of the Forst- und Gutsverwaltung Dr. Gutmund Schütte. As part of this study, an ALS drone is used to fly over the scheduled harvesting units. The point data is used to optimise the creation of the cable yarding lines in the field. The data is used to determine the layout of the yarding lines, to calculate the growing stock and to identify anchor and support trees. The individual yarding lines will be design in the geographic information system QGIS with the support of the plug-in Seilaplan. This plugin programme calculates key figures such as the skyline deflection and the forces acting on the cable, the skyline anchor and the intermediate supports.

The layout of the yarding lines in the harvesting trial units will be done by the machine operator on site as usual. The resulting yarding layouts will be assessed against each other. Furthermore, estimated and actual harvest volumes will be compared.

Poster

Analysis of Fir Cancer (Melampsorella caryophyllacearum) Infestation in the Bregenzerwald: Influence of Exposure, Altitude, Diameter Class and Structural Type

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Abstract:

As part of a follow-up inventory, the infestation of fir cancer (Melampsorella caryophyllacearum) was investigated for the first time at 177 locations in the Bregenzerwald. The infestation was visually assessed based on trunk deformation within a fixed sample plot and subsequently analyzed using R-Studio. For this purpose, four classes were formed according to trunk section (0 = no cancer, 1 = first third of the trunk, 2 = second third of the trunk, 3 = third third of the trunk). Since the visual identification of the third trunk section was difficult, this section was not considered in the analyses.

The aim of this study is to analyze the influence of various factors on fir cancer infestation. Factors such as exposure, altitude, diameter class, and structural type are compared with the cancer infestation. For the structural type, several mixture types were formed based on tree species distribution, which were further divided into strength classes and then examined for probability of cancer infestation.

Fir was present in 85.88% of the 177 plots studied. 21.71% of the fir plots showed cancer infestation. No significant difference was found regarding the exposure group. In terms of diameter class, a trend towards occurrence in larger diameter classes can be observed. Since our analyses are not yet fully completed, further results will follow.

Poster

Integrating AI in Simulating Cable Corridors Based on Terrestrial LiDAR Data

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Abstract:

Within this doctoral thesis a novel methodology for optimizing cable corridor layouts in timber extraction on steep terrain through the use of a digital twin of a forest was introduced. Traditional approaches, relying on less accurate contour maps, often result in layouts dependent on infeasible supports, thereby reducing confidence in their practical application. Our approach employs high-resolution tree maps and digital terrain models to generate more realistic representations of all potential cable corridors within a given terrain. Established forestry methods combined with machine learning methods were applied to compute most feasible cable corridors, incorporating rope deflection, adequate tree anchors, and the placement of intermediate supports as necessary. The individual cable corridor trajectories derived from this process form the basis for an optimized overall layout, aimed at reducing installation and operational costs while promoting sustainable timber extraction practices. One focus is on mathematically optimizing the layout of feasible cable corridors based on multiple criteria, including cost, ergonomic considerations, and ecological impact, and integrating these results into a user-friendly workflow.

Poster

(RECLIK) Revisiting Climate Change Mitigation Potential in Smallholder Farming Systems in Kenya

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Abstract.

Climate change poses serious difficulties for Kenya's smallholder farming systems, thus effective mitigation measures are required to maintain sustainable agriculture and better livelihoods. Building on the SAMPLES project from November 2012, this study, carried out in the Nyando region of Kisumu County in Western Kenya, intends to explore the potential of smallholder farming systems to mitigate climate change through the RECLIK project. Soil qualities, agricultural management, and greenhouse gas fluxes are the three main areas of focus for the research. To obtain detailed data, a variety of methods were used, including field surveys, interviews, soil sampling, and landscape stratification using GIS and remote sensing techniques. The results showed a variety of land tenure arrangements, with 95.18% of farmers holding land, which had an impact on land management techniques. Groundnuts, maize, beans, cassava, and shrubland made up a sizable portion of the land cover (79.30%), which was primarily grassland/shrubland. The management of soil fertility revealed a growing use of organic supplements like compost and manure and a dependence on synthetic fertilizers. 55.01% of farmers practice homesteading, which incorporates a variety of plant types, livestock, and waste management to promote climate resilience. An examination of ground cover revealed that more vegetation is required to improve carbon sequestration and lessen erosion. Various grazing management techniques are used, and notably, rotational grazing promotes the health of the ecosystem and the cycling of carbon. Burning was only utilized by 0.73% of farmers to control weeds, suggesting a move towards more sustainable methods. The study emphasizes the significance of organic soil amendments, improved land tenure security, and sustainable land management. Smallholder communities can reduce climate change, protect biodiversity, and guarantee long-term food security and resilience by fusing scientific knowledge with traditional methods.

Thank you very much for participating in the 9th WABO Students Conference !