BOKU University, Vienna

Department of Ecosystem Management, Climate and Biodiversity

Previously Department of Forest and Soil Sciences (WABO)

10. WABO Student Conference 2025
Advancing Forest and Soil Sciences

Book of Abstracts

Tuesday, June 3, 2025, Vienna, Austria
09:00 – 17:00

This student conference is the final student colloquium and
comprises the following BOKU courses (2025S):
Bachelor's thesis seminar 910110,
Master's thesis seminar 910301, and
Doctoral seminar 910400.

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Program

Welcome “old” WABO colleagues!

The “10th WABO Student Conference 2025 (LV 910110, 910301, 910400): Advancing Forest and Soil Science” takes place on Thursday, **June 3, 2025 (09:00 – 17:00 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 last 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	**Peter SYKACEK**	O1 Keynote: Decoding the morphological structure of an African Nile tilapia population with probabilistic machine learning
09:30	**Stefan SCHWENG**	O2 A Modular Decision Support System for Smart Farming: Optimizing Economic Growth and Soil Health using Digital Twins
09:45	**Rachele SBABO**	O3 Combined effects of cover crops and tillage intensity on soil properties, microbial functions and community co-occurence networks
10:00	**Cecilie FOLDAL**	O4 Accounting of regional N2O emissions from agricultural soils under different Tiers, an example from Austria
10:15	**Ulises R. ESPARZA-ROBLES**	O5 N2O emission changes by SOC sequestration practices in European croplands: a climate-change mitigation trade-off?
10:30-11:00	**Coffee Break with Poster session**	Festsaal / hallway (coffee-walk-talk)

Oral Presentations

Session 2 – Festsaal (MENH-03/01)

Chair: Eva OBURGER

Time	Presenter	Title
11:00	**Constantin MÜLLER**	O6 Microplastic and Heavy Metal Contamination - an Analysis of Vienna's Gardens
11:15	**Lisa GASSER**	O7 Soil compaction effects on the abundance, dynamics and characteristics of fine roots in forest soils
11:30	**Sophie MUTZE**	O8 Comparison of the phenology models PHENIPS and PHENIPS-Clim for modelling spruce bark beetle development to trap monitoring data in Saxony (Germany)
11:45	**Martina KITTINGER**	O9 Shades of Gray: Analyzing the Evolution of Soil Carbon Topics in gray literature during the past two decades
12:00	**Felix THALER**	O10 Bioassays to test for host choice of the spruce bark beetle *(Ips typographus)* depending on stand age, nutritional quality and water supply of Norway spruce *(Picea abies)*
12:15	**Johannes BLÜMKE**	O11 Ecology of the fungal community of Ips acuminatus and suitability of different host trees to this bark beetle species
12:30-14:00	**Lunch break with Poster session**	Festsaal / hallway (eat-walk-talk)

Oral Presentations

Session 3 – Festsaal (MENH-03/01)

Chair: Tim RITTER

Time	Presenter	Title
14:00	**Valentin SARKLETI**	O12 LaDiWaldi - A big step towards laser-based digital forest inventory
14:15	**Lukas MOIK**	O13 Measurement of timber stacks on an individual log basis using LiDAR
14:30	**Richard SODER**	O14 Laser scan based forest road design and timber harvesting planning taking local geology into account
14:45	**Philip SVAZEK**	O15 Estimation of tree centroids based on terrestrial laser scan data
15:00	**Gerhard PICHLER**	O16 Tracking and tracing in the timber supply chain: State of the art and case studies
15:15	**Coffee Break with Poster Session**	Hallway (coffee-walk-talk)

Oral Presentations

Session 4 – Festsaal (MENH-03/01)

Chair: Johannes FRIEDL

Time	Presenter	Title
15:45	**Carlos Claramonte MANRIQUE**	O17 Shifts in nitrogen transformations in response to long-term organic vs. mineral fertilisation in an alpine grassland soil
16:00	**Lisa MILANOLLO**	O18 Effects of seasonal food quality of host and non-host plants on the performance of the oak lace bug *Corythucha arcuata (Het., Tingidae)*
16:15	**Balazs GARAMSZEGI**	O19 Scaling the climate sensitivity of radial growth of oaks along a regional climatic gradient
16:30	**Bianca CANEPPELE**	O20 Microplastics in Austrian Agricultural Soils: Linking Environmental Conditions and Farming Practices
16:45	**Julius JÄKEL**	O21 The Influence of Microplastic Contamination on Soil Health and Microbial Properties in Urban Soils
17:00	**CLOSING**	

Poster Sessions – Festsaal (MENH-03/01)

Poster Chairs: Christa SCHAFELLNER, 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 author of the posters are mentioned here (there is always one responsible person per poster)

Poster	Contribution
P01	**Andreea SPIRIDON** Root trait adaptation under drought for resilient cropping systems: Insights from two faba bean genotypes grown in different soils
P02	**Luis Quironga GUTIERREZ** Development of peat alternatives from agricultural and food industry by-products
P03	**Quiwen GUO** Above and belowground phenology and production of four tree species with contrasting root and leaf traits
P04	**Leopold ZEHL** The effects of different tillage regimes on soil microbial activity and the carbon pool. Examined on a long-term trial in Hollabrunn, Lower Austria
P05	**Anita LEITGEB** Stability of carbon from methane pyrolysis in soils
P06	**Gergely KOLESZAR** Detection and Quantification of natural Regeneration with a Personal-Laser-Scanner
P07	**Michael ANGERLER** Protective forest undergoing change – analysis of pine dieback and forestry measures on Silbersberg
P08	**Christopher WORM** Automated LiDAR based detection of bark stripping in forest stands
P09	**Peter NAGELE** Development of Spatial Basal Area Increment Models Using Personal Laser Scanning Data from Managed Forest Stands
P10	**Robert KNAPPITSCH** Branch whorl detection in handheld laser scanner point clouds

P11	**Juliane KIENESBERGER** Leaf Area Index (LAI) in Urban Vegetation: A Comparison of Satellite Data with AccuPar Measurements
P12	**Anton SINGER** Development of a spatial model for sustainability assessment of timber harvesting
P13	**Sarah WAGNER** Application of forest vegetation parameters extracted from PLS- (Personal Laser Scanning) and ALS- (Airborne Laser Scanning) point clouds for wall-to-wall modelling of the habitat preferences of red deer *(Cervus elaphus)*
P14	**Agnes KLAUS** Characteristics of leaf stomata of common ash genotypes tolerant and susceptible to ash dieback and growth of *Hymenoscyphus albidus* and *H. fraxineus* at various temperatures on artificial media
P15	**Jannik RENNER** Oviposition and egg development of the nine-spotted moth *Amata phegea (Lepidoptera: Erebidae)*
P16	**Kevin TENNE** Evaluation of a temperature-based phenology model for the development of the oak lace bug *Corythucha arcuata (Heteroptera: Tingidae)* in the field
P17	**Benjamin PAUSER** Potential alternate hosts of the spongy moth parasitoids *Glyptapanteles liparidis* and *G. porthetriae (Hym., Braconidae)*
P18	**Jakob FALLY** Modelling sub-canopy light intensity using LiDAR data and its correlation with forest regeneration
P19	**Caroline KLAMPFER** Influence of parasitization by braconid wasps *(Glyptapanteles spp.)* on the immune defense of the oak eggar *(Lasiocampa quercus) (Lep.: Lasiocampidae)*
P20	**Luisa SCHENKE** The growth of swiss stone pine *(Pinus cembra)* in the Zillertal across an elevational gradient and the influence of macro-topography

Enjoy the 10th WABO Student Colloquium !

Keynote

Decoding the morphological structure of an African Nile tilapia population with probabilistic machine learning

Wilfried Wöber[1], Papius Tibihika[2], Lucas Muster[1], Harald Meimberg[3] and Peter Sykacek[4*]

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[2] National Agricultural Research Organization (NARO), Aquaculture Research and Development Centre Kajjansi (ARDC), Uganda.
[3] Institute for Integrative Nature Conservation Research, Department of Ecosystem Management, Climate and Biodiversity University of Natural Resources and Life Sciences, Vienna, Austria.
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Abstract:

Links between genotype and morphology led previously to hypothesizing that morphological assessments can aid ecological monitoring. To assess this hypothesis we propose to investigate the relations between specimen morphology and other sample characteristics. Morphology is to this end represented by machine learning derived and quality checked features and analyzed with generative models and quantitative metrics. Inferring morphological relations among samples depends crucially on deciding for an adequate number of morphotypes. Variational Bayesian Gaussian mixture models (GMM) provide to this end a model selection yardstick. To elucidate the morphological structure of an Ugandan Nile tilapia population we quantify morphological distance by subjecting the GMM implicit probabilistic soft clustering of samples to distance metrics in probability space. Two key results emerged from our analysis: i) the studied Nile tilapia population is optimally represented by a small number of morphotypes and ii) the relation between specimen morphology and morphotypes depends on sample location and genotype. Morphological structure is thus examined from a geographic and a genetic perspective. While variation in genotype is linked with morphology, sample location has a stronger effect. The latter corroborates established knowledge that genotype causes morphological predisposition while still allowing that morphology adapts to environmental characteristics. While geographical and morphological distance are often correlated, we see violations which were however previously linked with anthropogenic intervention. Specific environmental characteristics at certain sites provide furthermore a plausible explanation for pronounced morphological differences which we observe in relation to nearby locations. Interestingly this observation is even made in a genetically homogeneous population in lake Victoria. Morphological variation may hence be observed in populations of limited genetic diversity. We therefore conclude that confining ecological monitoring to morphological examination may overlook populations with a limited genetic fitness and that alternating between morphology and genotype based assessments is a more useful strategy.

Oral Presentation

A Modular Decision Support System for Smart Farming: Optimizing Economic Growth and Soil Health using Digital Twins

Stefan Schweng[1*], Katharina Keiblinger[2], Hans-Peter Kaul[3], Niko Lukač[4], Iztok Fister[4], Andreas Holzinger[1]

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Abstract:

The main goal of this doctoral thesis is developing a modular framework for a Decision Support System (DSS) for Smart Farming, aimed at optimizing economic growth and soil health. In this context the proposed system leverages a hybrid digital twin for agricultural land, integrating both data-driven and physics-based models. This hybrid approach enables the DSS to utilize historical and real-time data — such as weather conditions, soil parameters, and crop performance — alongside established process-based modelling techniques. The core of the system is designed to address the multi-objective optimization problem of balancing metrics related to economic growth as well as sustainability, with the latter having a specific focus on soil health. Given the diverse priorities among stakeholders, the system allows weighting each metric category, enabling tailored decision-making that aligns with the goals of different user groups. For example, policy makers in the European Union might prioritize sustainability, while individual farmers could emphasize economic outcomes. The integration of a digital twin within the DSS offers a dynamic and responsive tool for simulating and forecasting the impact of various agricultural practices, ultimately supporting informed decision-making in complex, real-world scenarios. The thesis addresses the challenges of outlining a concept for such a modular framework, including the need for a robust and scalable architecture, identifying appropriate agricultural parameters to be modelled by the digital twin and the integration of heterogeneous data sources. After presentation of this concept, the last step of this thesis is to develop a proof-of-concept optimization approach with the identified parameters that allows different stakeholders to put emphasis on metrics of their specific interests. By advancing the capabilities of smart farming technologies, this research aims to contribute to the sustainable intensification of agriculture, promoting environmental protection, economic resilience and crop quality.

Oral Presentation

Combined effects of cover crops and tillage intensity on soil properties, microbial functions and community co-occurence networks.

Rachele Sbabo[1,2*], Katharina Keiblinger[2], Martin Schneider[2], Niklas Bruhn[2,3], Christoph Rosinger[3], Gernot Bodner[3]

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[3] Institute for Agronomy, Department of Agronomy, University of Natural Resources and Life Sciences Vienna (BOKU), Tulln, Austria

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Abstract:

Global change and persistent food insecurity are intensifying negative feedbacks in agro-ecosystems, while tillage and lack of soil cover contribute to soil organic carbon (SOC) loss and a decline in ecosystem services. Soil microbial communities are key indicators of soil health and are influenced by management practices. Most studies focused on single factors or on higher taxonomic levels, overlooking species-level resolution and microbial functions. This study, conducted in a semi-arid region, assessed soil properties, microbial activity, relative abundance, diversity, functions and co-occurrence networks of fungal and prokaryotic communities across a 17-year gradient of tillage intensities and 3-year cover cropping (CC) treatments in a full factorial design. Tillage intensity emerged as the dominant driver of microbial dynamics, with no-tillage (NT) and minimum tillage (MT) associated with significantly higher SOC, microbial biomass, enzymatic activities and aggregate stability. Fungal taxa were more sensitive to tillage-induced disturbance than prokaryotes. Relative abundance and functional predictions indicated a higher abundance of fungal and prokaryotic saprotrophs under conventional tillage (CT), due to crop residue incorporation. Conversely, fungal pathogens increased under NT and MT, as a result of superficial residue retention. Mycorrhizal abundance was influenced by both tillage and CCs, with arbuscular mycorrhiza being enhanced under NT and fallow. Among prokaryotes, Gram-positive, oligotrophic and environmentally stress-resistant bacteria were significantly enriched with increasing tillage intensity, showing negative correlations with SOC, microbial biomass, enzymatic activity and aggregation. Nitrososphaeraceae archaea were more abundant in NT, potentially contributing to soil nitrification. Co-occurrence networks revealed greater complexity and interconnectivity under NT and advanced CC, suggesting more stable and resilient microbial communities. Furthermore, average yields over 18 years were comparable across tillage treatments, whereas net revenues were highest under NT. Overall, NT proved to be the most effective strategy for enhancing soil health and addressing the pressing challenges of global change and food security.

Oral presentation

Accounting of regional N_2O emissions from agricultural soils under different Tiers, an example from Austria

Cecilie Birgitte Foldal [a, b,*]; Regine Maier [b,1]; Bettina Schwarzl[c]; Barbara Amon[d,2]; Edwin Haas [e]; David Kraus [e]; Barbara Kitzler[a] & Sophie Zechmeister-Boltenstern[b]

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Abstract:

Nitrous oxide (N_2O), a potent greenhouse gas, is a key target under both the Kyoto Protocol and the Paris Agreement, under which Austria is committed to reporting its national greenhouse gas inventory (NIR). The Intergovernmental Panel on Climate Change (IPCC) provides guidelines for estimating soil N_2O emissions from agricultural soils and encourages countries to apply the highest Tier possible in their assessments. This study compares the approaches currently used in the Austrian NIR (Tier 1 and Tier 2) with those derived from a Tier 3 process-based model, LandscapeDNDC. The analysis focuses on six representative agricultural regions, using identical assumptions for land use, crop types, and management practices across both approaches. The results reveal opposing patterns: Tier 1/Tier 2 estimate significantly higher N_2O emissions from cropland soils, while Tier 3 simulates higher emissions from intensively managed grassland. Crop residues emerged as a key factor explaining these differences. The simulations also indicate that the drivers of N_2O emissions differ by land use type. In croplands, chemical and physical soil properties are the dominant factors, whereas in grasslands, nitrogen fertiliser application is the primary driver of annual N_2O emissions. Despite their divergent results, both approaches are supported by international scientific literature. These findings suggest that integrating Tier 3 modelling into national inventories - or enhancing Tier 2 approaches with regionally specific parameters—could substantially improve the accuracy of GHG reporting and support more effective mitigation strategies.

Oral Presentation

N_2O emission changes by SOC sequestration practices in European croplands: a climate-change mitigation trade-off?

Ulises R. Esparza-Robles[1*], R. Porre[2], L. Martinez-Garcia[2,3], J.P. Lesschen[2], Eugenio Díaz-Pinés[1]

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Abstract:

Promoting soil organic carbon (SOC) storage via agricultural management can contribute to climate change mitigation. However, management practices that increase SOC stocks may also have an impact on other GHG emissions, especially on N_2O emissions due to the higher energy source for bacteria responsible for denitrification. This study aims to quantitatively assess different agricultural SOC-sequestration measures on soil N_2O emissions and to evaluate their net effectiveness on GHG-mitigation effects. For each of the main SOC sequestration practice, we executed a separate search in Web of Science and selected the studies that fulfilled the following criteria: studies conducted in Europe or in areas with climate conditions present in Europe reporting N_2O field measurements, comparing cumulative emissions of a control to the treatment, conducted in mineral soils with a defined period and reporting standard deviation. The overall effect for each practice on N_2O fluxes is reported using the Response Ratio. Overall, we addressed eight general categories and about 15 specific soil management practices. Practices with a trade-off risk (i.e., increasing N_2O emissions while increasing SOC) were cover crops and the incorporation of green crop residues, whereas the practices with a confident synergy are biochar and agroforestry. Organic amendments, mature crop residues, irrigation and reduced tillage showed tendencies to increase the N_2O emissions but not significantly different from zero. We observed a lack of research data specifically on livestock manure and irrigation due to the relatively low number of comparative studies on N_2O. The overall mitigation off-set risk of SOC sequestration practices by N_2O emissions appears very low. Although some SOC sequestration measures might increase N_2O emissions, these risks can also be minimized by specific management, for example, by managing timing for organic amendment application or cover crop species selection.

Oral Presentation

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

Rebecca Hood-Nowotny[1], Constantin Müller[1*], Maria V. Rechberger[1], Christian Zafiu[2], Franz Zehetner[1], Elisabeth Ziss[1]

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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 was to determine the level of both common heavy metal (HM) contaminants such as As, Cu, Pb, Cd, Zn as well as microplastics (MP) in the soil to ensure a safe gardening environment. The soil was analysed via both *aqua regia* and 1M NH_4NO_3 extraction. In addition, radishes were planted in the 10 gardens to determine the transfer of heavy metals into plant biomass. The amount of MP was determined with a combination of optical identification and attenuated total reflection infrared (ATR-IR) spectroscopy. To determine the MP for the fraction below 500µm down to 20µm size an infrared microscopy analysis was applied. The amount of As and Cd did not exceed current thresholds, while elevated levels of Pb (up to 759 mg/kg) and Cu (up to 230 mg/kg) were found in *aqua regia* extracts of some of the gardens. We did not see a significant transfer of these elements into plant biomass and the extraction with 1M NH_4NO_3 also indicated low levels of mobility for the analysed elements. The elevated HM levels could be explained by previous industrial use of the area before being transformed into community gardens. On average, 84 MP particles per kg dry mass for the fraction 5mm-500µm were determined, with the highest amount being 176 particles per kg dry mass and one sample where no particles were found.

Oral Presentation

Soil compaction effects on the abundance, dynamics and characteristics of fine roots in forest soils

Lisa Gasser[1*], Douglas Godbold[1,2], Klaus Katzensteiner[1], Hans Sandén[1], Boris Rewald[2]

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Abstract:

Logging-induced soil compaction poses a significant threat to essential soil habitat functions, particularly affecting tree root systems. A comprehensive understanding of these impacts is essential for sustainable forest management, given that intact forest ecosystems play a vital part in mitigating and adapting to climate change. However, persistent knowledge gaps highlight the need for comparative assessments of harvesting techniques and high-resolution spatial analyses. To gain a detailed insight into these complex relationships, we conducted a Before-After Control-Impact study in a beech-dominated forest in Lower Austria. Different harvesting methods (harvester-forwarder and cable-yarding with motor-manual-felling), were applied in the winter 2022/23, taking into account previous harvests (19 years earlier). Our study used a transect approach to determine spatially explicit effects on standing root biomass and growth rates by using soil cores and in-growth cores, respectively. Transects were placed transversely across the tracks, covering areas that were directly (tracks and skid marks) or indirectly (between the wheels and in marginal areas) affected by logging activities. Comprehensive analyses of root biomass distribution and morphological traits were performed. Preliminary results reveal the significant impact of recent and historical timber harvesting on standing root biomass, suggesting long-term changes in belowground biomass allocation and root system structure. Our results indicate that different harvesting methods cause widely varying degrees and patterns of soil compaction – with contrasting effects on fine root dynamics. The long-lasting effects of soil compaction, especially its negative impact on root development and function, emphasise the importance of preserving the physical integrity of the soil. The outcomes of this study emphasise the necessity of forest management strategies that minimise soil disturbance. These strategies are essential for preserving the long-term viability of soil as a habitat for plant roots, thereby enhancing forest resilience and supporting broader climate mitigation objectives.

Oral Presentation

Comparison of the phenology models PHENIPS and PHENIPS-Clim for modelling spruce bark beetle development to trap monitoring data in Saxony (Germany)

Sophie Mutze, Sigrid Netherer

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Abstract:

Accompanied by extreme weather events, climate change is causing stressed and unstable forest stands, which are more susceptible to forest insect pests. Higher temperatures and drought are contributing to the development of large-scale, increasingly frequent outbreaks of the Eurasian spruce bark beetle, *Ips typographus*.

In order to surveille population densities, a network of monitoring sites has been established in Saxony since 1991. Traps equipped with pheromones are emptied weekly and beetle abundance is determined. In this bachelor thesis, the phenology models PHENIPS and the advanced PHENIPS-Clim were used to calculate the start of swarming, swarming days, generation numbers and sister broods, as well as the onset of diapause (i.e. stop of reproduction in fall). The deviations of the two model versions were calculated and the correspondence of model predictions with the observed fluctuations in trap catches was determined.

While PHENIPS sets fixed dates for calculating the start and end of the swarming period, PHENIPS-Clim predicts these thresholds in a more flexible way, using the available daily climate data from the German Weather Service also before April. This means that early swarming beetles (e.g. in March) and late established generations (e.g. in September) are not neglected. Although temperature and solar radiation are not the only influencing factors, they are the most important input data for the models, which were calculated using the R-package `barrks'.

The period of the investigations is 2015-2024. 15 trap sites were selected via an altitudinal gradient, which represent the occurrence of Norway spruce well and were operated for as many years as possible during the observation period.

This work is intended to deliver data for the development of proposals for action in bark beetle management for the use of phenology models and in the forest stands of Saxony.

Oral Presentation

Shades of Gray: Analyzing the Evolution of Soil Carbon Topics in gray literature during the past two decades

Martina Kittinger[1*], Sophie Zechmeister-Boltenstern[1], Rajasekaran Murugan[1]

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Abstract:

The interest in agricultural soils as a tool for climate mitigation strategies is increasing all over the world and triggered a rapid increase in research on soil carbon issues in recent years. Additionally, gray literature can offer valuable information often prior to peer reviewed publications. This study aims to (i) compile an inventory of gray literature relevant to soil carbon and (ii) analyze the evolution of research concepts, thematic trends, and co-occurrence patterns across European agroecosystems over the past two decades. We employed topic modeling to examine approximately 1,000 publicly available documents published between 2000 and 2023 by more than 30 European initiatives. Reports were the most prevalent document type published (54%), followed by action plans and syntheses. A total of 43 keywords were categorized into five carbon concepts such as `soil carbon´, carbon fraction`, `carbon mechanisms´, `soil health´ and `carbon farming´. The predominant concept found in scientific literature is `soil health´, the least addressed is `carbon farming´. Within gray literature the most dominant concept is `soil carbon´, the least `carbon fraction´. Temporal analysis showed a shift in focus: in 2000, `soil carbon´ (with keywords such as `organic matter´, `carbon stock´ and `carbon storage´) was predominant, while by 2023, soil health (with terms like `fertility´, `ecosystem service´ and `soil biodiversity´) took precedence. With regard to the appearance of single keywords within the documents large variations occur e.g. `soil health´ from <14% (2000-2010) to over 82% in 2023. Overall, our analysis highlights the changing trends in soil carbon research with the `soil health´ concept dominating over the last 10 years but understanding mechanisms and fractions of soil organic carbon as such is still far from becoming a mainstream topic.

Oral Presentation

Bioassays to test for host choice of the spruce bark beetle (Ips typographus) depending on stand age, nutritional quality and water supply of Norway spruce (Picea abies)

Felix Thaler*, Sigrid Netherer, Sabine Rosner

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[2] Institute of Botany, Department of Integrative Biology and Biodiversity Research, University of Natural Resources and Life Sciences Vienna (BOKU), Vienna, Austria

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Abstract:

Ips typographus (Coleoptera: Curculionidae: Scolitinae), the Eurasian spruce bark beetle, is the most important biotic disturbance factor in Norway spruce stands. Monocultures outside their potential natural distribution are particularly predisposed to abiotic damages, making them even more susceptible to secondary infestations by bark beetles. Drought stress of forest stands can trigger the shift from an endemic to an epidemic infestation phase. The extent to which different bark constituents and hydrological parameters influence host selection and breeding success is still not completely understood and was investigated in this study.

Secondary spruce stands in a district of the Austrian Federal Forests (ÖBf) served as the study area. Bark samples from three stands of different ages (Df = 41, A = 51, Alt = 70 years) were collected on three dates over the course of the season (June, August, September) and analysed regarding their constituents (C, N, non-structural carbohydrates NSCs). At each stand two soil moisture sensors were installed to monitor the volumetric soil water content. In addition, the relative water content in the bark of the study trees was determined. Bark samples of the trees were tested in Petri dish arenas for host selection and stem samples for breeding success in brood cages at 20 °C under long-day conditions (16:8, L:D).

No significant difference in the C/N ratios per stand variant between the sampling dates was found and C and N proportions remained relatively stable over the season. The sugar contents of stand A differed significantly from stand Alt at all sampling dates, but there was no significant difference between Df and A, or Df and Alt. Starch content decreased on average by 85 % across all stands from June to August and remained stable until September.
In the choice experiments, the chi-square tests showed no significant beetle preferences for certain stem samples, based on sampling date or water supply. Although more beetles tended to choose bark from older stands (25 to 15), this difference was not statistically significant.

Oral Presentation

Ecology of the fungal community of *Ips acuminatus* and suitability of different host trees to this bark beetle species

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Abstract:

The pine bark beetle *Ips acuminatus* has an increasing negative impact on pine-dominated forests throughout Europe. Severe drought events and warm conditions have been linked to high beetle densities and increased mortality of Scots pine (*Pinus sylvestris*). *Ips acuminatus* exhibits a phloeomycetophagous lifestyle, feeding on both phloem and fungal structures growing in its breeding systems. It is associated with several ophiostomatoid fungi, such as *Ophiostoma macrosporum*, which serves for nutrition of larvae and young adults and is vertically transmitted by females via an oral mycetangium. These fungi lead to rapid blue-staining of the sapwood adjacent to galleries; yet, the principal agents of blue-stain remain unclear. The beetles predominantly colonise stressed Scots pines, but they can also infest other conifers, including the non-native Douglas-fir (*Pseudotsuga menziesii*). The aims of the present master thesis were the examination of relationships between *I. acuminatus* and its fungal associates as well as the suitability of three host species, *P. sylvestris*, *P. nigra* (Austrian pine) and *Ps. menziesii*, for breeding. The temporal and spatial succession of fungi in the phloem and into the sapwood beneath the insect's breeding systems was studied during a period of seven weeks following artificial infestation of *P. sylvestris* stem sections. Here, four fungi, *Graphilbum acuminatum*, *Ophiostoma canum*, *O. clavatum* and *O. macrosporum* were frequently isolated. Likewise, the attractiveness of two specific fungal associates of *I. acuminatus*, *O. macrosporum* and *O. clavatum*, and the pine pathogen *Diplodia sapinea* to male beetles was assessed through Petri dish choice experiments, allowing to evaluate the insects' behavioural responses. Moreover, Cafeteria experiments in the laboratory showed that *P. sylvestris* is most suitable for the development of *I. acuminatus*, while breeding success was low on *P. nigra* and *Ps. menziesii*. In summary, this thesis has increased knowledge on the ecology of *I. acuminatus* and its interactions with ophiostomatoid fungi.

Oral Presentation

LaDiWaldi - A big step towards laser-based digital forest inventory

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Abstract:

The LaDiWaldi research project aims to develop and evaluate innovative methods for large-scale, spatially explicit forest inventory and management by integrating traditional surveying with modern remote sensing technologies.

Test areas across the Austrian federal states of Styria, Carinthia, and Tyrol encompass a wide range of site conditions, forest structures, and ownership types. In a first step, terrestrial inventories were conducted on 589 sample plots using personal laser scanning (PLS), enabling the creation of detailed three-dimensional "digital twins" of sample plots. These digital models provide a high-resolution basis for estimating growing stock volume (GSV) and analysing stand structure. To model key forest attributes over larger areas, spatial Bayesian regression models were developed using airborne laser scanning (ALS) data and topographic variables. In addition to GSV, a multivariate model was implemented for the simultaneous prediction of basal area (BA), quadratic mean diameter (QMD), and stem density (N). Cross-validation demonstrated high predictive accuracy and low bias, with over 74% of GSV estimates for individual forest stands exhibiting a coefficient of variation below 25%. Based on these results, we developed an automated stand segmentation approach that integrates ALS and PLS data. This technique enhances the delineation of growth classes, particularly in structurally diverse forests. A variant relying solely on ALS data applies machine learning algorithms such as random forests to produce stand maps closely aligned with traditional inventory classifications. Furthermore, a free available mobile app ('Digitaler Waldhelfer') was developed in collaboration with project partners. Designed for use on low-cost devices (e.g., Apple iPhones), it integrates geospatial data, sample plot management, and 3D scanning, offering a practical tool for foresters in the field.

By combining digital forest models, spatial prediction tools, and mobile applications, LaDiWaldi marks a significant step towards more efficient, standardised, and reproducible forest inventory and management at regional scales.

Oral Presentation

Measurement of timber stacks on an individual log basis using LiDAR

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Abstract:

Accurate timber measurement is essential in forestry and the wood industry, as it forms the basis for invoicing. However, obtaining precise measurements before transporting timber to a sawmill remains challenging because of the inefficiency and error-prone nature of manual methods. Therefore, efficient and precise measurement techniques are required. This study explores the automated measurement of timber stacks using LiDAR and a novel algorithm to provide objective estimates of net stack volume and log parameters. Ten timber stacks (total volume 427.9 m³) were scanned using a terrestrial laser scanner (TLS), a personal laser scanner (PLS), and a tablet with a LiDAR-sensor. Log ends were identified from point clouds using machine-learning (random forest model), followed by spatial clustering and the circular Hough-Transform. Logs were virtually reconstructed by connecting corresponding log ends on both sides of each stack. Based on these reconstructions, three variants of mid-diameter (MD), log volume (LV), and net stack volume were calculated, with electronic sawmill measurements serving as reference values. Overall, the TLS performed best, with a detection rate of log ends of 98.9%, enabling the virtual reconstruction of 93.3% of logs. The best estimates of MD and LV from TLS data had an RMSE of 5.11% and 11.24% respectively and the mean difference of the total net volume ranged from 105.22% to 92.70% depending on the LV variant. This research has potential applications in preliminary timber volume estimation for forest owners and tracking timber flows across the supply chain.

Laser scan based forest road design and timber harvesting planning taking local geology into account

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Abstract:

Efficient forest road network is fundamental for the sustainable and economically viable management of forested areas. In Austria, easily accessible regions are largely developed, though leaving predominantly steep, topographically and geologically complex terrain that hinder profitable forest operations. This study focuses on a selected area within the Loferer Steinberge in the municipality of St. Ulrich am Pillersee, where such constraints significantly limit forest accessibility. With the help of modern digital planning tools, forest road planning for forestry management of the selected area is to be researched. Topographical and geological data will be taken into account from the beginning.

The objective is to develop and evaluate digital planning alternatives for forest road alignment using QGIS and RoadEng, supported by high-resolution LiDAR data. Key research questions address the efficiency of digital variant analysis, the creation of a permit-ready plan, the precise quantification of tree removal along the route, and the economic impact of improved accessibility.

Methodical, this master thesis includes three core phases: (1) a variant study, which relates to forest road planning based on digital terrain models (0.5 m resolution), including automated alignment generation, 3D optimization, and multi-criteria evaluation; (2) a comparative analysis of timber harvesting conditions before and after road construction, using GIS-based assessment of extraction distances and slope gradients; and (3) the detailed design of the selected route, integrating geological stability analyses, earthwork volume optimization, and planning of drainage and timber storage infrastructure.

This study contributes a practical example of how digital tools can enhance forest road and harvesting planning in difficult terrain. It emphasizes the value of incorporating geological assessments early in the process and demonstrates how data-driven methods can support both technical feasibility and economic decision-making in forestry.

Oral Presentation

Estimation of tree centroids based on terrestrial laser scan data

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Abstract:

Timber harvesting is among the most dangerous activities in forest management, causing many fatal accidents annually. Incorrect determination of tree felling direction and inclination significantly contributes to such accidents. Accurate predictions of felling direction allow controlled tree felling, protecting residual stands and natural regeneration, and preventing accidents. Although precise estimation of tree inclination requires expertise and experience, human error cannot be entirely eliminated. Therefore, innovative technologies, such as laser scanning, offer critical support in planning timber harvesting, reducing misjudgement risks. Terrestrial Laser Scanning (TLS) effectively visualizes scanned trees in detail. In our study, several stationary scans were conducted for 52 oak trees, producing individual point clouds representing digital twins. Quantitative Structural Models (QSM), particularly the reliable "TreeQSM" algorithm integrated into MATLAB, reconstruct tree structures from these point clouds. This algorithm models tree segments with cylinders matching their actual diameters. The statistical software R queries coordinates and radii of these cylinders, calculating their centres by averaging start and end coordinates. Lever arm distances and cylinder volumes are computed, allowing weight calculations for each cylinder considering relative density. These calculations provide the actual tree centroid position through the sum of individual cylinder resultants. This novel method precisely determines tree inclination and the force necessary for controlled felling. Selecting appropriate felling directions significantly impacts harvesting productivity and remaining stand conditions. Careful planning of felling layouts, supported by accurate inclination data, enhances cost-efficiency and worker safety. To validate this method's practicality, computational results were compared with forestry workers' estimations, confirming its effectiveness.

Oral Presentation

Tracking and tracing in the timber supply chain: State of the art and case studies

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Abstract:

The importance of tracking and tracing in the timber supply chain is steadily increasing and research on this topic is essential for the continued success. Illegal logging and timber trade are problems that can be addressed in the forest and timber industry supply chain and the digital transformation of timber tracking and tracing has the potential to contribute to the resolution of these issues. They can enhance supply chain efficiency and safety. The innovative method of remote sensing-based RFID tree marking for timber harvesting was tested and compared to standard tree marking. Case studies were conducted on a study site near the village of Annaberg im Lammertal in the Austrian province of Salzburg where the timber was tracked in a mountain forest supply chain by integrating RFID technology with digital survey tools and intelligent machines. The utilisation was successfully demonstrated to be a viable method, exhibiting numerous advantages such as in-depth forest information, passing on the information along the entire supply chain and using the data to enhance efficiency, guarantee safety and add value. However, the endeavour required a considerable investment of effort and financial resources and further improvement of the intelligent processor prototype is required before its market introduction. Consequently, there is a clear necessity for further refinement, with a particular focus on the reduction of survey costs. A systematic literature review of timber tracking and tracing in the forest and timber industry supply chain, focussing on recent decades, was also performed to ascertain the current state of the art in this research field. The review revealed that combating illegal logging and trade was the main driver for research in the field of timber tracking and tracing.

Oral presentation

Shifts in nitrogen transformations in response to long-term organic vs. mineral fertilisation in an alpine grassland soil

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Abstract:

Organic fertilisers including farmyard and liquid manure supply organic matter and nutrients to grassland soils, with potential benefits for organic carbon (C) storage, soil fertility and ultimately, productivity. However, these benefits may be partially offset by shifts in nitrogen (N) turnover and associated emissions of nitrous oxide (N_2O), a potent greenhouse gas, contributing to climate change. Here, we investigated long-term fertilisation effects on N transformations and N_2O emissions from a pre-alpine grassland in Raumberg-Gumpenstein, Austria, subjected to organic (ORG), mineral (NPK), or no fertilization (NIL) since 1971.

Combining the ^{15}N pool dilution and the ^{15}N gas flux method enabled to quantify gross rates of mineralisation, nitrification and dissimilatory nitrate reduction to ammonium (DNRA), together with N_2O production and the reduction to environmentally benign dinitrogen (N_2) using a fully automated incubation setup coupled to a Picarro G5131-i analyser and ^{15}N gas and solids analysis via isotope ratio mass spectrometry.

Long term ORG fertilisation increased soil pH compared to NPK, and increased soil organic C, yet these changes did not affect N_2O emissions, with no significant differences across treatments. Gross mineralisation and nitrification rates but also DNRA increased in ORG vs. NPK, while remaining similar in NIL compared to NPK.

The lack of treatment effect on N_2O emissions despite increased N turnover treatment indicates no increased N_2O emission potential under ORG and may be explained by increased reduction of N_2O to N_2. Gross transformation rates denote increased N turnover under ORG but also highlight increased retention of N via DNRA. Similar turnover between NPK and NIL indicate the potential for soil N mining, as exported N is not replaced. Further ^{15}N analysis will reveal potential effects of long-term fertilisation on the N_2O:N_2 ratio, defining the environmental significance (N_2O) and overall gaseous loss potential (N_2+N_2O) via this pathway in alpine grassland soils.

Oral Presentation

Effects of seasonal food quality of host and non-host plants on the performance of the oak lace bug *Corythucha arcuata* (Het., Tingidae)

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Abstract:

The oak lace bug (OLB) *Corythucha arcuata* (Heteroptera: Tingidae), originating from North America, was introduced to Europe (Italy) in 2000 and first recorded in Austria in 2019. Since then, the species has spread rapidly across the eastern regions of our country and attracted public attention in recent years due to massive damage to oak trees caused by nymphs and adults that suck the palisade parenchyma cells from the underside of the leaves.

All oaks (*Quercus* spp.) native to Central Europe are suitable hosts for the OLB. Mature nymphs and adults have also been observed feeding on tree species other than oak, such as European beech, *Fagus sylvatica*, and hornbeam, *Carpinus betulus*. In laboratory experiments, we documented the development, mortality and oviposition preference of the OLB on five tree species (*Q. petraea*, *Q. cerris*, *Q. rubra*, *C. betulus, F. sylvatica*) in relation to leaf age. OLB egg clusters and leaves were collected in early July, August, and September 2024 from trees in a mixed oak forest in Burgenland (Klingenbach). Immature and adult OLB were cultured on leaves in Petri dishes in a climate chamber at constant 23°C and long day photoperiod. In addition, we conducted experiments on host choice of female OLB and analyzed primary and secondary leaf compounds (carbohydrates, starch, protein, tannins, phenolics).

The total development time (neonate nymphs to adults) was significantly longer on leaves of *Q. petraea* collected in August than on leaves collected in July. The development time on *Q. cerris* leaves was longer than on *Q. petraea* leaves collected in July, but shorter than on *Q. petraea* leaves collected in August. Nymph mortality was slightly higher on *Q. cerris* leaves than on leaves of *Q. petraea*, regardless of leaf age.

On leaves of *Q. rubra*, *C. betulus* and *F. sylvatica*, nymph mortality was 100 %. Mature nymphs and adults transferred to leaves of these species survived for some time. However, oviposition was only observed on leaves of *Q. petraea* and *Q. cerris*, and adult females showed a clear preference for both tree species in the host choice experiments. Our results suggest that OLB may use leaves of *Q. rubra*, *C. betulus* and *F. sylvatica* as alternative food plants when suitable oak trees are not available, but the insect cannot develop successfully on these tree species.

Oral Presentation

Scaling the climate sensitivity of radial growth of oaks along a regional climatic gradient

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Abstract:

Tree-rings provide the longest available quantitative records of tree and forest growth conditions at a high, annual resolution. Sampling designs of dendroecological studies are typically planned for local representativity, without systematic data collection at larger spatial scale. The integration of different sampling schemes may, however, facilitate the upscaling of findings and better align with the information needs of forest planning.

This study tested the transferability of statistical models of the climate sensitivity of radial growth of oaks between two complementing sampling schemes, for two consecutive 30-year periods. The analyses were based on 665 increment core-samples of *Quercus petraea/robur* collected at 520 "extensive" sites and additional *Q. petraea* samples from seven "intensive" sites, each with a replication of 15 trees. Both sampling schemes spanned along the entire climatic range of *Q. petraea* in Austria, approaching also the xeric edge of its distribution.

The climate sensitivity of radial growth was found to be mainly driven by the climatic water balance along the shifting climatic gradient over the two 30-year periods. The performance of the regression models on the complementing datasets indicated that the main patterns of climate sensitivity can be well-captured by the different sampling schemes. The single-tree intra-population variability of climate sensitivity at the "intensive" sites was also comparable in its magnitude to the variability among the "extensive" sites under similar climatic conditions.

The results indicated that the main spatiotemporal patterns of the response of radial growth to the climatic drivers allow for space-for-time projections under shifting conditions in a regional context. A better understanding of the intra-population variability was found to be a crucial aspect to the interpretation of dendroecological findings. Potential non-linear effects, in relation to the changing frequency and severity of droughts, may require further attention.

Oral Presentation

Microplastics in Austrian Agricultural Soils: Linking Environmental Conditions and Farming Practices

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Abstract:

Microplastics are considered emerging contaminants being a trend topic in soil pollution research. Plastics are resilient and its persistence in the soil environment poses a threat towards the functioning of soil ecosystems. This study aims to investigate the extent and characteristics of plastic contamination in agricultural soils across two Austrian agricultural production regions (Marchfeld and Alpenvorland). Furthermore, the relationships of plastics with environmental factors and farming practices are explored. In this study, a total of 21 farms were selected, 11 in Marchfeld and 10 in Alpenvorland. From each farm, two fields were sampled at 0-10 cm depth. Soil samples were analysed for soil parameters (pH, plant available P and K, TOC and soil texture) and soil plastic visual analysis with a stereomicroscope (particles >1 mm). Polymer shape identification was also conducted. Moreover, four questionnaires were conducted with farmers to gather information on their agricultural practices. Meteorological data will be extracted from Geosphere database, and distance to roads and artificial surfaces will be measured in QGIS using Austrian land use maps. To identify trends and correlations, a principal component analysis will be performed. Plastic particles were found in 18.2 % of the fields in Marchfeld and in 60 % of the fields in Alpenvorland, with field-level abundances ranging from 0 to 13 particles per kg. Films were the dominant shape found. Data collected from the questionnaires showed that organic farming was practiced on 80% of Marchfeld fields and 50% in Alpenvorland. Cereal crops dominated 30% of fields in Marchfeld and 50% of fields in Alpenvorland, followed by vegetables with 30% and 35% of fields respectively. Overall, more visible plastic was detected in Alpenvorland, suggesting regional differences in plastic input and retention.

Oral Presentation

Title of Presentation: The Influence of Microplastic Contamination on Soil Health and Microbial Properties in Urban Soils

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Abstract:

Microplastic (MP) contamination is a growing environmental concern, particularly in terrestrial ecosystems, as MP can act as a long-term source of contaminants. Especially in urban and agricultural areas like urban gardens used for food production, MPs can originate from diverse sources such as tire wear, litter, agricultural films, and paint. Current knowledge regarding MP characteristics and their ecological impacts in these specific urban soil environments remains limited.

This research addresses these gaps by investigating the extent and effects of MP contamination in soils from 15 urban soils and community gardens. The objectives are to: 1) quantify the influence of MP on soil microbial biomass, growth and respiration, 2) evaluate effects on key soil enzyme activities and their individual favored nutrient acquisition, and 3) assess MP abundance, polymer type, size, and morphology in relation to urban soil types and presumed input sources.

For MP extraction, soil samples will be treated by a combination of sieving and density separation techniques, dissolution of carbonates, organic material and ironoxides with potential adaptations for dense polymers such as paint residues. MPs will be quantified (e.g., particles kg^{-1} dry soil) and characterized, with particles < 2 mm identified via optical microscopy and Fourier-Transformed Infrared Spectroscopy (FTIR). Simultaneously, microbial biomass carbon (C_{mic}), nitrogen (N_{mic}), microbial respiration, and enzymatic activities will be assessed as indicators of soil health. Multivariate statistical analyses will explore correlations between MP properties, pollution sources, and biological soil responses.

This study will generate crucial data on MP contamination in urban garden soils and provide empirical evidence of impacts on vital soil biological processes. Findings will advance scientific understanding, inform local soil management, and underscore the need for risk mitigation in urban food production. In the long term, the study can contribute to the development of remediation measures and political framework conditions for urban soil protection.

Poster

Root trait adaptation under drought for resilient cropping systems: Insights from two faba bean genotypes grown in different soils

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Abstract:

Grain legumes, such as faba beans (*Vicia faba*), are core crops contributing to global food security and are becoming increasingly significant amid the growing global shift toward plant-based protein sources. Drought stress significantly threatens legume productivity, adversely affecting yield, nutrient content, and overall agricultural sustainability. While root morphology is recognized for its role in drought adaptation, the influence of root exudation, a key trait shaping plant-soil interactions remains less understood, particularly across different soil environments and plant genotypes.

This study investigated drought-induced changes in root traits and exudate composition in two faba bean genotypes (*Zoran* and *Lynx*) grown in transparent acrylic columns filled with three soils from distinct agroclimatic zones: Bullionfield (UK), Arvalis (France), and Ptuj (Slovenia). Plants were grown under both optimal and limited water conditions for 21 days. Before harvest, root exudates were collected using the soil-hydroponic-hybrid approach. Biomass, shoot nutrient concentrations, root morphology (WinRhizo), as well as key root exudate compound classes were determined, including total carbon and nitrogen, sugars, amino acids, and phenolic compounds.

Our findings show a significant reduction in shoot biomass under drought across all soil types and genotypes, while root biomass exhibited a smaller, soil-dependent decline. Drought significantly increased total carbon (C) exudation rates in both genotypes, along with higher levels of amino acids, phenolic compounds, and soluble carbohydrates. Multivariate analyses (PERMANOVA, PCA) revealed that drought is the most significant factor driving variation in root exudate composition, followed by soil type and plant genotype. Our results suggest a possible adaptive shift in drought-stressed plants towards increased root exudation, potentially as a stress-mitigation strategy, whereas optimal conditions favoured biomass growth.

These findings highlight the complex interplay between drought stress, soil environment, and plant genotype in shaping root exudation patterns, emphasizing the need to further explore their role in legume resilience and agricultural sustainability.

Poster

Development of peat alternatives from agricultural and food industry by-products.

Development of peat alternatives from agricultural and food industry by-products.

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Abstract:

Peats form when the accumulation of organic matter is greater than decomposition rates. Peats are physically characterized for their composition of partially decomposed organic material, high water holding capacity and low bulk density. Chemically and biologically peat offers desirable qualities as a growing medium for multiple reasons including low nutrient availability while retaining high cation exchange capacity (CEC), low pH and rich in organic matter. However, while peat is highly sought after as a growing medium and its formation is a process which takes a long time; approximately at a rate of 1mm a year. Furthermore, currently the European Union has launched several initiatives that aim at the reduction of peat extraction. Circular food systems are systems which incorporate the use of by-products and waste into a circular economy aiming to decrease waste as well as fomenting the decentralization of certain resources such as growing substrates. The use of a mixture of both composted and intact by-products of the agricultural and food industry shows potential for the development of a substrate that could match the properties found in peat. Materials such as composted barks, composted straw (e.g. maize), residue of biogas production, wood fibres, coco choir, etc. show potential as key elements in devising a peat substitute that could be used as a growing medium. While these materials are renewable their heterogeneity and lack of uniformity throughout their production is still a problem that growers face. In this thesis, different agricultural and food industry by-products (e.g. biogas digestates, crop residues, etc.) will be used in mixtures, with or without transformation (e.g. composting), with the objective of mimicking the physical and chemical properties of peat when used as a growing medium.

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

The effects of different tillage regimes on soil microbial activity and the carbon pool. Examined on a long-term trial in Hollabrunn, Lower Austria.

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Abstract:

Tillage practices and cover crops are expected to influence the soil carbon dynamics. While carbon plays an important role in soil fertility, structure and resilience, the amount, diversity and activity of the soil microbial life is governing the soil nutrient dynamics. By focusing on microbial properties, this study tried to generate a better understanding of tillage-derived responses and about the relevance of cover crops.

In this study we´ve investigated the effects of four different long term tillage regimes (conventional > reduced > minimized > no-till) after 17 years and three different cover crops (standard, fallow, diverse) on a sandy loam. Samples were taken in 0-15 and 15-30 cm soil depths in October, after the harvest of maize and before sowing of winter wheat.

Total carbon and total organic carbon were found to be similar among all treatments while total nitrogen turned out to be 15% higher in minimum tillage (MT) than in conventional tillage (CT). The upper soil layers of all treatments, except CT, had higher total organic carbon contents than the 15-30 cm horizon. Labile and stable carbon increased from conventional to reduced tillage (RT) by 25% and 79% but not in no tillage (NT). Microbial carbon did not respond to the tillage regimes, while microbial nitrogen increased with decreasing tillage intensity. Potential extracellular enzyme activities responded with increased activities in RT, MT and NT. Carbon use efficiency was found to be highest in RT and correlated strongly (r=0.88) with the bacterial growth rates. The diverse cover crops increased the total carbon contents of all treatments but did not influence other factors significantly.

Overall, this suggests: In the less intensive tillage regimes the microbial community shifts towards being more bacterial dominated. It has higher nutrient cycling activities and a higher carbon sequestration potential.

Poster

Stability of carbon from methane pyrolysis in soils

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Abstract:

Soil is the largest terrestrial pool of organic carbon globally and contains 1500 PgC in the first meter, which represent more than in the atmosphere (700 PgC) and plant biomass (500 PgC) combined. The amount of carbon stored in terrestrial ecosystems has made it an important part of the global carbon cycle. Soil organic carbon (SOC) additionally plays a crucial role in maintaining soil fertility. In the context of climate change, modelling the dynamics of SOC stocks can help estimate the effect of sustainable management practices on greenhouse gas emissions. However, conventional crop management practices in the agricultural sector have led to a decrease of SOC. While the application of biochar as a sustainable soil management strategy to sequester carbon is well established, carbon derived from methane pyrolysis (CMP) represents an innovative approach with key potential for enhancing the long-term stability of carbon sequestered in croplands. In this study, the effects of soil amendments (biochar and CMP at concentrations of 1%, 2.5%, and 5%) on soil respiration were studied over a four-month period, based on greenhouse gas flux measurements, using the automated soil CO_2 flux system LI-8100A. The preliminary results indicate that CMP is substantially more stable than biochar, demonstrating its potential for long-term stability in soil. Four process-based carbon models: the AMG model, the Introductory Carbon Balance Model (ICBM), C-TOOL, and the Rothamsted Carbon Turnover Model (RothC), were used to simulate and predict the SOC stock dynamics and to calibrate amendment decay rates. The model performance was evaluated with the root mean squared error (RMSE); ICBM provided the best prediction (RMSE = 2.13). Furthermore, the carbon models were applied to analyse the impacts of climate change, estimate the stability of the applied carbon amendments and sensitivity analyses were used to help guide future research focuses.

Poster

Detection and Quantification of natural Regeneration with a Personal-Laser-Scanner

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Abstract:

Forest regeneration is a new frontier for the implementation of LiDAR (Light detection and ranging) in forest inventories. Ground-based LiDAR could be an effective tool for detecting and quantifying forest regeneration. The aim of this study is to test the use of Personal-Laser-Scanners (PLS) for this purpose. 19 sample-plots were scanned once with a GeoSLAM PLS and once with a high-resolution Terrestrial-Laser-Scanner (TLS), after which an on-site canopy estimation and a manual measurement of the regeneration coverage from the TLS point clouds was performed for reference purposes. The PLS-point clouds were rasterised into surface-models and voxel-density-models which then were processed using 5 different combinations of algorithmic methods to find potential treetops from which to segment crown areas. The resulting regeneration coverages were compared to the manually processed TLS-point-clouds as well as on-site estimates. The results show, that two of the algorithmic methods we tested have lower variance and achieve a more precise estimation of the regeneration coverage than the visual estimation. While the visual estimation had a deviation between -18.5 and +29.9%, the two LiDAR-based methods deviated only between -9.1 and +12.3% from the reference, showing a much higher correlation with the reference (R^2=0.94 and 0.85, compared to 0.66 for the visual estimation). This shows that automated processing of PLS-point clouds is an effective way to estimate regeneration coverage and there is a need for further research to implement the methodology in forest monitoring practice.

Poster

Protective forest undergoing change – analysis of pine dieback and forestry measures on Silbersberg

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Abstract:

Introduction: This study examines the phenomenon of pine dieback and the associated classification of land cover types at Silbersberg in Lower Austria. Due to prolonged drought, wildfires, and pests, the forest in this region has suffered significant losses, jeopardizing its protective function. The aim is to analyse the distribution of tree species and pine mortality, thereby supporting a forestry project aimed at restoring the forests function.

Methodology: The analyse were conducted using drone data and remote sensing techniques. Multispectral imagery and UAV-based technologies were employed to determine land cover classes. The classification was performed using the Random Forest algorithm in RStudio software. Reference data were collected through field surveys; tree species identification was conducted based on personal expertise, and geolocation was carried out using a GPS device to optimize classification accuracy.

Results: The analysis of forest structure at Silbersberg revealed high classification accuracy for “deadwood on the ground” (PA: 84.21%) and “dying conifers” (PA: 74.36%), effectively capturing the extent of pine dieback. Distinguishing between healthy and dying pines proved challenging, particularly between black pines (PA: 57.5%) and white pines (PA: 47.37%), due to overlapping spectral characteristics. Broadleaf species such as oaks (PA: 27.5%) and ashes (PA: 28.21%) showed low classification accuracy, likely due to spectral similarities with other species. Variations in lighting, resolution, and topography further affected classification accuracy, especially in shaded and steep areas.

Conclusion: The study demonstrates that drone data combined with AI technologies such as the Random Forest algorithm is an effective tool for classifying land cover types. However, additional methods are necessary to improve classification accuracy for tree species with similar spectral characteristics. These findings are particularly relevant for forest monitoring and the management of protective forests.

Keywords: Pine dieback, drone data, land cover classification, Random Forest, UAV, protective forest, remote sensing, AI, biodiversity

Poster Presentation

Automated LiDAR based detection of bark stripping in forest stands

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Abstract:

Bark stripping represents a significant threat to forest health, leading to growth reductions, vulnerability to disease, and increased mortality in affected trees. Effective monitoring of bark damage is crucial for sustainable forest management, and digital methods-particularly LiDAR-based technologies-offer the potential for efficient, large-scale assessment.

The aim of this bachelor thesis is to develop methods for the automated detection of bark stripping wounds in forest stands. The primary objective is to integrate the detection process seamlessly into digital, LiDAR-based forest inventories, allowing for the assessment of bark damage alongside standard volume estimations. To achieve this, a suitable detection model must be identified and trained to process data collected through various scanning technologies.

Data acquisition was conducted using an Apple iPad, a personal laser scanner (XGrid Lixel L2), and a terrestrial laser scanner (Riegl VZ-600i) in designated sample plots within the Franz Mayr-Melnhof-Saurau forestry enterprise. Among these, the terrestrial laser scanner (TLS) was employed as the primary source for reference data due to its superior resolution. Bark stripping wounds were manually delineated from unwrapped stem scans in QGIS, forming the reference dataset for model training.

The detection models are anticipated to differ based on the scanning technology used, as each scanner type provides unique data attributes such as intensity, reflection, and RGB information in addition to LiDAR-based point clouds. The models will be trained to recognize bark stripping by correlating these attributes with the manually classified reference data. Plots without visible damage were also scanned to serve as control samples during model evaluation.

This approach aims to streamline the detection of bark stripping by embedding it into routine LiDAR-based forest assessments. By leveraging the same data collected for volume calculations, bark damage can be simultaneously identified without additional fieldwork. Thus, the proposed method represents a significant step toward fully digital, automated forest health monitoring, enhancing the efficiency and accuracy of large-scale forest inventories.

Poster Presentation

Development of Spatial Basal Area Increment Models Using Personal Laser Scanning Data from Managed Forest Stands

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Abstract:

An economically viable silvicultural management of forest stands requires targeted interventions to maximize the growth rate of individual trees. A key prerequisite is the timely and adequately release of crop trees.

Modern technologies such as Personal laser scanning (PLS) enable digital forest inventories, providing precise measurements of forest structures. In addition to traditional inventory data, PLS also captures the crown morphology of crop trees and surrounding competing vegetation. Based on these data, various growth models can be derived. However, such models have rarely been applied using PLS-based data.

The aim of this study is to develop species-specific, spatially basal area increment models derived from pseudo-temporal data. The core of the models is a system of equations describing individual tree growth as a function of competitive conditions. Based on these results, practical guidelines for thinning and releasing crop trees are developed, focusing on diameter growth as a key management target. Effect curves will illustrate the influence of competition on diameter increment. In particular, the impact of intensive crown release on tree growth is assessed and critically evaluated.

Data were collected using a PLS system (GeoSLAM ZEB Horizon) as part of a digital forest inventory. The study sites belong to the "Bestandeserziehung - Wertholz" demonstration plots continuously monitored by the Forest Service of Carinthia, Austria. In total, 23 plots dominated by *Quercus robur*, *Acer pseudoplatanus*, and *Betula pendula* were analysed.

The results are expected to demonstrate that PLS-based inventories are suitable for developing growth models and for precisely capturing the relationship between competition and tree growth. The derived management recommendations aim to support forest practitioners in optimizing stand development and promoting the diameter growth of crop trees.

Poster Presentation

Branch whorl detection in handheld laser scanner point clouds

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Abstract:

Branch whorls - circular arrangements of branches around the tree stem - are key morphological features used to assess growth patterns in forestry. Despite their relevance, detecting these structures in point clouds acquired with handheld laser scanners remains challenging due to irregular data quality, occlusion, and stem curvature. This study focuses on an automated method to identify branch whorls from terrestrial point cloud data collected under field conditions.

Our approach begins by segmenting the tree point cloud into horizontal slices of 10 cm thickness. For each slice, a circle-fitting algorithm estimates the stem's center and diameter. Using this information, points belonging to the stem are removed, isolating potential branches. The remaining points are then transformed into polar coordinates with respect to the estimated stem center. To identify individual branches, we apply the DBSCAN (Density-Based Spatial Clustering of Applications with Noise) algorithm, assuming that each cluster corresponds to one branch. A branch whorl is defined when the number of clusters within a single layer exceeds a given threshold. This method enables layer-by-layer classification of whorl presence throughout the tree stem.

The algorithm was evaluated using point cloud data from coniferous trees (norway spruce and silver fir) scanned in natural forest environments with a GeoSLAM ZEB Horizon handheld laser scanner. First results demonstrate a high detection rate of visually confirmed branch whorls, with robustness to noise and different stem diameters.

This work contributes a practical and scalable approach to tree structure analysis using consumer-grade scanning equipment. It supports improved forest inventory automation and facilitates downstream tasks such as growth modeling. Future research will aim to improve the detection rate even further by using more accurate circle fitting algorithms or potentially machine learning.

Poster

Leaf Area Index (LAI) in Urban Vegetation: A Comparison of Satellite Data with AccuPar Measurements

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Abstract:

The leaf area index (LAI) is an important variable for characterising vegetation surfaces, describing the one-sided leaf area relative to the ground area occupied by the tree. Furthermore, LAI is an important factor for deriving estimates of its ecosystem services such as light transmission, photosynthesis, leaf phenology and water and climate interactions. For urban tree species, limited data exist that accounts for urban-specific conditions. The LAI can be determined from remote sensing data (such as RGB images) and terrestrially using light measurement devices such as the AccuPar. The aim of this work is to measure the LAI for 20 specimens of each of three urban tree species in Vienna using the AccuPar model LP-80 and to compare these with freely available satellite image data. The tree species *Acer platanoides*, *Pinus nigra* and *Tilia cordata* were chosen because of their adaptability and tolerance to urban conditions they are considered resilient urban trees and they are representative species for the measurements due to their high frequency in Vienna. To determine the LAI from the remote sensing data, a formula was taken from existing literature. Based on the reflection of light in the visible (red) and near-infrared (NIR) spectral range, the Normalised Difference Vegetation Index (NDVI) and the LAI were calculated. A comparison of the results from terrestrial measurements with those from the image data, shows significant differences. LAI values obtained from terrestrial measurements are significantly lower than the values determined using the NDVI. This may be due to technical factors such as the resolution of the image data or the inaccuracy of the tree location data, as well as weather and lighting conditions. For more precise and representative statements on the LAI of urban trees, further research is needed to harmonise measurement methods and to take site-specific and seasonal influences into account.

Poster

Development of a spatial model for sustainability assessment of timber harvesting

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Sustainability, originating in 18th-century forestry to combat deforestation, is essential for preserving forest ecosystem functions like resource provision, habitat protection, and hazard mitigation. Timber harvesting should consider economic, ecological, and social aspects. However, only about 1% of studies examine all three dimensions together (Grünberg et al., 2023), despite the value of a holistic approach. Austria's alpine terrain presents specific harvesting challenges, making spatial planning crucial. This thesis investigates which spatial parameters influence sustainability, what data is available, and how such criteria can be implemented in GIS. A literature review identified key parameters, and the availability of spatial data was assessed using platforms like Open Government Data to evaluate their usefulness for harvest planning.

A total of 87 parameters influencing timber harvesting sustainability were identified, of which 35 were classified as spatially representable. In the economic dimension, the main spatial parameters included slope and shape at the terrain level, tree volume at the tree level, and extraction distance at the operational level. In the social dimension, slope and shape were the most frequently mentioned spatial parameters, while parameters at the tree or operational level were rarely addressed. In the ecological dimension, slope, soil type, and soil moisture were predominantly referenced at the terrain level. Other commonly mentioned parameters included distance to extraction lines and to driving tracks at the operational level.

The availability of spatial data varies between the parameters. Terrain parameters such as slope and shape can be found frequently in high resolutions and via various platforms (e.g. data.gv.at). Soil type and soil moisture can be obtained via various data sources as well. Forest inventory data is rarely available on GIS platforms but often available as internal data of forest enterprises. Operational parameters such as extraction distance, distance to extraction lines or distance to driving tracks depends on the individual forest operations. Data sources for those parameters are generally not freely available and needs to be acquired for individual stands.

Poster Presentation

Application of forest vegetation parameters extracted from PLS- (Personal Laser Scanning) and ALS- (Airborne Laser Scanning) point clouds for wall-to-wall modelling of the habitat preferences of red deer (*Cervus elaphus*).

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Abstract:

Laser scanning is a tool with increasing importance in forest inventory application to efficiently gather data on forest inventory plots and stands. In contrast to airborne laser scanning (ALS), personal laser scanning (PLS) also allows for gathering detailed information on the understory vegetation. Especially this vegetation layer and its structures are crucial for the habitat selection of forest-dwelling wildlife species. While the application of laser scanning systems has been increasing in the field of wildlife ecology, most projects only use ALS captures to assess large areas of interest, while understory vegetation is still mostly evaluated from time-consuming manual samples. In this thesis, it will be investigated whether data from a handheld PLS system in combination with ALS data is feasible to investigate the habitat preference of red deer in the Hohe Tauern National Park Salzburg. PLS recordings are taken on 100 sample plots. Tree positions, tree height, diameter at breast height, volume, and vegetation parameters (vegetation cover, vegetation density, leaf area density, biomass, height percentiles, …) are derived from the PLS point clouds. Different metrics (canopy cover, point density in the understory, height percentiles, …) are calculated from the ALS point clouds. These metrics are used to predict the parameters from the PLS samples on the entire research area with a random forest model. The modelled parameters are further used as explanatory variables in habitat models to predict the habitat preference of red deer. As a response variable data from red deer equipped with GPS will be used to estimate the probability and duration of stay via T-LoCoH (Time Local Convex Hull). Ultimately, it will be assessed which parameters derived from the PLS data are feasible for predicting the habitat preferences of red deer. Furthermore, maps depicting different estimated vegetation parameters and habitat maps for red deer will be produced.

Poster

Characteristics of leaf stomata of common ash genotypes tolerant and susceptible to ash dieback and growth of *Hymenoscyphus albidus* and *H. fraxineus* at various temperatures on artificial media

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Abstract:

Dieback of common ash (*Fraxinus excelsior*) is caused by the alien invasive fungus *Hymenoscyphus fraxineus* and poses a major threat to European forests. While susceptibility varies among *F. excelsior* clones, the Asian species *F. mandshurica* generally shows higher tolerance to the pathogen. The native, non-pathogenic *Hymenoscyphus albidus*, has largely disappeared, due to competition with *H. fraxineus*.

This master thesis had three main goals: (1) to assess differences in stomatal density and length among *F. excelsior* clones with varying susceptibility levels and between *F. excelsior* and *F. mandshurica*; (2) to investigate relationships between stomatal traits, leaf fall intensity, and ash dieback severity; and (3) to compare the growth of *H. fraxineus* and *H. albidus* isolates.

Stomatal traits were measured from leaf surface imprints (nail polish and adhesive tape) using transmitted-light microscopy and image analysis software. For assessing fungal growth, 12 isolates per species were transferred to ash leaf malt extract agar and incubated at seven temperature levels with 2.5 °C intervals (15 – 30 °C) for three weeks.

No significant differences in stomatal density or length were found between *F. excelsior* clones of varying susceptibility ($p > 0.05$). Likewise, stomatal traits of clones were not significantly correlated with ash dieback intensity ($p > 0.05$). However, leaf fall in September correlated negatively with stomatal density ($r = –0.4$, $p < 0.01$), but not with stomatal length ($p > 0.05$).

The species-level comparison revealed a lower stomatal density ($p < 0.01$) and longer stomata ($p < 0.01$) of *F. excelsior* compared to *F. mandshurica*.

Hymenoscyphus albidus isolates grew significantly slower than *H. fraxineus* across all tested temperatures. Maximal growth of *H. albidus* was observed at 22.5 °C and of *H. fraxineus* at 27.5 °C. Cultures of the former species died after three week's exposure to 25 °C and that of the latter species at 30 °C. Between 17.5 and 20 °C growth rates of *H. albidus* and between 17.5 and 22.5 °C those of *H. fraxineus* were similarly high, and the growth optimum of both species could therefore not be precisely determined.

Poster Presentation

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, subfamily Arctiinae) is common in southern Europe and parts of central Europe. It prefers dry, semi-open habitats sparsely covered with trees. Although *A. phegea* has no direct significance in forestry, caterpillars are very abundant in Austrian oak forests during winter and early spring and may have important ecological functions. For example, they could serve as overwintering hosts for parasitic wasps of forest pests such as the spongy moth, *Lymantria dispar* (Lepidoptera: Erebidae). We investigated oviposition and egg development rates of *A. phegea* at different temperatures. Our findings provide various insights into the ecology of the species.

Specimens were collected in early spring 2024 in oak forests in eastern Austria. In the laboratory, the larvae were provided with fresh dandelion foliage and reared until adult moth eclosion. Ten pairs of male and female moths were kept in a small wooden cage at room temperature under current natural daylight in May. Moths were provided water and honey solution, dandelion leaves served as oviposition substrate. Eggs were collected and counted regularly.

Oviposition started 1 to 10 days after eclosion, with a median of two days. On average, females lived for 14.6 days and males for 14.2 days. Most females deposited at least three separate egg clusters. The total number of eggs per female ranged from 168 to 539, with an average of 390 eggs. Eggs clusters were divided into three climate chambers simulating long-day conditions (16 h light, 8 h dark) at constant temperatures of 15 °C, 20 °C, and 25 °C, respectively. Egg mortality (no hatching) was significantly higher at 15 °C (58 %) than at 20 °C (23 %) and 25 °C (12 %). Development was significantly faster at the higher temperatures. At 25 °C, caterpillars hatched after 7 days, compared to 20 days at 15 °C, indicating a strong temperature effect. The lower development threshold for egg development was calculated as 10.9 °C.

Poster Presentation

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 North American oak lace bug (OLB) *Corythucha arcuata* (Heteroptera: Tingidae) was unintentionally introduced to Italy in 2000. It is a fast spreading, invasive insect pest with significant damage potential in European oak forests. Both nymphs and adults suck on the underside of leaves, causing stippling of the upper leaf surface and complete foliage discoloration of heavily attacked trees. In Austria, the insect was first detected in 2019; it is currently infesting oak and mixed oak forests throughout Styria, Burgenland, Lower Austria, and Vienna. Based on local conditions, the insect produces 2-3 generations per year. Adults overwinter in bark crevices.

A phenology model based on development times of different life cycle stages of the OLB was recently established at the IFFF, obtained from laboratory experiments at constant temperatures. An average of 510 degree-days (DD) above 12.3°C (lower development threshold) was required to complete one generation, including nymph development (183 DD) and preoviposition (115 DD). In this thesis, we evaluated the model in the field for two consecutive generations in 2024.

Egg clusters from infested *Quercus robur* stands near Neulengbach (Lower Austria) were collected in late May, put in Petri dishes on moist filter paper and stored in the field, protected from direct sunlight and rain. Newly hatched nymphs were monitored daily until they reached adulthood. Temperature and photoperiods were recorded with data logger. Nymph development of generation 1 (June) required an average of 180 DD (Min/Max 167/205 DD), generation 2 (August) required an average of 197 DD (Min/Max 178/230 DD), indicating that data from the field corresponded very well with the model. Preoviposition of generation 2 (July) required 188 DD, which was significantly longer than predicted by the model. Preoviposition of generation 3 (late August) required 124 DD, a value very close to the model. So far, no field data are available for egg development.

Poster

Potential alternate hosts of the spongy moth parasitoids *Glyptapanteles liparidis* and *G. porthetriae* (Hym., Braconidae)

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Abstract:

In spring 2024, we conducted a field survey for potential overwintering hosts of two endoparasitic wasp species, *Glyptapanteles liparidis* and *Glyptapanteles porthetriae* (Hymenoptera: Braconidae), which are among the most important natural enemies of the spongy moth, *Lymantria dispar* (Lepidoptera: Erebidae). Since the spongy moth overwinters in the egg stage, the wasps utilize alternate host larvae for overwintering. The identities of these alternate hosts are still unknown. The purpose of this study was to evaluate the availability of potential overwintering hosts at sites with a known history of spongy moth outbreaks and presence of the wasp species.

We collected larvae from four forest sites in Lower Austria (Ebergassing, Eggenburg, Auersthal) and Burgenland (Klingenbach). To detect both day and night active caterpillars, two locations (Eggenburg, Auersthal) were searched during the day and at night. In Ebergassing and Klingenbach, lepidopteran larvae were collected during daytime only. In total, 147 larvae of five potential alternate host species were found: *Macrothylacia rubi* (Lasiocampidae), *Dysauxes ancilla* (Erebidae), *Diloba caeruleocephala* (Noctuidae), *Arctia villica* (Erebidae), and *Amata phegea* (Erebidae). By far the most abundant species (141 out of 147 larvae) was *A. phegea*. For this species, several development parameters were investigated in the laboratory.

The larvae were reared under controlled conditions (20°C, 16 hours light, 8 hours dark) until adult moth eclosion and provided with fresh dandelion leaves. The average time to pupation was 14,8 days and the average pupal duration was 17,8 days. Out of 141 larvae, 60 individuals (43 %) died as larvae or pupae, while 81 individuals (57 %) developed to adult moths. The sex ratio was 43 % males and 57 % females. This ratio was similar for all collection dates, except for the small number of larvae collected during daytime in Auersthal, where more male individuals were found. Three larvae of *A. phegea* from Eggenburg and Auersthal were parasitized by the generalist tachinid fly *Carcelia gnava* (Diptera: Tachinidae). Neither *G. liparid's* nor *G. porthetriae* emerged from the caterpillars collected in the field.

Poster presentation

Modelling sub-canopy light intensity using LiDAR data and its correlation with forest regeneration

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Abstract:

Digitalization is playing an increasingly important role in modern forestry. Especially advanced surveying methods based on Light Detection and Ranging (LiDAR) have proven to be a key technology for efficient and large-scale forest inventories. Unlike traditional surveying methods, LiDAR data can be flexibly reused for various applications. Data collected during a forest inventory can also be used for additional analyses, such as individual tree and crown segmentation or the generation of comprehensive radiation models. This thesis describes the creation of such a radiation model and the correlation of calculated light intensities with natural forest regeneration. The LiDAR data for the radiation model were collected using the Personal Laser Scanner GeoSLAM ZEB-Horizon, while reference data were obtained using Solariscope and HemiView software in the BOKU teaching forest near Lanzenkirchen. Compared to these traditional methods for measuring below-canopy radiation, the model created with the free software environment for statistical computing and graphics R, achieved a coefficient of determination (R^2) of 0.71 and an RMSD of 0.04 %. The natural regeneration data were recorded using the GeoAce app on an iPad Pro. The analysis of the regeneration data showed both a significant influence of radiation on the number and growth of the measured plants, as well as a tendency toward ecological optima.

Poster Presentation

Influence of parasitization by braconid wasps (*Glyptapanteles* spp.) on the immune defense of the oak eggar (*Lasiocampa quercus*) (Lep.: Lasiocampidae)

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Abstract:

The braconid wasps *Glyptapanteles liparidis* and *G. porthetriae* (Hymenoptera: Braconidae) regulate *Lymantria dispar* (Lepidoptera: Erebidae) populations in European oak forests as natural enemies. Successful overwintering of the wasps depends on alternative hosts, such as the oak eggar, *Lasiocampa quercus* (Lepidoptera: Lasiocampidae). This study examined the effect of parasitism on the immune defense pathways of *L. quercus* larvae, focusing on two key indicators of the insect cellular and humoral immunity.

Second-instar *L. quercus* larvae were parasitized by *G. porthetriae* or *G. liparidis*. An unparasitized group served as control. Larvae were kept at 20 °C with a 12:12 light–dark cycle. Hemolymph samples were collected on days 5, 8, and 12 after parasitization and the number of blood cells (hemocytes) were counted in a hemocytometer under a light microscope. The activity of the enzyme phenoloxidase in the hemolymph was determined photometrically at 405 nm.

Parasitization by both species reduced the hemocyte numbers significantly compared to the control group (ANOVA: $p < 0.001$), with no significant difference between the wasp species. Hemocyte numbers in the *G. liparidis* group increased significantly from day 5 to day 8, whereas no increase was observed in the *G. porthetriae* group. On day 8, phenoloxidase activity was lower in both parasitized groups compared to the control group. However, the differences were not significant (ANOVA: $p = 0.080$). By day 12, enzyme activity in the *G. porthetriae* group increased to control levels (1.77 vs. 1.84 ΔA405/ml/min), while it decreased to a significantly lower level in the *G. liparidis* group (0.46 ΔA405/ml/min) (ANOVA: $p = 0.005$).

These findings suggest that both wasps suppress host immunity through different dynamics. *Glyptapanteles liparidis* seems to induce a delayed but more potent suppression of the phenoloxidase activity, eventually due to a stronger involvement of the long-term effective polydnaviruses. The short-term effective venom may play a more important role in *G. porthetriae*.

Poster Presentation

The growth of swiss stone pine *(Pinus cembra)* in the Zillertal across an elevational gradient and the influence of macro-topography

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The growth of the Swiss stone pine *(Pinus cembra)* is closely linked to site-specific environmental conditions, particularly in alpine regions where elevation and topographic complexity strongly influence the development of trees. Understanding the growth dynamics in high-elevation environments is essential for predicting forest responses to climate change.
This study investigates radial growth patterns of *Pinus cembra* across an elevational gradient (approximately 1900 – 2300m a.s.l.) in the Zillertal Alps in Austria and examines the modifying effects of macro-topography on growth performance. Tree-ring data from 12 sites distributed along south- and north-facing slopes were analyzed using standardized dendroecological techniques. Linear mixed-effect models revealed a significant decline in mean tree-ring width with increasing elevation. In addition to structural tree and site variables, monthly precipitation and temperature data from HISTALP dataset were merged to match individual tree-year combinations. Growth patterns were analyzed using generalized additive models (GAMs), which enabled the flexible modelling of nonlinear relationships and interaction effects. The GAM results showed a significant negative relationship between elevation and tree-ring width, indicating reduced growth at higher altitudes.

However, this trend was moderated by macro-topographic features: concave landforms exhibited increased growth compared to convex or planar forms, especially at higher altitudes. Furthermore, slope aspect influenced growth sensitivity to elevation with north-facing slopes showing reduced growth rates but higher climatic responsiveness. These findings highlight the importance of integrating topographic complexity into growth models and suggest that macro-topographic buffering may play a critical role in mitigating climate constraints in high-elevation forests.