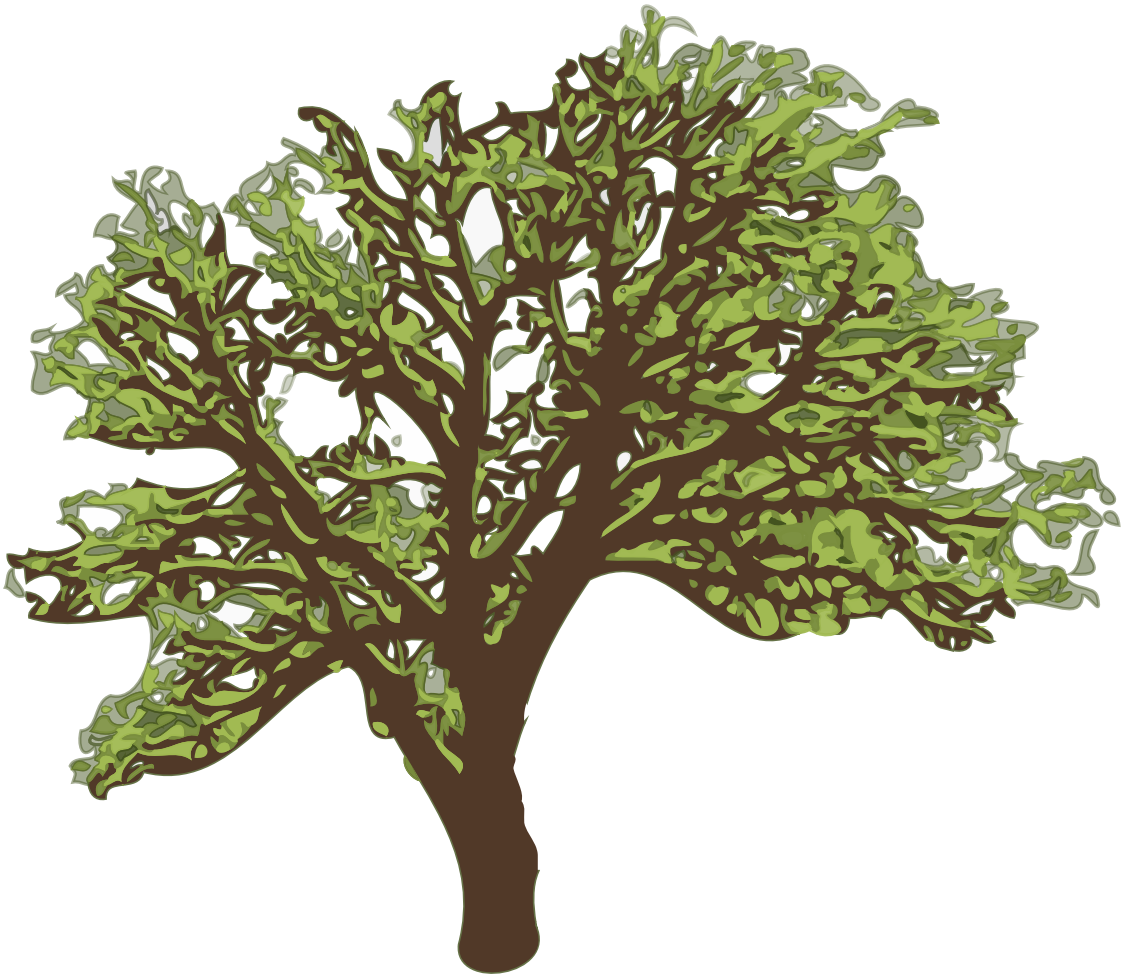
# AURA
# SYMPOSIUM

March 19th – 21st 2025

UNIVERSITY OF TURKU

Åbo Akademi University

# Book of Abstracts



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# *Welcome to AURA Symposium 2025!*

The AURA (Aboa Universities Research Advances) Symposium is a biennially organized two-and-a-half day research and learning event for PhD and Master's students. The Symposium is organized jointly by doctoral researchers from the University of Turku (UTU) and Åbo Akademi University (ÅAU). The objective of the symposium is to provide a forum for students from primarily UTU and ÅAU, but also other Finnish universities, to present and discuss their research and to practice talking to a broad audience.

*- The organising committee*

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# Session 1

## First Year Doctoral Researchers

Mark Spa

### East or West, Where Does Morbidity Manifest? Spatial Patterns of Historical Death Causes in Finland

*Spa M.[1], Briga M.[1], Lummaa V.[1], Lahdenperä M.[1]*

*[1] Department of Biology, University of Turku*

Human health is affected by a complex system encapsulating genetics, environment and lifestyle which thus far is not yet fully understood. This has resulted in unexplained morbidity disparities and questions regarding the effects of environmental factors on both historical and current human health. This study aims to investigate the spatial patterns of morbidity in historical Finland, spanning from 1750 to 1850, shedding light on health disparities and their potential environmental and socio-cultural drivers. Finland provides an ideal setting for researching disease disparities, given the previously documented yet still largely unexplained health differences between its southwestern and northeastern regions. Using the HisKi data composed by the Finnish genealogical society we translated and deciphered historical death causes recorded across more than 400 Finnish parishes covering more than 3 million individuals. This study employs spatial analysis methods (Global Moran's I and Spatial Scan Statistic) to identify geographic clusters and trends over time. After analyzing these historical disparities, we seek to eventually couple them to how socio-cultural and environmental factors—such as climate, living conditions, etc. —may have shaped mortality outcomes across different regions and time periods. Ultimately, this study aspires to link past patterns with Finland's present-day spatial health inequalities, providing insights into the lasting impact of historical conditions and morbidity on modern public health. The study's findings describe death cause patterns in historical Finland but could further contribute to a better understanding of long-term health outcomes and contribute to our ability to predict disease in a rapidly changing world.

## Waqar Khalid

**Bed-form Dynamics and Morphological Changes in a Meandering River: A Case study of the Pulmanki River, Finland**

*Khalid W.[1], Kasvi E.[1], Nylén T.[1], Gonzales-Inca C.[1]*

*[1] Department of Geography and Geology, University of Turku*

Bedform-scale changes in meandering rivers have to be framed within the context of assessing fluvial dynamics and response to climatic influences. This work investigates the geomorphic changes in the Pulmanki River-a high-latitude meandering river in northern Finland-over a nine-year period, using high-resolution LiDAR-derived digital terrain model (DTM) and orthophoto mosaics from 2015 to 2024. It will focus on point bars, channel thalwegs, and floodplains to describe erosion, deposition, and channel migration processes. In this paper, channel migration rates, elevation difference, and sediment erosion and deposition areas will be calculated using GIS-based spatial analysis. Orthophotos will be used to outline vegetated and unvegetated areas from which information about riparian dynamics can be extracted. The data derived from the DTM combined with seasonal orthophoto analyses will enable us to visualize variations in maximum inundation extents and sediment transport. Preliminary results indicated significant morphological changes at point bars of erosion and deposition caused by seasons of flooding, indicating likely redistribution of sediment downstream. It has also been established that the presence or absence of vegetation in the riparian zones has been very important for determining sediment stability and resistance to flooding. High resolution in time gives insight into how to identify rather small but statistically important changes within the river system. Results have added to our understanding of the dynamics of meandering rivers, with some important implications for their management within evolving hydrological regimes.

Sanna Pausio

## Top-Down or Bottom-Up: The Impact of Resource Environment and Predation on Bacterial Community Assembly and Resilience

*Pausio S.[1], Hiltunen T.[1]*

*[1] Department of Biology, University of Turku*

Microbial communities provide crucial ecosystem services, serving as essential components of ecosystem functionality and host health in the case of microbiomes. Maintaining and engineering functional, stable microbiomes is one of the pressing challenges in modern society. Addressing this task requires a profound understanding of microbial interactions and how interaction networks form and respond to environmental change. Resource availability significantly affects community dynamics and assembly by altering emergent interaction networks. Especially in the microbial systems, these networks are further modulated by rapid adaptive evolution. The stability of these networks depends on the nature and strength of the interactions. Competitive and exploitative interactions as well as simple community structure have been suggested to increase stability, although some models suggest communities with moderate levels of cooperative interactions to be most stable. We intend to investigate how community structure and resilience vary with increasing complexity in community dynamics and resource environment. We will employ a synthetic six-species bacterial community in combination with a five-species Tetrahymena predator community to assemble diverse subpopulations under varying resource conditions. Historical contingency will be assessed by using two evolutionarily divergent strains of bacteria species. Finally, we will test the internal stability of the communities by exposing them to bacterial-specific and global stressors and monitoring their recovery. This work will illuminate the roles of exploitative and competitive interactions in shaping community assembly and stability as a function of resource availability.

Somnath Chindhe

## Genetic adaptations towards past epidemics and infectious diseases in the Finnish population

*Chindhe S.[1], Onkamo P.[1], Salmela E.[1,2], Baltazar-Soares M.[1]*

*[1] Department of Biology, University of Turku*

*[2] Department of Archaeology, University of Turku*

It is evident that infectious diseases have been among the strongest selective pressures that drove human evolution. Prolonged selection pressures such as past epidemics and environmental challenges have impacted human genomes, due to natural selection. Notably, genes associated with immune response and metabolic pathways emerge as crucial targets of selection under these selection pressures. Population genetics framework has been utilized to use genomics data to identify genetic loci that are naturally selected. While many studies have identified genetic adaptations across different human populations, However, identifying genetic adaptations is complex and difficult since local environmental, infection and mortality patterns, demographic, and historical factors also influence genetic changes. While infections and epidemics in North-Eastern Europe are well known, local selection signals may have remained unidentified due to limitations such as the focus of studies, sample sizes, and the absence of ancient DNA data in previous studies. Despite this, no comprehensive analysis has yet explored the natural selection exerted by infectious diseases in the Finnish population. Using modern DNA and ancient DNA datasets, this study will examine genetic loci and genes linked to these pressures to understand how infectious diseases have shaped genetic adaptation in Finnish populations. While the analysis is ongoing, this project will offer valuable insights into the genetic adaptations influenced by infectious diseases in the Finnish population and contribute to a broader understanding of the role of local adaptation in shaping human health-related traits.

Constantina Georgiade

## Forest grouse species in the vicinity of wind turbines

*Georgiade C.[1], Lindén A.[2], Brommer J.E.[1], Laaksonen T.[1]*

*[1] Department of Biology, University of Turku*

*[2] Natural Resources Institute Finland, Luonnonvarakeskus (Luke)*

The expansion of Wind Energy Facilities (WEF) in Finland is rapidly increasing, reaching more than fifteen hundred turbines in 2023. This growth has raised concerns regarding the impact of WEF on the Finnish wildlife. Forest grouse species are known to be sensitive to human disturbance. Studies initially focused on estimating the direct impact on grouse species population, caused by collisions with the wind tower. More recently, the attention shifted to understanding the potential indirect effects on the population through turbines' avoidance and movement behaviour. Recent studies showed that grouse species, such as the western capercaillie and black grouse, were found to avoid areas around wind turbines by selecting less impacted habitats mostly during lekking and summer, two periods crucial for their reproduction. Despite the already addressed indirect effects, their consequences on species population and breeding success are yet unspecified and the number of related studies within Finland is limited. Therefore, this study aims to address the magnitude of WEF's impact on a number of forest grouse species populations in Finland. To accomplish that, I perform analysis on observation data that have been collected in the country since 1990 through the "Wildlife Triangle" scheme. Following a BACI approach, I first estimate the level of avoidance by calculating the abundance distribution and then map the changes in breeding success over the years per triangle site. Overall, I expect a decrease in abundance and breeding success in triangles closer to wind farms, but there will be no effect in the control areas.

Leticia Duarte

## Howling Against the Wind: Assessing the Impact of Wind Energy Development on Finnish Wolves Using Acoustic Monitoring

*Duarte L.[1], Brommer J.E.[1], Laaksonen T.[1]*

*[1] Department of Biology, University of Turku*

The growing human population has put a strain on energy demand. Renewable energy seems to be the most common and accepted solution to reduce the use of fossil fuels. Even though these are considered sources of “green energy”, they have associated emissions, and can have an impact on the ecosystems. In Finland, the construction of wind farms is at an unprecedented rate, and knowledge about the indirect effects of these infrastructures in forested areas is lacking, particularly for terrestrial species. My doctoral research aims to evaluate the impacts of wind farm development on wolf behaviour, demographics, habitat use, and prey dynamics. The first part of my project includes using passive acoustic monitoring to investigate wolf behaviour towards wind farms. A pilot study, using recordings previously collected, will assess the feasibility of this approach. If successful, we will deploy recording devices at varying distances from wind turbines. Acoustic monitoring has primarily been used to study insects, birds, bats, and marine mammals, while its application to terrestrial species remains relatively limited. Wolves are elusive yet highly vocal, making them well-suited for this method. Acoustic monitoring also provides a broader detection range compared to traditional methods, such as camera trapping. By analysing wolf howls, this method can provide valuable insights into pack dynamics, territorial behaviour, and reproduction.
With this research, I hope to contribute to the better understanding of the ecological impacts of wind energy on wolf population dynamics, bridging the gap between renewable energy development and wildlife conservation of apex predators.

Akanksha Ingale

## Understanding Public Perception of Invasive Species: The Role of Social Conditions

*Ingale A.[1], Ramula S.[1], Kalske A.[1], Vuorisalo T.[1]*

*[1] Department of Biology, University of Turku*

After habitat loss, invasive alien species (IAS) are one of the major causes of biodiversity loss. When introduced to new habitats, invasive species often outcompete native species, disrupt ecosystems, and exert negative ecological and economic impacts. Recent studies show that, IAS are associated with 423 billion US$ global annual cost due to negative impacts of the species and their management. Public perception plays an important role in successful management strategies for IAS. Differences in the perception and values of the stakeholders can lead to varied expectations and actions in invasive species management. The social conditions of the stakeholders affect their perception of invasive species and their better understanding is thus vital for crafting effective management strategies for IAS. In our study, we aim to identify various social conditions that affect public perception of IAS. We conducted a literature survey of peer-reviewed publications in the Scopus to examine the socio-economic factors typically used and their impacts on the perceptions of IAS across different taxa globally. Our findings indicate that gender, age, and education background are the most frequently studied variables. We observed a lack of studies on public perceptions of invasive species before 2015, and a geographical bias with the majority of research conducted in Europe during the past years, followed by America. Future investigations will build on these insights to explore specific public attitudes and their implications for effective communication and outreach in invasive species management.

Sewwandi Alwis

## Diet and reproductive success in birds exposed to metal pollution: A DNA metabarcoding study

*Alwis H.A.S.S.[1], Leino L.I.[1], Vesterinen E.J.[1], Rainio M.J.[1], Eeva T.[1]*

*[1] Department of Biology, University of Turku*

Avian dietary studies provide insight into nutritional shifts caused by natural and anthropogenic disturbances, such as environmental pollution. In highly polluted areas, insectivorous passerines are directly exposed to pollutants and indirectly affected through their invertebrate diet. Point sources of heavy metals have the capacity to induce shifts in abundance and species composition of invertebrate populations. This shift may in turn lead to variation in the diet of insectivorous birds during their breeding period, potentially influencing their reproductive success. The goal of this study is to link anthropogenic changes in invertebrate prey with changes in the reproductive success of three hole-nesting bird species – great tit (*Parus major*), blue tit (*Cyanistes caeruleus*), and pied flycatcher (*Ficedula hypoleuca*) around a Finnish copper-nickel smelter in Harjavalta. The first chapter of my doctoral thesis will examine the diet of the focal bird species using DNA metabarcoding and assess the variation in the diet of these birds in metal-polluted and reference areas. The dietary information will be combined with nestling growth and other parameters (e.g. clutch size, and fledging success). This work will contribute important perception to ongoing work investigating the health status of these common model bird species in Finland.

# Session 2

**Keynote Speaker - Fred Krüger**

*Department of Geography and Geosciences, Friedrich-Alexander University*

## Thinking Green Future Cities – Towards Just, Sustainable, Climate Change- and Disaster-resilient Urban Environments?

### Biography

Prof. Dr. Fred Krüger is a Full Professor at the Institute for Geography of the Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany. He focuses on Risk and Disaster Studies, Development Geography and Urban Studies and is committed to cross-disciplinary approaches. Regional foci are on urban centers in the 'Global North', Eastern and Southern Africa and South-East Asia. Major research fields cover linkages between culture(s) and risk, vulnerability, livelihoods and food security, and disaster prevention and preparedness. Topics include sustainable and climate change resilient urban development, Green Infrastructure, Nature-based Solutions, citizenship and creativity, and urban livelihoods and life-worlds.

### Abstract

So-called Nature-based Solutions and Green Infrastructure concepts have of recent become important elements of the restructuring of cities worldwide. It is hoped that greener cities help to mitigate disastrous impacts of climate change induced natural hazards, provide opportunities to enhance urban food security, contribute to equitable and socially just urban living environments and, in more general terms, make cities more livable. This keynote talk explores the potentials but also the challenges and pitfalls of these greenification ideas. It draws on examples from the "Global North" and "South" to shed light on the many facets of everyday urban lifeworlds, and how they may be positively or negatively affected by greener urban spaces.

Akseli Tolvi

## Landscape Approach and GeoAI in Sustainable Management of Cultural Heritage

*Tolvi A.*[1]

[1] *Department of Geography and Geology, University of Turku*

Cultural heritage plays an important role in forming our identities and as a knowledge depository providing understanding of the past and contributions to building a sustainable future. However, heritage management is largely focused on preservation and is separated from management of other aspects of landscape and thus unable to respond to challenges posed by the modern, rapidly changing world. This prompts a need for development of new management practices with holistic approach. I propose a landscape approach based on theories and methods of landscape ecology and concept of cultural heritage as a multidimensional and dynamic part of a larger human-nature system. My approach will make use of a wide variety of data from archaeological and historical record to geospatial and participatory data as well as geospatial methods based on GeoAI. With these data and methods, I aim to develop novel approach for sustainable cultural heritage management.

Antti Hynni

## Uncovering barriers to circular economy in agriculture - a case from Southwest Finland

*Hynni A.[1], Käyhkö J.[1], Kuhmonen T.[2]*

*[1] Department of Geography and Geology, University of Turku*

*[2] Finland Futures Research Centre, University of Turku*

The agricultural sector worldwide faces growing pressure to adopt sustainable practices due to climate change, environmental degradation, and resource scarcity. A circular economy offers a promising framework to address these challenges. It focuses on improving resource efficiency while reducing waste and emissions. However, transitioning to a circular economy in agriculture is challenging and hindered by numerous barriers that slow progress toward long-term sustainability. Our study identifies the barriers preventing farmers in Southwest Finland – an economically important but ecologically vulnerable Finnish province – from adopting circular economy practices and proposes perspectives to overcome these barriers. We applied gap analysis to examine qualitative survey responses from local farmers, identifying policy, economic, technological, and sociocultural challenges. The key findings highlight that high costs and uncertain financial returns are significant economic barriers. Technological issues, such as the availability and compatibility of equipment for organic fertilizers, cause challenges. Regulatory constraints prioritizing traditional farming methods also hinder progress. The lack of developed markets for recycled products and insufficient dissemination of knowledge further limit adoption rates. To overcome these barriers, we suggest that stakeholders should pay more attention to financial incentives, regulatory reforms, and improved knowledge transfer within agricultural systems. Encouraging business-to-business collaboration and supporting market structures are essential to facilitate the transition. These findings provide actionable insights for advancing circular economy practices and building a more sustainable and resilient food system in Southwest Finland.

Inka Kuusisto

## Vegetation changes in high-elevation high-latitude mountain

*Kuusisto I.[1], Gonzalez Inca C.[1], Huttunen S.[2], Risto V.[3]*

*[1] Department of Geography and Geology, University of Turku*

*[2] Herbarium (TUR), Biodiversity Unit, University of Turku*

*[3] Department of Ecology and Genetics, University of Oulu, Finland*

High-latitude arctic environments have been warming at unprecedented rates, which may strongly impact high-elevation cryptogam assemblages with sparse vascular plant cover. Here we investigate the changes in high latitude-high elevation cryptogam-vascular assemblages under 32 years by resurveying a transect study in 2022, earlier surveyed in 1990 on Mt Ritničohkka, NW Finnish Lapland. We used ordination methods with adonis to detect the possible temporal differences in community structures. To study the responses of individual species we conducted Indicator species analysis. We also calculated weighted Ellenberg's indicator values for studied plots and studied changes in community qualities. Furthermore, we divided our data into vascular plants, mosses, liverworts and lichens and studied temporal changes in species richness and coverages of these groups with generalized linear models. We observed temporal vegetational changes in the composition of the plant assemblages. Different plant groups showed different temporal patterns. For example, total vascular plant richness increased, total bryophyte richness decreased and total lichen richness stayed constant. In contrast, vascular plant alpha diversity showed no temporal trend but bryophyte and lichen alpha diversities changed temporally with altitude and topography. The changes were species-specific and more than 10 percent of the species showed significant temporal changes. High latitude-high elevation plant communities are about to reassemble into novel compositions of bryophytes, lichens and vascular plants. Temporal changes in one group are poor surrogates for another.

Giorgio Zavattoni

## Management and threats of Natura 2000 protected areas and their relationships to agricultural practices

*Zavattoni G.[1,2], Gaget E.[2], Brommer J.E.[1]*

*[1] Department of Biology, University of Turku*

*[2] Centre de recherche de la Tour du Valat, Le Sambuc, France*

Natura 2000 (N2K) sites, the backbone of biodiversity conservation in the European Union (EU), combine both biodiversity protection and socio-economic targets. Human activities, such as agricultural practices, can affect biodiversity in N2K sites in diverse ways to either support or undermine conservation efforts. Balancing these impacts is crucial for effective N2K management, yet site-level information on how this is achieved is lacking. To address this gap, we conducted an EU-wide survey among N2K site managers. Our aims were to assess the implemented conservation measures, their funding sources, and the extent to which different threats are addressed. Among the 505 surveyed N2K sites, 67% implemented conservation measures linked to agricultural practices, in particular promoting extensive approaches like mowing and grazing. Sites with management tied to agricultural practices relied more on EU funding, such as the CAP, whereas other sites depended more on state funding. However, 63.8% of the surveyed N2K sites reported threats which remained unaddressed by any conservation measures, suggesting that the total funding for the management may be insufficient. Most of the unaddressed threats resulted from intensive agricultural practices, such as the use of agrochemicals. These findings provide details on the dual role of agriculture in N2K sites, highlighting how some extensive practices are a key tool for biodiversity conservation management, whereas intensive ones remain a significant source of unmitigated threats. The results suggest that to achieve N2K conservation goals, policies should better promote the adoption of extensive beneficial practices, while regulating the harmful aspects of intensive ones.

Leonie Jonas

## The Potential of Conservation Measures to facilitate Waterbird Responses to Climate Warming

*Jonas L.[1,2], Gaget E.[2], Jung M.[3], Brommer J.E.[1]*

*[1] Department of Biology, University of Turku*

*[2] Tour du Valat Research Institute for the Conservation of Mediterranean Wetlands, Arles, France*

*[3] Biodiversity, Ecology, and Conservation Research Group, International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria*

Biodiversity is increasingly negatively affected by climate warming, which makes this issue a major concern for conservation. Many bird species respond to warming temperatures by shifting distribution ranges, but such shifts often lag behind temperature changes. Protected areas (PA) can facilitate such shifts in distribution by acting as migration corridors, stepping stones or buffers. However, an increasing body of literature suggests that not all PAs support bird responses to climate warming equally, as PAs can differ in realized management actions and conservation funding. Here, we study waterbird community change as a response to climate warming in relation to management actions implemented in Natura 2000 protected areas in the EU. We combined long-term European bird surveys (i.e. International Waterbird Census) with data on conservation actions funded by the LIFE program, the main EU instrument for environmental actions in Natura 2000 areas. We used the community temperature index to measure community changes over 28 years. Community adjustment to climate warming lagged behind temperature changes. However, community adjustment was faster at sites receiving funding targeted at wetland conservation compared to sites with other conservation targets. Our results demonstrate that management actions currently not targeting climate warming impacts on biodiversity, have the potential to support species responding to climate warming and highlight how conservation actions can be used to ensuring long-term biodiversity conservation.

Karen C. Tse

## Parental care and male plumage coloration are linked to hatching (a)synchrony in the pied flycatcher

*Tse K.C.[1], Laaksonen T.[1], Kärkkäinen T.[1]*

*[1] Department of Biology, University of Turku*

Female passerines, such as the pied flycatcher (*Ficedula hypoleuca*), often start incubation before completing their whole clutch, leading to asynchronously hatched broods. This can increase male parental care because early incubation may force male to start feeding the first hatchlings. Male pied flycatchers show variation in plumage coloration, which influences their nestlings' condition (e.g. body mass and mortality) in a temperature-related manner. Our study, conducted in Ruissalo, Turku, Finland, with a nest box population of pied flycatchers examined hatching asynchrony on two aspects: (1) parental care in synchronous vs. asynchronous broods, and (2) female incubation strategies under different temperatures with different coloured males. We created synchronous and asynchronous broods and monitored the parents' activity during feeding period. In another study, we used iButton- thermometers to determine the female incubation strategy. Males visited nests more frequently than females in asynchronous broods, but not in synchronous broods when chicks were younger, likely due to early feeding demands, when the female was still incubating the last eggs. In warm temperature, females that were paired with darker males incubated asynchronous broods more likely than females paired with lighter males. Earlier studies show that dark males are better parents than light males in warm temperatures, thus females might strategically incubate asynchronous broods to reduce their own workload, conserving resources. These studies add new insights to the long studied subject of avian hatching asynchrony.

# Session 3

**Keynote Speaker - Suvi Ruuskanen**

*Department of Biological and Environmental Science, University of Jyväskylä*

## Gut microbiome, host phenotypic variation and responses to environmental challenges

### Biography

Dr. Suvi Ruuskanen is an Associate Professor in Environmental Physiology at the Department of Biological and Environmental Science, University of Jyväskylä. Her research is at the intersection of environmental sciences and evolutionary, physiological and molecular ecology. Dr. Ruuskanen is broadly interested in the mechanisms underlying organismal adaptation to environmental changes, including the role of transgenerational and developmental plasticity. Her research currently has a strong focus on host-microbiome interactions in birds to understand the causes and consequences of variation in gut microbiome, from molecular mechanisms to evolutionary patterns.

### Abstract

Microbes are everywhere, all organisms carry them, and the gut microbiome varies vastly across individuals and species. A current key challenge is to understand how microbiome variation contributes to host phenotypic variation within and across generations, and especially how the microbiome may help the host to respond to environmental variation. Yet, until very recently, most data originate from laboratory model species, which do not reflect the complexity of natural conditions, life-history variation and different selection pressures. In this talk I summarize recent key eco-evolutionary host-microbiome research and use examples our own experimental and longitudinal studies in wild passerine bird populations, to understand the role of gut microbiome in phenotypic variation and adaptations. In particular, I show that (1) gut microbiome is shaped by both large-scale and local environmental variation; (2) gut microbiome contributes to phenotypic variation across time-scales; (3) gut microbiome plays a role in host adaptive responses to environmental (esp. thermal) challenges, and (4) gut microbiome associates with host fitness. These data emphasize that gut microbiome is an important (and complex) mechanism that contributes to individual differences, and potentially evolution.

Linda Laakso

## Thermoregulation of dragonflies and damselflies: Interspecific comparison

*Laakso L.[1], Ilvonen J.[2], Suhonen J.[1]*

*[1] Department of Biology, University of Turku*

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Insect thermoregulation is an important research area in evolutionary ecology. Activity of insects depends on air temperature. In insects, darker and smaller individuals warm up faster because they absorb more light. The study objects are odonates. There is variation in colour and size between species which makes them suitable model organisms for thermoregulation studies. In odonates, species with similar evolutionary history may have evolved similar responses to temperature changes. The aims of this research are to (1) find out if the smaller species warm up faster than larger species and (2) if the evolutionary history is affecting the thermoregulation of odonates and whether more closely related species have similar thermoregulatory responses. In previous interspecific comparative studies, the evolutionary history of thermoregulation in odonates has been neglected. The big picture of the evolution of their thermoregulation is still missing. Data will be analyzed from phylogenic perspective and linked to evolutionary history. Temperature measurements were done in a lab with a thermal camera. This study gives knowledge about the thermoregulation of insects and their evolutionary adaptations, ecology and how the climate change may affect them. This is the most extensive research ever done on this field. In future odonates could be used as climate change indicators. As the climate is warming up, distribution areas of insects are changing and new species from warmer areas could migrate to the north.

Jonna Kukkonen

## Conserving apollo butterflies: habitat characteristics and conservation implications in Southwest Finland

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The conservation of insects, particularly endangered species such as the Apollo butterfly, is a pressing global concern. Understanding the habitat requirements and factors influencing species occupancy is crucial for designing effective conservation strategies. We focused on investigating the habitat characteristics expected to affect the occupancy of the nationally endangered Apollo butterfly in Southwest Finland. We conducted field surveys and GIS analysis to assess the impact of larval host plant and adult nectar resources, habitat encroachment, elevation, connectivity, and spatial variation on Apollo larval occupancy in rocky outcrop habitats. We found that rocky outcrops with abundant host plants and those less isolated from nectar patches play a significant role in supporting Apollo reproduction, whereas encroachment, specifically increased tree volume, negatively affected occupancy. We also observed spatial occupancy variation across different blocks within the study area. Our findings emphasise the importance of resource availability for Apollo butterflies and highlight the dynamic nature of their habitat requirements. Maintaining a network of intact rocky outcrops with suitable resources is essential for the long-term persistence of the Apollo butterfly population in the region. Our research underscores the critical need to protect and restore habitats for the Apollo butterfly, particularly by addressing threats such as habitat encroachment and construction projects that pose risks to their breeding sites.

Elisabeth Mikkonen

## Milk cortisol concentration is shaped by maternal and infant factors in Asian elephants

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Maternal milk not only provides the offspring with the necessary nutrients for growth but also a wide range of non-nutritive bioactive compounds. These compounds, such as cortisol, are believed to act as chemical messengers between the mother and her offspring, influencing the neonatal development and health. However, little is known about the determinants of milk cortisol, and there are no studies on animals living in natural habitats. Here, we used longitudinal data of 48 semi-captive Asian elephant females living in their natural environment in Myanmar to investigate maternal, infant, and environmental determinants of milk cortisol. 324 milk samples were collected in 2020–2021, and milk cortisol was analysed by enzyme-linked immunoassay. We found that milk cortisol increased with calf age. Moreover, the sex of the calf moderated the association between the pregnancy status of the lactating female and milk cortisol. Milk cortisol concentration of mothers in their late pregnancy was generally lower than that of non-pregnant mothers. However, in mothers of female calves, milk cortisol levels were already decreased during early pregnancy. Our results suggest that changes in the hormonal composition of elephant milk are related to interactions between maternal and infant characteristics. This study increases our understanding of the factors associated with breast milk composition of Asian elephants and provides information for the conservation of this endangered species.

Elina Tuomikoski

## Presence of an apex predator controls alien mesopredator occurrence and reduces ground-nest predation

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After worldwide extirpations, some apex predators, such as the grey wolf (Canis lupus), are now recolonizing their natural habitats. The return of apex predators is shaping trophic cascades anew, but their effects on alien mesopredators and ground-nesting birds are understudied, especially in human- affected landscapes. We examined whether the recovering native apex predator, the grey wolf, reduces the nest predation risk of artificial forest grouse nests by suppressing mesopredator occurrences. This was done by comparing nest predation risk and mesopredator occurences in 16 wolf territories to reference sites. We found artificial grouse nest survival to be lower outside wolf territories than inside, and the raccoon dog (*Nyctereutes procyonoides*), an invasive alien mesopredator, to drive this pattern. Although raccoon dog was also the most common mammalian nest predator in the boreal forested landscape, our results indicate that the grey wolf can have a prominent effect on its occurrence and impact. We also found that the area of agricultural land around artificial grouse nests had a negative effect on nest survival and a positive effect on mesopredator occurrences, indicating that human land use is affecting predator-prey dynamics. We conclude that apex predators induce trophic cascades and can provide a nature-based solution to suppress invasive alien mesopredator populations and help protect native prey species.

Gian Luigi Bucciolini

## Biotic and abiotic factors affect winter cavity use in a nocturnal raptor

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Natural cavities play a crucial role for the survival and reproduction of many forest-dwelling species, providing roosting and nesting sites and serving as refuges against cold temperature. This may help to survive to cold winters, or against predators and mobbers to reduce stress and risk of being predated upon. Despite the importance of cavity availability and use for animal survival, a deep understanding of cavity use throughout the year, and in particular how biotic and abiotic factors involved in their use is still lacking. To fill this gap in the knowledge, we investigated winter cavity use by tawny owls (*Strix aluco*), in four European populations, each with different environmental and climatic conditions, in order to understand conspicuousness and behavioural strategies adopted in diverse habitats. Our findings reveal that cavities are primarily used in occupied territories and not by floaters passing through and that nest boxes are sparsely used outside the breeding season in all populations except Italy, where they are frequently occupied. Cavity use, in winter, is more common in deciduous forests than in coniferous forests, and northern populations (Finland and Sweden) seldom utilized cavities during winter, even in cold conditions, whereas cavities were more commonly used in Italy´s milder climate. This study offers valuable insights into behavioural strategies of tawny owls during the non-breeding season and highlights factors influencing cavity use across different European habitats. These findings will help us understand the year-around survival strategies of this owl species and the potential threats they face.

Mélissa Gagnière

## Mammals Gone Urban: Exploring behavioural differences of three medium-sized mammals in Finnish gardens along an urban-rural gradient

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In Finland, red foxes, European badgers, and raccoon dogs have been observed exploiting anthropogenic food sources and shelters, becoming veritable city dwellers. However, no studies have assessed variation in behaviours towards novelty in these urban species in Finland so far. Therefore, it is essential to conduct such studies to mitigate potential future human-wildlife conflicts, understand how animals adapt to urbanisation, and develop effective wildlife management strategies to help prevent biodiversity loss in urban areas. We aim to evaluate adaptation in these urban mammals by examining whether their behaviours towards novelty change along an urban-rural gradient. We are conducting behavioural experiments on free-living animals in private gardens and forested areas, using novel objects and camera traps over two- week periods. The study period for 2024 ran from June to September, with 70 gardens studied, resulting in approximately 500 useful video recordings. We plan to continue our experiments annually until 2027. The experiments involve food-baited novel objects (e.g., plastic or aluminium-covered boxes) or surfaces (e.g. bubble wrap, aluminium foil), requiring animals to interact with them to access the food reward. We will measure bold behaviours, defined as any physical interaction with the object/surface (e.g. pushing, biting, sniffing). A similar study by Morton et al. (2023) on red foxes in UK cities found that urban animals showed bolder behaviours, with greater willingness to interact with new food-related objects compared to rural areas. We anticipate similar findings for these three mammal species in our study, with possible additional effects related to the geographical area.

# Session 4

**Keynote Speaker – Pasi Eilu**

*Department of Geography and Geology, University of Turku*

## Mineral Resource Development in Finland

### Biography

Dr. Pasi Eilu is an independent consultant and an Adjunct Associate Professor (Docent) in Economic Geology. He has 40 years of professional experience in research and training on mineral deposit geology and exploration in Finland, Sweden, Norway, Greenland, Australia, and several countries in Africa, with a main focus on Precambrian metallogeny and formation of gold deposits. Pasi Eilu has worked on metallogeny, mineral deposit databases, mineral resources, mineral raw material supply, critical raw material, and mineral resource classification issues, including several EU-funded projects.

### Abstract

Human societies have always needed resources for survival, food production, infra, and various devices sensu lato. Resources not possible to gather, grow, or recycle must be mined. In probably all societies, mining started with acquiring materials for stone tools and earthen pigments. This was the case also in terrain what we today call Finland. With metals, iron was the first thing to be mined in Finland, by 15th Century. This was followed by copper and lead in 18th Century. Modern mining begun with the Outokumpu copper mine in 1910. Through the 20th Century, dozens of mines were operated, producing a long list of metals and industrial minerals, with copper, zinc, nickel, chromium and phosphate dominating. Today, the only P, Cr, Co and PGE mines of the EU are in Finland. Finland also is the dominating nickel producer and host the largest gold mine of the EU.

The mineral wealth of Finland is based on geology unique to most of the Europe. It directly relates to supercontinent evolution of the Earth. From early Archaean protocontinent formation, through formation, rifting, and disintegration of Kenorland, Columbia and, to some extent, Pangaea, we see formation of major metal and industrial mineral deposits. Mafic-ultramafic magmatic processes have produced Ni-Cu-Co-PGE, PGE-only, Cr, and Ti-V(-P) deposits, submarine hydrothermal systems Cu-Zn-Ag-Au, active margins porphyry Cu-Au and epithermal Au, rifting-related carbonatite and peralkaline magmatism REE-P-Zr-Hf-Nb-Ta, hydrothermal processes IOCG, metamorphic processes Au, graphite, high-purity quartz, talc-magnesite, and high-quality carbonate rocks, and euxinic passive margin settings produced black shale-hosted Ni-Co-Cu-Zn deposits.

Mohib Billah

## Anthropogenic actions impact water quality and varve formation in Lake Kallavesi

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Human activities can significantly influence the environmental conditions of water bodies close to urban areas. Maljalahti Bay, located next to the City of Kuopio at the northern end of Lake Kallavesi, has undergone many significant development activities over the last centuries. This study intends to explore how anthropogenic actions influence water quality and sediment characteristics in the lake area. We conducted major physical and geochemical analyses of the sediment record and diatom assemblage analysis. The sediment core was dated using varve counting and vertical distribution of 137Cs. The 100 cm long sediment record comprises 117 varves. A 12 cm thick clastic layer between 88 and 100 cm sediment depth likely relates to the partial filling of the bay in 1901. This event possibly triggered the deterioration of water column oxygen conditions and the introduction of faintly laminated varved sediments since 1901. As a consequence of repeated construction at the bay and within its catchment, an increased amount of minerogenic matter was introduced since the 1960s. The Maljalahti Bay varve comprises mineral-rich clastic lamina formed during the spring floods and an organic-rich biogenic lamina resulting from production during the growing season. The pronounced varve preservation indicates either rapid sedimentation or oxygen- poor conditions.

Sohvi Railo

## Seasonal succession of diatoms in the coastal Baltic Sea: insights for their use as a micropaleontological proxy for past environmental change

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Diatoms are important primary producers and a common environmental proxy in paleoceanography. They preserve well in sediment and often have narrow environmental tolerance, which makes them excellent indicators of past environmental change. However, the annual succession of diatom communities through all seasons is deficiently known (Luostarinen et al., 2023), even in the relatively well-studied Baltic Sea, which limits the use of diatoms in reconstructing changes in marine system seasonality. Comprehensive understanding of the relationship between environmental factors and proxy species is crucial when environmental reconstructions are based on sedimentary archives. Automatic sediment traps are an excellent tool to monitor seasonal succession of diatoms in detail. Furthermore, sediment traps provide an opportunity to examine the under-ice processes, which are otherwise inaccessible without disturbing the sea ice. In this PhD project annually and seasonally changing succession of diatoms is monitored over multiyear period in Tvärminne Storfjärden, Gulf of Finland. Diatom community is compared to environmental data gathered from the area to pinpoint key environmental factors triggering the change in the community. Sampling is conducted with two automatic sediment traps deployed in different depths (middle of the water column and close to the sea bottom). Comparing the difference in sedimentary material reveals what is happening in water column before deposition.

Anna Johnson

## Dark magmatic rocks mark internal rupturing of a mountain belt more than 1800 million years ago in the Nagu (Nauvo) area, southern Finland

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In my research, I investigate dark magmatic rocks (called gabbros) from southern Finland. The bedrock of southern Finland was formed during a mountain-building process at a convergent plate margin between 1900 and 1800 million years ago (Svecofennian orogeny). The theory of plate tectonics was established in the 1960s as the main process forming the surface features of the Earth. Such processes have been active for at least 2500 Ma and have greatly influenced air, water and rock chemistry and thus, life on the planet. In the supercontinent cycle, the continents move apart and come together again in new configurations. Going back in time, it gets more complicated to find out how the pieces grew, rotated and were connected in each cycle. Magmatic rocks that have formed in different tectonic environments are composed of different minerals and have differing chemical compositions. Later modifications in high temperatures and pressures deep in the crust (metamorphism) can affect the rocks, overprinting their initial characteristics. In this work, I present the Kaiplot gabbros found in Nagu (Nauvo), southern Finland. Via age determination and chemical analysis, I show that they were formed from magmas rising from the hot mantle in connection with crustal extension (spreading and rupturing) during the Svecofennian orogeny, which was otherwise largely dictated by compressional forces. My aim is to define this extensional episode within the development of this very important mountain-building event.

Tuomas Tall

## Sensitivity to glyphosate in Bacteria

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Glyphosate is the most common broad-spectrum herbicide. It targets the key enzyme of the shikimate pathway, 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS), which synthesizes three essential aromatic amino acids. This gene is found in plants, fungi, and bacteria. The widespread use of glyphosate may have an impact on the diversity and composition of microbial communities, including the human gut microbiome. In a previous study we have shown that in fungi, the EPSPS sequences have complex domain architecture that may affect its sensitivity. However, in bacteria and most plants, the EPSP protein is characterized by a single domain. Here, we aim to determine the evolutionary dynamics of the epsps gene in bacteria by analysing the database of alignable tight genomic clusters (ATGC). This database is used to perform a microevolutionary analysis of the EPSP protein within closely related bacterial groups. The EPSPSClass webserver was used to determine potential sensitivity or resistance to glyphosate, based on the amino acids in the active site of the enzyme. We analysed the associations of the evolutionary dynamics of the EPSPS protein with several genomic parameters. The results show that phylogenetic groups and bacterial lifestyles are key factors determining sensitivity to glyphosate. However, previous studies have shown that sensitivity of bacteria may change in a relatively short evolutionary time. Furthermore, it seems that microbes more exposed to the herbicide are intrinsically more resistant. Future analyses of our dataset should elucidate key factors to gain/loss antimicrobial resistances to the herbicide.

Milla Similä

## Microbial Community Assembly: Predictable Patterns or Emergent Properties?

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Microbial communities play vital roles in a wide range of natural processes, ranging from host health to global biochemical cycles. Understanding how these communities assemble— how species come together to form functional ecosystems—is critical for predicting community functions and designing microbial consortia with desirable properties. Community assembly research centers on two perspectives: one argues that assembly process can be predicted based on pairwise competition outcomes, while the other emphasizes the importance of higher-order interactions in complex communities. Although evidence supports both processes occurring in nature, it remains unclear when microbial community assembly behaves as a community-level property versus a straightforward additive process. This study investigates the predictability of microbial community assembly and examines whether and how assembly patterns rules change with increasing complexity. Using a 4-species synthetic bacterial community, we assembled all possible 2-, 3- and 4-species subcommunities and exposed them to a gradient of antibiotic concentrations over a 16-day serial transfer experiment. By including both antibiotic-resistant and susceptible strains?, we also evaluated the role of evolutionary history in shaping community assembly. Our results provide new insights into whether and when complex microbial community assembly can be predicted from interactions between smaller subsets of species. Understanding how community assembly processes work can help predict how natural microbial communities respond to environmental changes as well as offer valuable insights into designing communities with beneficial properties for human use.

Juhani Rantanen

## Bacterial Players in the Game of Growth and Resistance

*Rantanen J.*[1]

[1] *University of Turku, Department of Biology*

The world around us is brimming with bacteria, and communities consisting of them. As a matter of fact, they are found even within us. These communities perform a variety of services within their ecosystems, and for many of these communities, one of the most fundamental properties is their biomass production and resource utilization. Furthermore, due to the use of antibiotics in the past 80 years, antimicrobial resistance has also become a vital property of bacterial communities, especially when human or animal health is considered. We studied the growth and resistance of synthetic bacterial communities by assembling them by randomly selecting 4 species from a pool of 16 species. We then made all possible combinations from these species (15), and measured their growth either in control conditions, or under antibiotic stress. We analyzed this data using the principles of cooperative game theory, which to our knowledge, has not been applied to synthetic communities before. Using this approach, we were able to discern which species were the most influential members of the bacteria consortia in terms of growth and antibiotic resistance, and if the ecological interactions between them were positive or negative.

Annika Nylund

## Urbanization modifies the composition of pollination-related plant traits

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Pollination is an irreplaceable ecosystem service that safeguards food security. However, in recent decades, global insect pollinator populations have been declining due to anthropogenic impacts, such as land-use change, and there is thus an urgent need to find solutions to restore pollinator habitats. Understanding how urbanization modifies the composition of pollination-related traits will help the design of pollinator-friendly green spaces that can restore plant-pollinator interactions in cities. Here, we investigated how urbanization modifies vascular plant communities by filtering plant and floral traits related to pollination (e.g., flower size and color, plant height) and how the functional diversity of these traits, in turn, influences the richness of visiting insect pollinators. We collected data on vascular plant species and insect pollinators from 90 traffic-related locations (traffic islands, parking lots, and road verges) in Finnish metropolitan areas and recorded seven pollination-related traits for each plant species. We then explored these traits in relation to three types of urban indicators: imperviousness, length of roads, and distance to the city center. We found that urbanized areas contained taller vascular plant species and disproportionally more species with yellow flowers than less urbanized areas. Furthermore, plant species were shorter in traffic islands than in parking lots and road verges, and short-lived species were more common in traffic islands than in road verges. These results indicate that urbanization filters some pollination-related plant traits, and that plant communities in urban areas should be particularly attractive to generalist pollinators, including many flies and some butterflies, that typically favour yellow flower color.

# Session 5

**Keynote Speaker - Lena Bergström**

*Department of Aquatic Resources, Swedish university of Agricultural Sciences*

## Biological knowledge for ecosystem-based management-improving assessments of coastal ecosystems

### Biography

Dr. Lena Bergström is an Associate Professor (Docent) and head of the Ecosystem Analysis unit at the Department of Aquatic Resources (SLU Aqua), Institute of coastal research at the Swedish University of Agricultural Sciences, Uppsala, Sweden. Her research focuses on Baltic Sea ecosystem analysis and providing scientific support for ecosystem-based management, with a particular emphasis on integrated analyses, sustainable sea use, and conservation. Her work bridges scientific research and policy, aiming for ecosystem-based management processes and decisions informed by the best available science.

### Abstract

Ecosystem-based management (EBM) is a global objective, supported by directives for terrestrial and marine management worldwide as a key approach to achieving sustainability and improving ecosystem health. Adopting EBM involves implementing place-based solutions and acknowledging the many ways nature and people are connected. Due to the complexity of socioecological systems, many actors find it helpful to embrace EBM as a direction rather than a goal, adopting an adaptive learning process. The biodiversity of the Baltic Sea is globally unique, important to many people, spatially and temporally variable, and subject to a wide range of pressures. Several measures are needed to improve its environmental status, such as reducing pressures, improving protection, and implementing restoration efforts. Existing legal instruments support EBM in the Baltic Sea, but successful implementation depends on a wide range of actors. Furthermore, improving the status requires ecosystem-informed decisions at regional, national, and local scales. Within an EBM-framework, a key challenge for marine biologists is to develop and communicate ecosystem understanding to a wide range of stakeholders. Biological knowledge - including diet composition, trophic efficiency, habitat preferences, population structure, responses to pressures, and physiological functions – informs food web models and spatio-temporal analyses to clarify ecosystem linkages. Another key development point is designing useful decision support tools and risk assessments tailored to the quantity and quality of available evidence. Key current challenges that are supported by EBM include the sustainable use of marine resources, sharing ecosystem benefits, and the efficient design of restoration measures.

Lars Pelikan

## Snail responses to invasion of a novel predator: Do shell traits show adaptive plasticity?

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Native prey may show various adaptive responses to novel invasive predators. These include evolutionary responses to selection and induced plastic responses to alarm cues from conspecifics or even to cues from the predator itself. Thus, we study the responses of the snail *Theodoxus fluviatilis* to the ongoing invasion of the mud crab *Rhithropanopeus harrisii* in the Baltic Sea. We hypothesise that the novel type of predator poses strong selection for anti-predator traits and provokes adaptive responses that influence the outcome of the predator-prey interaction. We sampled snails from several populations that either had or had not been exposed to the novel predator. Moreover, we conducted predation experiments to investigate selection by the novel predator on prey traits and long-term rearing experiments of the snail with crab and alarm cues to study potential adaptive plasticity of the prey. The focal prey traits included body-size, body-shape, shell thickness and shell strength. We found significant differences in shell traits among *T. fluviatilis* populations, partly attributable to coexistence with the crab. Furthermore, we found a significant decrease in body-size with increasing shell strength in snails exposed to alarm cues of wounded conspecifics. The predation experiments indicated that crabs are selecting larger snails. These results demonstrate that selection by a novel species can lead to adaptive prey responses in an ecological time scale. Therefore, it is important to consider the evolutionary consequences of invasions, to fully understand the impacts of invasions and their temporal progression.

Sarah Rühmkorff

## Multiple trait responses within the interactions of three ecosystem engineers

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Seagrasses host diverse communities and co-occur with other ecosystem engineers. Yet, we have little understanding of the complex interactions of seagrass with co-existing bivalves and their importance for habitat structure and ecosystem processes. In a 101-day-long mesocosm experiment, we investigated the individual and combined effects of epifaunal (*Mytilus trossulus*) and infaunal (*Macoma balthica*) bivalves on the performance of Zostera marina and their influence on nutrient (porewater and water-column) uptake and (re-) cycling, the impacts of Zostera presence on bivalve traits, and interactions between the two bivalves. Macoma presence decreased Mytilus mortality, while Zostera did not influence the bivalve traits. Both bivalves increased nutrient availability, with Mytilus having stronger effects. Overall, the two bivalves had strongly antagonistic effects on the performance of Zostera, where in co-occurrence, the positive impacts from Mytilus (on shoot number, growth, leaf length, nutrient availability) could mitigate the negative impacts from Macoma, despite increases nutrients. This study investigated multiple trait responses within the interactions of three important ecosystem engineers. The findings suggest that the performance of one ecosystem engineer largely depends on the presence but also the interaction of co-occurring engineer species. The findings provide an understanding of the ecosystem processes with the potential to inform seagrass restoration.

Karl Weckström

## Water depth affects the biodiversity and functional traits of Fucus vesiculosus-associated macroinvertebrate communities in the Baltic Sea

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Eutrophication is one of the major anthropogenic drivers that extensively modify coastal ecosystems. Bladderwrack *Fucus vesiculosus* (hereinafter Fucus) is the main habitat-forming perennial algae on Baltic Sea rocky shores and provides essential habitats for many fish and macroinvertebrate species. Eutrophication has reduced Fucus depth distribution and led to the shallowing of Fucus-dominated habitats. Still, it remains unclear how this affects these littoral ecosystems. In this study, we examined changes in taxonomic and functional trait diversity of macroinvertebrates along a depth gradient ranging from 1 to 7 meters in four locations. Our results reveal that both taxonomic and functional richness increase with depth within the Fucus- dominated habitat. The results also indicate a significant change in community structure and functional trait composition with increasing depth. The deeper communities had a higher expression of traits linked to ecosystem stability, e.g., long-lived and larger body size and essential ecosystem functions such as nutrient cycling by detritivores. In contrast, the shallow communities were characterized by, e.g., high mobility and short lifespans, i.e., traits linked to opportunistic taxa. Our study highlights the importance of these threatened deep Fucus communities for coastal ecosystem functioning and stability. Further, to halt and reverse the trend of decreasing depth penetration of Fucus, efforts to counteract eutrophication are needed, and the remaining deep Fucus habitats should be protected.

Patrik Ståhl

## Food web robustness depends on the network type and threshold for extinction

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Species loss in ecological communities can trigger cascading extinctions, the extent of which likely depends on network type and extinction thresholds. Traditionally, network responses to node removal are analysed using unweighted food webs, ignoring interaction strengths and extinction thresholds. Here, we examine how food web robustness varies with network type (unweighted vs. weighted), extinction thresholds, and species removal sequences, and explore how network properties - connectance and relative ascendency both unweighted and weighted - predict robustness. First, our results show that network robustness, measured by the R50 index, can be up to 40% lower in weighted networks compared to unweighted ones. Additionally, incorporating extinction thresholds reveals a consistent reduction in robustness when species deletions proceed from the highest to the lowest species degree or sum of link weights. This suggests that measures of robustness that do not include extinction thresholds overestimate of ecological network robustness. Furthermore, it highlights that species with high energy through-flow are crucial for maintaining energy pathways and network integrity in weighted food webs, emphasizing their importance in a conservation context. Second, relative ascendency emerged as the strongest predictor of food web robustness, providing the clearest temporal and ecological signals related to changes in energy fluxes. This metric reflects both link distribution (skewness) and pathway architecture (energy flux constraints), underscoring the importance of these network properties in assessing food web stability. Therefore, these properties should be considered in ecosystem management recommendations.

Anna Ikonen

## The fatty acid profile of resurrected diatoms under changing temperature conditions

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The sea surface temperature and nutrient loading in European coastal waters are predicted to increase due to the ongoing global change. This has already resulted in range shifts and local extinction of phytoplankton species. We have recently shown that diatoms in the Baltic Sea may also adapt to global warming by increasing their temperature optima in natural conditions. Here, we resurrect resting stages of diatoms from the last 100 years from different locations across Europe to investigate if diatoms have adapted to the historical increase in sea surface temperatures in a larger geographical context. So far, we have resurrected about 10 different species of diatoms across Europe, oldest originating from the 1880s. The most probable number method shows that viable resting stages are well preserved even in century-old sediment layers. We are currently testing the nutritional value of resurrected and modern diatoms in predator-prey experiments, as preliminary data show that the fatty acid content of diatoms may change with thermal adaptation. In collaboration with the HiLIPID team at Helsinki University we expect to finalize the fatty acid analyses in January 2025. Further, we will conduct a feeding experiment with copepods and resurrected diatoms to assess potential trophic consequences of thermal adaptation and evaluate potential temperature adaptation in diatoms from Thau Lagoon (France) during the last ~140 years. This research will provide data for more accurate models predicting future ecosystem response to global warming, as current models are based on static tolerance ranges not accounting for the adaptive potential of species.

# POSTER SESSION

Jonna Kangas

## The impact of salinity on the host parasite interaction of a Baltic Sea cyanobacterium and its fungal parasite

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Fungal parasites belonging to the phylum Chytridiomycota (e.g. chytrids) are known parasites of phytoplankton. While chytrid fungi are well-known parasites of freshwater phytoplankton, their interactions with phytoplankton in brackish environments such as the Baltic Sea, remain largely unexplored. Host-parasite interactions are influenced by the biotic and abiotic environment that can affect both fitness of the host and parasite. Moreover, the interacting species may differ in their tolerance ranges to varying environmental conditions leading to host refuges, where hosts can grow while avoiding the pressures of infection. In the Baltic Sea, which is known for its horizontal salinity gradient, salinity is likely influencing host-parasite interactions between chytrids and phytoplankton. We isolated a chytrid and its cyanobacteria host from the Baltic Sea outer archipelago and experimentally assessed their salinity tolerance ranges and optima. We acclimatized parasite and host to 11 salinity treatments, ranging from salinities 0 to 35. We then followed the growth of uninfected and infected host cultures in the salinity treatments and assessed potentially plastic traits of host and parasite that may vary with salinity. First results show that the optimal salinity of both parasite and host is at salinity 5, which is closest to their local salinity of 6. The cyanobacteria host could grow up to a salinity of 30 and its chytrid parasite could infect hosts up to a salinity of 15, indicating potential salinity refuges of cyanobacteria hosts at higher salinities.

Beata Plutova

## The combined impacts of land-use and climate changes on nutrient loads in river systems

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Rivers are critical water sources for human societies but are increasingly threatened by land use and climate changes. Agriculture tends to have the largest overall impact on river water quality, particularly in regions with intensive farming practices. It is a major source of excess nutrients like nitrogen and phosphorus from fertilizers, which cause eutrophication in rivers. Additionally, climate change intensifies these effects by altering rainfall patterns and raising water temperatures, leading to more frequent floods and droughts, which disrupt water quality and quantity in river ecosystems. Therefore, understanding the impacts of agricultural land use changes together with climate change towards nutrient loads in rivers is crucial for identifying hotspots and making corrective interventions. However, many

studies focus on either land-use or climate factors individually, leaving gaps in our understanding of how these factors interact towards nutrient loads in rivers. This PhD project aims to evaluate and quantify the nutrient loads within Finnish agricultural rivers under the combined impacts of land use and climate changes. Using a novel integration of remote sensing and field data, statistics, and modeling, the project will identify critical hotspots, and assess variations across spatial, seasonal, and temporal scales. The findings will inform targeted interventions to protect and improve water quality in river ecosystems under changing environmental conditions.

Amalia Skrifvars

## The effect of a wintertime marine heatwave on the phytoplankton community composition in a coastal ecosystem

*Skrifvars A.[1], Hattich G.[1], Lanndér R.[1], Heikkinen J.[1], Segovia M.[1,2], Machado M.[1,3], Padilla A.[1], Pansch-Hattich C.[1], Sjöqvist C.[1]*

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Marine heatwaves are intensifying globally, including in the Baltic Sea, which is one of the fastest-warming seas. This causes significant ecological disruptions, like alterations in phytoplankton blooms, the foundation of marine ecosystems. Wintertime marine heatwaves and their influence on the phytoplankton community in temperate coastal ecosystems remain poorly understood. Previous research suggests that warmer than average sea surface temperatures during winter and early spring can trigger earlier and prolonged spring blooms. However, the specific impacts of an acute winter heatwave on community composition are unclear. We examined the phytoplankton community in a shallow coastal bay in the Åland Islands before, during, and after a wintertime heatwave in 2019-2020. This data was compared to corresponding data from the winter 2021-2022, which was characterized by average sea surface temperatures and typical sea ice conditions. Our analyses revealed significant differences in community composition, species richness, and diversity between these contrasting winters. Most notably, the community consisted of a significantly lower phytoplankton biomass, as well as a substantially lower diatom:dinoflagellate ratio following the marine heatwave. The significant differences in species composition and lower biomass underline the importance of the annual sea ice conditions in coastal phytoplankton communities. Moreover, the substantially altered phytoplankton community composition in response to the wintertime marine heat waves can have far-reaching consequences for the coastal ecosystems, including reduced carbon and nutrient cycling. The study underscores the importance of understanding wintertime heat waves for predicting the impacts of global warming on phytoplankton functioning.

Emmy Kärkkäinen

## Identifying Atlantic salmon spawning areas based on multispectral airborne laser scanning, and hydraulic modeling

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Setting the spawning targets is a core part of modern fishing management. The spawning target is partly based on the definition of the spawning areas. Based on previous studies water depth, flow velocity and substrate type (particle size) are the most important instream habitat variables in determining the spawning habitat selection of salmonids. The subarctic Tana River is the largest salmon river in Northern Europe and one of the most diverse salmon rivers in the world, but in 2019 the state of Atlantic salmon stocks began to deteriorate significantly. In recent years salmon fishing has been completely prohibited in the Tana River system, which has had a negative effect on the local community.

The location and size of the spawning areas in the Tana River system relies on coarse resolution maps and subjective habitat evaluation (local knowledge and expert judgement). The aim of this study is to offer a quantitative, objective, and high-resolution approach for identifying the potential spawning areas. By integrating high-resolution digital elevation model (DEM) obtained from multispectral airborne laser scanning (ALS) and hydraulic data, a hydraulic model will be generated to identify the ideal depth and velocity areas for spawning, and simulate different water levels and discharge scenarios. The substrate type is defined based on ALS data and aerial photographs. The model is also used for studying the effects of extremes, such as floods and droughts, on the spawning areas.

Inga-Katariina Aapalampi

## Investigating competitive dynamics of ESBL E. coli against common E. coli using high- resolution lineage tracking

*Aapalampi I.K.[1], Cairns J.[1], Hiltunen T.[1], Savilahti H.[1], Tamminen M.[1]*

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Antimicrobial resistance (AMR) is a global threat and multidrug-resistant ESBL E. coli in particular cause infections that are difficult to treat with antibiotics. The competitive dynamics of ESBL E. coli against commensal E. coli living in the human gut are not yet known. Understanding these dynamics explains how antibiotics and ecological interactions influence AMR evolution and competitive fitness. Rapid evolution influences ecological dynamics, but it is unknown how molecular evolution is altered at increasing levels of ecological complexity. Experiments are mostly performed in one- or two- species systems, and molecular evolution in complex communities cannot be followed at high resolution with current research methods. With a new genetic engineering method called high- resolution lineage tracking (HRLT), it is possible to monitor strain

frequency and the frequency of thousands of clades simultaneously to determine eco-evolutionary dynamics. Here, we will develop and use HRLT technology to study eco-evolutionary dynamics of multidrug resistant ESBL E. coli. First, barcoded and strain coded bacterial clones will be created. Then, a three species community containing two common E. coli and one ESBL E. coli strain will be created. The community will be exposed to different antibiotics and antibiotic concentrations and 24-hour serial transfers will be performed for 20 days. The barcode locus will be amplicon-sequenced, and a large number of clones will be whole-genome sequenced. This will allow us to trace the competitive fitness of the strains and the evolution of mutations in the community. These data reveal the competitive advantage and evolutionary role of ESBL E. coli.

Pavan Chikkanarayanaswamy

## Unveiling the impact of anthropogenic pressures on Finnish wildlife: an experimental study on human-induced influences

*Chikkanarayanaswamy P.[1], Brommer J.E.[1], Laaksonen T.[1]*

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The escalating human population and rapid development pose significant threats to global biodiversity, including in Finland. In recent years, commercial forestry and wind power production have increased notably, adversely affecting Finnish biodiversity. This study aims to comprehensively examine the impact of these anthropogenic stressors on Finnish wildlife. Employing a Before-After Control Impact (BACI) study design, we will assess the effects of commercial forestry on forest bird communities in southern Finland. Additionally, we will investigate the factors influencing the avoidance behavior of bats near wind turbines and evaluate the impacts of wind power on boreal forest bird communities. Our findings will provide valuable insights into how human interventions affect Finnish wildlife and inform strategies to mitigate negative impacts. The research, spanning from 2024 to 2027, will include data collection, analysis, dissemination of results, and thesis defense. This study will contribute significantly to the conservation and management of biodiversity amidst increasing human-induced pressures in Finland.

Niina Smolander

## Glyphosate and phosphate treatments in soil differentially affect crop microbiomes depending on species, tissue and growth stage

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Glyphosate-based herbicides (GBHs) are among the most widely used pesticides, controlling weeds by inhibiting the shikimate pathway. However, the effects of GBH on non-

target organisms, such as shikimate pathway-containing microbes, are understudied, and their impact on crop microbiomes, crucial for agricultural productivity, remains largely unknown. Furthermore, the complex interactions between GBH and fertilizers are difficult to predict. Hence, for long-term GBH use, we investigated the effects of GBH and phosphate fertilizer on the composition of endophytic bacterial communities of potato, faba bean and oat during early and late summer, and on plant growth in late summer. GBH treatments significantly affected bacterial communities of potato roots and faba bean leaves in early summer, while phosphate treatments significantly affected bacterial communities of potato leaves, tubers and faba bean leaves in late summer. GBH treatments reduced bacterial diversity and abundance of beneficial bacteria but significantly increased the aboveground biomass of all crops. Thus, agrochemicals affected differently in diverse crops, tissues and growth stages. While improved crop yield is often prioritized in chemical-intensive farming, shifts in microbiomes, which may compromise crop health, are overlooked.

Maria Perkkola

## Dynamics of hunters and attitudes to hunting

*Maria Perkkola*[1]

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Across societies, hunting has evolved from a survival necessity to a recreational activity with cultural, social, and ecological significance. However, in today's rapidly changing world, traditional citizen-driven activities like hunting face new challenges as populations age, rural areas depopulate, and societal values shift. These trends threaten the social sustainability of hunting, which depends on active participation and alignment with modern values. Finland serves as an interesting case within this context of societal transition and sustainability. Here, hunting remains culturally significant, but it must adapt to ongoing changes. Hunters play a vital role in game management and contribute economically through fees, permits, and local activities. However, hunting is shaped by complex dynamics, including societal attitudes, regional differences, and individual motivations. These factors are further influenced by tensions between rural traditions and modern values, as well as growing scrutiny from environmental and animal rights perspectives. Positive societal perceptions are crucial for the future of hunting and effective game management. My PhD research examines hunting dynamics in Finland, focusing on hunters' profiles, motivations, and societal perceptions. My poster outlines this research plan. The first chapter analyzes trends in hunter numbers, including the proportions of male and female hunters. The second investigates motivations for taking up and continuing hunting, with an emphasis on gender differences. The third explores societal attitudes towards hunting, while the fourth examines how the media portrays hunting and wildlife. This research aims to understand how hunting can remain socially sustainable amid shifting societal values and demographic changes.

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