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Semi-distributed Hydrological Model of Amalie Site

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Hydrological models are developed to describe the water cycle on different spatial and temporal scales. These models have a wide range of applications from water resources forecasting and hydrological extreme studies to climate change impact assessment. To have an accurate conceptual representation of the water balance components using these models, it is essential to calibrate these models' parameters properly. A well-calibrated hydrological model can give an almost clear insight into the hydrological processes in the river basin area, and the models' output can be used for the above-mentioned purposes. This study aims to develop a semi-distributed hydrological model to simulate and predict water balance components in ungauged or poorly gauged catchments. The Amalie region, located in the Czech Republic, is chosen as the study area that comprises two basins, namely Brejlský Potok (BP) and Karluv Luh (KL). The hydrological model used in this study is called dHRUM (distributed Hydrological Response Unite Model) which is a conceptual semi-distributed model. In order to find the model's effective parameters using an optimization algorithm, the solution space of the parameters is constrained using expert knowledge and available information in the study area. The obtained results show the positive effect of constraining the solution space of the model parameters on decreasing the level of equifinality. In addition, capturing groundwater fluctuations in the modeling procedure leads to increasing the accuracy of total runoff simulation.

Keywords: hydrological modeling, ungauged catchment, calibration, semi-distributed modelling

Investigating the Antipredator Behavior of Jackdaws and Magpies in Prague's Urban Parks

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Corvids are intelligent birds with a large brain-to-body ratio. Their intelligence renders them highly adaptable, facilitating their adaptation to urban areas. One way birds adapt to urban areas is by increasing their tolerance to humans. The Flight Initiation Distance (FID; the distance at which an animal flees when approached by a potential predator or human) is a widespread method to assess the antipredator behavior of species and their tolerance to people. In this study, we collected the FIDs and ADs (Alert Distance, the distance at which the bird became aware of the approaching danger) of urban jackdaws and magpies in Prague, Czech Republic, during the breeding season of 2022. We compared the antipredator behavior of the two species and in terms of the individual's age and other factors (flock size and the number of pedestrians and dogs around the collection area) using Linear Mixed Models (LMMs). We found that jackdaws are more tolerant and less fearful of people in urban areas than magpies. Juveniles were more alert to danger and more fearful than adults. Individual corvids are less alert to danger in larger flocks. Finally, we saw no impact of the abundance of pedestrians and dogs on the antipredator behavior of the corvid species studied.

Keywords: Antipredator behavior, Corvids, Urbanization, Corvus monedula, Pica pica, Flight Initiation Distance, Alert Distance

Improved Climate Models Accuracy Using a Hybrid Dynamical-Statistical Approach

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Availability of spatially and temporally consistent climatic data is a critical requirement for hydro-meteorological studies, particularly in regions with limited access to climate data. As part of this study, a number of global precipitation products were analyzed across western Iran. According to the results, the APHRODITE global precipitation product exhibited superiority in a pixel wise approach as well as in regionally averaged precipitation across the study region. Furthermore, the CRU product was selected for this study due to minor differences among the different global temperature datasets. Further, we applied a hybrid statistical-dynamic approach for predicting temperature and precipitation across southwest of Iran. Long-term climate predictions can be modelled using both statistical and dynamic approaches. Each approach has advantages and disadvantages, and any combination of these approaches is likely to result in a more accurate estimate. A Bayesian network was used for the statistical part of the hybrid approach, and the MIROC5 AOGCM model for the dynamical part. Also, Teleconnection patterns (TP) were utilized as predictors for the Bayesian network, since precipitation and temperature are highly variable with TP fluctuations. Based on the results, the hybrid approach could accurately estimate precipitation and temperature temporal patterns. In the validation period, the CC for precipitation and temperature were 0.55 and 0.68, respectively. Furthermore, in estimating the average monthly temperature, the hybrid approach showed a reasonable performance, with RMSE, MAE, and bias of 6.54, 5, and 1.68, respectively. The results also demonstrate that the hybrid approach had poor accuracy regarding precipitation estimation, as the RMSE, MAE, and bias values were 28.33, 20.58, and 2, respectively. Generally, it appears that the hybrid approach

is more efficient at estimating the temperature when compared with precipitation. The findings of this study may be significant for a variety of hydro-metrological applications requiring long-term reliable data.

Keywords: AOGCMs, Bayesian network, Hybrid, Long term prediction, Teleconnection patterns.

Herbaceous Species Richness and their Potentially Toxic Metals Uptake in Contaminated Soil

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The study explored the shoot extractability of potentially toxic elements (PTMs) Cd, Pb, and Zn by expansive herbaceous species growing under a phytoremediation experiment of Short Rotation Coppice (SRC) of *Salix* and *Populus* clones with different ameliorants (compost and sewage sludge) compared with a set of control in Podlesí, Czech Republic. The moderately acid soil reaction (pH), high CEC, and C/N ratio supported mineralization, solubility, mobility, and shoot accumulation of the contents of (in mg kg^{-1}) Cd (7.7-9.76), Pb (1541-1929), and Zn (245- 320) in the soil. Overall species size of 58 herbaceous plants was characterized by 21 botanical families and higher dicots than monocots. Although the soil amendments improved the chemical properties, compost application resulted in higher species richness by families compared to sewage sludge and control without any additives in the SRC experimental field. The relatively similar number of species (sp) and botanical families (f) between the area with compost application (31sp and 15f) and control field without trees (31sp and 13f) outside the experiment site resulted from the absence of canopies and resource competition. Approximately 100% of herbaceous plants accumulated Cd and Zn above the regulatory threshold of plants according to WHO and green fodder in the Czech Republic decree, while only 36% of plants accumulated Pb above the regional limit (40 mg kg^{-1}). Dicots recorded the highest contents, where *Tenacetum vulgare* and *Hypericum maculatum*

are most suitable for Cd accumulation, *Stachys palustris, Lamium perpereum,* and *Campanula patula* for Pb, and *Glechoma hederaceae, Arabidopsis halleri, C. patula,* and *Cirsium arvense* for Zn. *Arabidopsis helleri* had a dominantly high accumulation of 7498 mg Zn kg^{-1} among all treatments and species. Combined application of herbaceous plant species and appropriate compost may not only amend soils but offer soil chemical properties suitable for the bioavailability and PTM extraction potency of many herbaceous plant species.

Keywords: *Arabidopsis helleri*; Compost; Dicot; Phytoremediation; Potentially toxic metals; Sewage sludge

Pollution sources in Nuuk, S Greenland

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Identifying pollution sources in highly populated cities can be complex, as the multiple pollutant signals often mix and overlap. Studying the origin of contamination in remote areas, where the sources are reduced and easier to discern, may help to understand this mixing between pollution sources and to distinguish local and remote inputs.

In our project, we study the origin of potentially toxic metal contamination in sparsely populated arctic areas using isotopic signatures. For this presentation, I will focus on the results found in one of these areas, located in southwest Greenland: Nuuk.

Keywords: anthropogenic metal pollution, arctic, lead isotopic analysis

Is Silo nigricornis an indicator of suitable habitat for *Margaritifera margaritifera*?

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Healthy and functional catchments are crucial for communities of organisms living in freshwater ecosystems. Freshwater pearl mussel (*Margaritifera margritifera*) is one of the organisms with high environmental requirements on its habitat.

Part of the bigger project (Šumava National Park, VUV T.G.M., 2018-2020) was carried out mapping of the spatiotemporal heterogeneity of the macrozoobenthos in the Vltavsky Luh, which is one of the few remaining localities with a natural occurrence of freshwater pearl mussel. Sampling was done using the modified PERLA method always in spring and autumn in 6 selected locations. The sampling methodology was adjusted so that not only the localities but also the individual sampled habitats in the given localities could be evaluated among themselves.

A total of 114,203 individuals of macrozoobenthic fauna were found in 166 samples. The most represented taxonomic group, which accounted for 20 % of the total number of individuals found, was caddisflies (*Trichoptera*). During data processing, a total of 14 endangered species were found, of which was the *Silo nigricornis* with the highest abundance. This species has similar habitat requirements as the freshwater pearl mussel, specifically gravelly sand to stony oligotrophic mountain streams.

Over 85 % of *S. nigricornis* individuals were in habitats with an inorganic bottom surface, from stones to sand. 86 % of representatives of this species in 2018 and 2019 were found in Teplá Vltava - Dobrá and Teplá Vltava - Chlum localities. These localities belong to the section of the stream where the largest part of the Vltava colony of freshwater pearl mussels is located. The evaluation of these data was carried out as part of the thesis,

and the following study will focus on the found endangered species, including *S. nigricornis*, and their bioindication potential with regard to the habitat of the freshwater pearl mussel.

Keywords: macrozoobenthos, bioindicator, Vltava river, freshwater pearl mussel, *Silo nigricornis*

Rethinking resilient agriculture: From Climate-Smart Agriculture to Vulnerable-Smart Agriculture

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Climate-Smart Agriculture (CSA) is seeking to overcome the food security problem and develop rural livelihoods while minimizing negative impacts on the environment. However, when such synergies exist, the situation of small-scale farmers is often overlooked, and they are unable to implement new practices and technologies. Therefore, the main aim of this study is to improve CSA by adding the neglected but very important element "small-scale farmer", and introduce Vulnerable-Smart Agriculture (VSA) as a complete version of CSA. VSA indicates, based on the results of

this study, that none of the decisions made by policymakers can be realistic and functional as long as the voice of the farmers influenced by their decisions is not heard. Therefore, to identify different levels for possible interventions and develop VSA monitoring indicators, a new conceptual framework needs to be developed. This study proposed such a framework consisting of five elements: prediction of critical incidents by farmers, measuring the consequences of incidents, identifying farmers' coping strategies, assessing farmers' livelihood capital when facing an incident, and adapting to climate incidents. The primary focus of this study is on farmers' learning and operational preparation to deal with tension and disasters at farm level. Understanding the implications of threats from climate change and the recognizing of coping mechanisms will contribute to an increase in understanding sustainable management.

Keywords: Vulnerability, Sustainable livelihood, Food security, Climate change, Small-scale farming

Vulnerability to extreme heat: Should we expect life in a hot city?

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Climate change and especially extreme heat represent an unprecedented challenge for cities, threatening the future prosperity, health and well-being of urban populations. Climate adaptation is therefore one of the central topics for sustainable cities and societies. This study introduces a methodological approach for assessing urban vulnerability to extreme heat until 2050, presented in the example of Prague as the pilot city. The assessment, based on the variety of future climate and socioeconomic scenarios and the extent of implementation of adaptation measures, led to the identification of vulnerable localities across the city. Results suggest that global climate scenarios, the extent of built-up vs green area and population density significantly affect overall vulnerability to extreme heat. The most vulnerable are generally the areas with the smallest share of greenery (typically the city centre, as expected) and densely populated areas with a significant representation of the vulnerable population (children and seniors). However, extensive implementation of adaptation measures can reduce vulnerability substantially. The introduced vulnerability assessment represents an essential tool in urban planning, as it provides complex data on possible future developments including adequate adaptation options.

Keywords: Climate change, vulnerability, extream heat, urban planning, adaptation measures

A geochemical and agronomic evaluation of technosols made from construction and demolition fines mixed with green waste compost

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Increasing efforts are being made to create functional soil-like substrates from waste materials, prompted by the need to replace degraded or sealed soils in urban environments, create bulk soils for the restoration of old capped landfill and mine site areas, and to re-utilise value-laden materials otherwise disposed of to landfill. Construction and demolition fines (C&D-fines) and green waste compost (GWC) are two such commonly generated urban waste materials that represent repositories of geochemical value. Here technosols were produced from volumetric mixtures of these wastes ranging from 0-100% C&D-fines, with the remaining proportion comprised of GWC. Agronomic assessment was carried out by way of pot and rhizobox plant growth experiments with ryegrass (Lolium perenne), barley (Hordeum vulgare L. cv. Optic) and pea (Pisum sativum L. cv. Corus) to determine germination, plant mass and rooting behaviors. Geochemical and mineralogical evaluation was achieved by soil solution measurements combined with X-ray powder diffraction analyses to characterise the technosols and their distinct deviations from a reference agricultural geogenic old-red sandtone derived podzol (soil).

Germination and growth of ryegrass was up to 80-fold greater after 30-days in the technosol composed of equal volumes of the two waste materials (50 % C&D-fines: 50% GWC) compared to the soil. Liksewise, in the rhizobox experiment, root surface areas of barley and pea were increased from 130-200 cm2 in this technosol, compared to < 30 cm2 in the geogenic soil. High concentrations of Ca and Mg in pore waters (550-800 mg l-1) were dominant features of the technosols produced, in contrast to the gegenic soil (< 50 mg l-1), resulting from gypsum and calcite enrichment of the C&D-fines. In

contrast, the GWC represented a source of soluble K (450-1000 mg l-1). Highly elevated Ca concentrations in extended leaching tests of the technosols reflected ongoing gypsum dissolution, whereas soluble Mg and K were rapidly depleted.

In summary, the short-term performance of the technosols tested here as plant growth substrates was strong despite their evident geochemical and mineralogical distinction from soil. Optimising the technosol recipe will require balancing the geochemical qualities of each material that forms it to gleaning maximum value and longevity from urban wastes in this way.

Keywords: Technosol, construction wastes, compost, gypsum, pore water

Phylogeny and taxonomy of Protodermaptera infraorder

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Protodermaptera representatives have been included only minimally in previously published phylogenetic studies focused on earwigs. The material used for a molecular phylogenetic analysis representing all four currently differentiated families of the Protodermaptera (Karschiellidae, Diplatyidae, Haplodiplatyidae and Pygidicranidae). The phylogenetic analysis was based on 5 genes (COI, 18S, 28S, H3 and TUBA) with the use of 61 species (including 12 species used as outgroups). The conclusion implies that Protodermaptera does not form a monophyletic clade, as it also includes species from the families Apachyidae, Anisolabididae and Labiduridae, which are currently included in the infraorder Epidermaptera.

Keywords: phylogeny, taxonomy, Dermaptera, Protodermaptera, marker

The water accumulation in the landscape using the existing drainage system – case study

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This diploma thesis is focused on the design of water accumulation in the landscape using the existing drainage system and evaluation of the effectiveness of the proposed measure, it is processed in the form of a study. Literature research focuses on floods and droughts, water retention and accumulation in the landscape, water management land reclamation, land management and measures that serve to retain water in the landscape, such as small reservoirs, ponds and wetlands. Then some subsidy programs are described, which aim to support water retention in the landscape. Then the area of the interest is described. In the detailed analysis of the current state, written and map materials were used, where current problems on the solved plots were identified. These problems include the poor state of land drainage, which is clogged and causes wetting of a large part of the land. Then the water slowly seeps into the drainage shaft, which is located on a piped watercourse, and the water flows through this channel into the Trojhorský stream. In this case, the reconstruction of the drainage seems completely unnecessary, as it is a permanent grassland and wetting does not endanger the surrounding land. In the next chapter, a draft measure was made, namely 2 ponds, which are located on the drainage drains, where water will accumulate. The ponds are taken as natural, water will seep from the ponds into the surrounding terrain. The ponds will be a refuge for many animals, but they will also fulfill an aesthetic function. The diploma thesis also includes drawings of designed ponds.

Keywords: water accumulation in the landscape, drain, drainage

Effect of plant secondary metabolites on the caterpillar gut microbiota of monophages and polyphages

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Microbiota of insect herbivores has been extensively studied, but the role of plant secondary metabolites (SMs) has been neglected. As the main factor shaping the caterpillar gut microbiota (CGM) is the species identity, the response of the CGM to SMs may be species-specific. We aimed to determine how the CGM of polyphages and monophages reacts to SM in an artificial diet (AD). We hypothesized that the effect of SMs contained in the host plant would be smaller than that of non-native SMs, and that this effect would be more pronounced in monophages. Seven polyphagous and two monophagous caterpillar species (from oaks) were fed by AD with tannin (oak-related compound), tannivin (artificial tannin-like compound), and salicylate (compound absent in oaks). The CGM composition of AD-fed individuals was compared with individuals fed by oak leaves, starved individuals, and AD enriched by microorganisms. The responses of the CGM to SMs did not differ substantially between polyphages and monophages, contrary to our hypothesis. The CGM richness decreased on AD without SMs but was reestablished with the increasing SMs concentration. The CGM similarity between AD-fed caterpillars and AD increased with increasing SMs concentration, suggesting the recruitment from AD. Whether this microbiota is beneficial for the caterpillars (e.g. helps to degrade SMs), or the pathogens prevail as the concentration increases, remains to be resolved.

Keywords: Bacteria, Fungi, Experiment, Tannin, Tannivin, Salicylate, Artificial diet

Development of a novel desiccation chamber for induction of tardigrade anhydrobiosis

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Tardigrades are micrometazoans that can survive up to 20 years of desiccation by entering an ametabolic state, anhydrobiosis. Different species have various desiccation tolerance. Some tardigrades, e.g. the laboratory model species Hypsibius exemplaris Gasiorek, Stec, Morek & Michalczyk, 2018, require a specific desiccation protocol with precisely controlled relative humidity (RH) for their survival (e.g.Poprawa et al., 2022). Different relative humidities (RH) allow "slower" or "faster" desiccation and induction of anhydrobiosis. Chosen RH is an important factor influencing post-anhydrobiotic survival of tardigrades, rotifers and nematodes (Crowe, 1975; Kondo et el., 2015; Örstan, 1995; Wright, 1989). Slow desiccation (and vacuum) is significant, also, for desiccation survival in human cells (Puhlev et al., 2001). Therefore, choosing a proper desiccation technique is essential. Traditionally, desiccator with different salt solutions is used to set appropriate RH in desiccation studies. This technique main limitation is insufficient control of RH and temperature. An alternative option is usage of desiccator cabinets. These can be quite expensive though. Therefore, novel desiccation tools with adjustable and controllable parameters including RH and temperature are required. Such devices could greatly accelerate the research on tardigrade desiccation tolerance, since it is known in only a handful of adult species.

Keywords: tardigrades, desiccation, anhydrobiosis, relative humidity

High Latitude Dust: Newly identified sources and impacts on climate and environment

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Dust particles from high latitudes have a large local, regional, and global significance to climate and the environment as short-lived climate forcers, air pollutants, and nutrient sources. HLD was recognized as an important climate driver in Polar Regions in the IPCC Special Report on the Ocean and Cryosphere in a Changing Climate in 2019. Sand and dust storms, including HLD, were identified as a hazard that affects 11 of the 17 Sustainable Development Goals. It is estimated that HLD contributes 5 % to the global dust budget with about 100 million tons of dust and active HLD sources cover > 1,500,000 km^2. Arctic HLD sources are estimated to contribute 1-3 % of the global dust, but during dust enhanced activity years, about 5.5 % of the Arctic land areas (with area of > 1,000,000 km^2) are active dust sources. Several studies have shown that Icelandic and other HL dusts can travel distances > 3000 km in High Arctic as well as to Europe. There are newly two online models (DREAM, SILAM) providing daily operational dust forecasts of HLD. DREAM is first operational dust forecast for Icelandic dust available at the World Meteorological Organization Sand/Dust Storm Warning Advisory and Assessment System (WMO SDS-WAS) at https://sds-was.aemet.es/forecast-products/dust-forecasts/icelandic-dust-forecast. SILAM from the Finnish Meteorological Institute provides HLD forecast for both circumpolar regions. The Icelandic Aerosol and Dust

Association (IceDust, https://icedustblog.wordpress.com/) is newly member aerosol association of the European Aerosol Assembly.

Icelandic volcanic dust has impacts on atmosphere, cryosphere, marine and terrestrial environments, as well as socio-economic sectors. Volcanic dust has similar impacts on snow/ice as Black Carbon in terms of albedo reduction and water retention capacity of snow. In atmosphere, Icelandic dust is an efficient ice-nucleating particle (INP) having impacts on the mid- to high-latitude mixed phase clouds. In this talk, new HLD observations, atmospheric measurements and long-term dust storm – erosion aeolian rates relation identified in dwarf shrub roots will be shown.

Keywords: Volcanic dust, air pollution, cold deserts, aerosol, Arctic, erosion, vegetation

An efficient method for making accurate simulated images to be used for visual impact assessment of wind turbines

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Today there is a growing global demand for faster development of wind energy supported by technological advancements which result in more and more powerful and efficient wind turbines. However, there is public opposition to the placement of these devices mainly due to their perceived visual impact.

Efforts to increase public acceptance of wind farms by those who are affected the most, uses public participation to guide the decision-making processes. This technique is already in practice in many European Union countries under SEA (Strategic environmental assessment) directive. Such participation needs an accurate, fast, and low-cost method to produce simulated images which illustrate how such devices might appear on the affected landscape. These images determine the public opposition/acceptance and allow authorities/professionals to assess the potential visual impact on specific landscape features at a proposed site.

The aim of this research is to propose a computer-aided method for producing simulated images. The method is fast, free and available for anyone who has the basic knowledge of GIS. It has been used by the author in a case study conducted in Ústecký region in the Czech Republic and the accuracy and quality of the method is proven to work. It consists of two major parts; the first is done by the use of some pieces of software; the second is performed in the field. The software is free of cost and open source. Therefore, the freedom for anyone to use this method in a wide variety of projects is assured; it also allows the development of new analytical tools. The in-the-field part does not require specialized equipment as this step can be easily performed using software and hardware tools available to everyone. The method has proven to be useful for the visual impact assessment of different elements such as electrical transmission towers, smoke stack chimneys, and large outdoor signs. However, this study is focused on visual impact of wind turbines.

Keywords: Wind turbine, Visual impact assessment, Open source software, 3D simulation

Extremely high number of neurons in weakly electric fish brains

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The ability to sense weak electric fields is widespread and likely ancestral in vertebrates. This capacity has been lost in neopterygian fishes and afterwards independently reinvented in several teleost lineages. Some of them evolved passive electroreception, while others active ability to produce weak electric fields and use them to catch prey items, orient in their environment and communicate with conspecifics. Even though it is likely that these innovations demand for extra computing capacity, the link between electric and brain evolution remains enigmatic. Here we use the isotropic fractionator to compare number of neurons and their distributions across major brain parts in basal ray-finned fishes, teleosts with no electroreception, and teleosts with secondarily evolved passive and active electroreception. We show that basal ray-finned fishes have rather modest numbers of brain neurons while teleost fish have more neurons than expected. Despite being small, their cerebellum features very high neuronal densities and therefore houses more than 50% of all brain neurons, dwarfing the telencephalic neuronal fraction by comparison. An enlarged cerebellum harbouring the vast majority of brain neurons has evolved multiple times independently in weakly electric teleost fishes. In the extreme cases, their cerebellum and telencephalon contain more than 95% and less than 0.5 % of brain neurons, respectively. Mormyrids feature extreme cerebellar neuronal densities and therefore have cerebellar neuron counts equal to or greater than large mammals (including primates) with much larger brains. These findings strongly suggest that processing of electrosensory information is extremely computationally demanding.

Keywords: number of brain neurons, ray-finned fishes, electroreception, brain processing capacity, isotropic fractionator.

High power Microwave atmospheric air plasma spectroscopy and opportunity to CO₂ decomposition

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The core plasma of the microwave atmospheric pressure torch spectroscopy was done during this work. High power Microwave max 100 Kw plasma torch system is used to generate atmospheric plasma. high flow 1000 SLM dust filtered air was used as plasma working gas. FLAME-T-XR1 OceanInsight Spectrometer was used to optical emission spectroscopy and spectrum wavelength range were 200nm up to 800 nm. Spectrum acquisition was done at five different microwave power, from 30 kW up to 100 kW. The maximum irradiation was in range of 230 nm up to 340 nm which are UVC and UVB. transitions of the OH band ($X^2\Pi \to A^2\Sigma^+$) emission spectrum was detected. This source of plasma with high intensity UV light can be used for plasma-photocatalyst CO₂ decomposition.

Keywords: Microwave Air Plasma, Optical emission Spectroscopy, UVC, UVB, Plasma-photocatalyst

Exploring the relationship between dry grasslands' characteristics and predicted atmospheric nitrogen input

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Nitrogen input presents one of the major threats to a range of grassland habitats by increasing the risk of their collapse. This is driven particularly by inducing changes in community composition. The ability to identify the sources of the nitrogen input across spatial scales is therefore often crucial for efficient management planning and prioritisation of mitigating actions. Using the data on habitat occurrence, quality and species composition acquired through a field mapping scheme, and the data on predicted atmospheric nitrogen deposition, we analysed the observed differences in multiple habitat characteristics across the nitrogen input gradient. The analysis revealed significant differences in the studied properties in response to the predicted nitrogen input across 10 various habitat types and subtypes of dry grasslands in the Czech Republic. Decreases in habitat quality, species composition metrics, and spatial characteristics of the habitat type were associated with higher rates of modelled nitrogen deposition where significant variation was found. The magnitude of the relationship between nitrogen deposition and habitat metrics was particularly high among the high-threat categories according to the Red List of habitats. Our results provide implications for setting future management targets aiming to counter the negative impacts of nitrogen input through increased removal of nutrients. Furthermore, more detailed spatial analysis and development of GIS tools could help the site managers in identifying the habitat patches at the highest risk of degradation and allow for adequate prioritisation of management actions.

Keywords: natural habitats, dry grasslands, mapping, nitrogen deposition

Insights into ongoing sea turtle harvest in Indonesia, Sumatra

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Sea turtles are marine reptiles that inhabit all oceans except for the polar regions. They are famous for large distance migrations and natal homing behavior which is an ability to return to natal beaches to lay eggs. Sea turtles face many threats such as illegal trade, bycatch, habitat destruction and climate change. The combinations of these threats led to population declines of up to 80%. As a result, sea turtles are listed in Appendix I of CITES and have full law protection in most of the countries including Indonesia. Contrary to this, illegal harvest and trade still continue, and Indonesia is considered as one of the largest sea turtle use and trade hotspots in the world. We have conducted a community survey in Sumatra, Indonesia and collected information on sea turtle take (direct take from the sea, egg harvesting) and perceptions about sea turtles. The questionnaire survey was based on a community-based turtle use and trade survey developed by the World Wide Fund for Nature (WWF) under the Turtle Use Project. Furthermore, we carried out carapace measurements of harvested turtles when possible. Our results suggested that mostly juvenile individuals are harvested and supported the concept of fishing down marine food webs. The majority of respondents reported to perceive population declines of sea turtles. All respondents knew that sea turtles are protected species by Indonesian law, however, the third of the respondents

admitted sea turtle harvesting and 70% consumed sea turtles. Only the consumptive use of sea turtles was perceived as important by the respondents, none of the respondents considered important non-consumptive use of sea turtles such as ecotourism. We propose to focus conservation activities on community work since the understanding of sea turtle importance is limited. We see a big potential in promoting non-consumptive use of sea turtles. Ecotourism could create possibilities for alternative livelihoods and motivate communities to protect sea turtles instead of exploiting them.

Keywords: sea turtle, conservation, illegal trade, Indonesia

Assessing internal tree stem decay using close-range photogrammetry

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As new technologies enter the market and evolve, improved ways of tree health state estimation are available and seem to be more objective and accurate than the usually used visual assessment of urban tree internal decay. Among such innovative methods, photography, photogrammetry, acoustic tomography, and machine learning can be placed. As tomography is one of the few objective methods of internal tree stem state estimation, it has great potential to be further enhanced or replaced by new approaches, requiring less labour and time. The presented project aims at finding a relationship between stem shape or texture and its internal conditions, which should be analysed using artificial intelligence and deep learning methods. The objectives of the study are as follows: 1) Comparing the tomography-estimated state of internal tree decay, after felling selected trees; 2) Improving accuracy of tomography by implementing 3D stem models into the calculations; 3) Assessing the difference between photogrammetric and smartphone LiDAR scans of stems; 4) Estimating the relationship between 3D stem shape and the presence of decay

The outcoming results shall provide innovative ideas in the relatively undiscovered field of arboriculture and open a new way for the development of a tool for both improved acoustic tomography workflow and an independent way of assessing tree decay using terrestrial remote sensing data. The latter-mentioned feature is an important step towards developing an objective tool for tree risk estimation in the field of parks, urban forests, and roadside forests management, without the need for deep knowledge in the discipline of arboriculture, which is missing by forest managers and governmental institutions employees.

Keywords: arboriculture, remote sensing, tomography, deep learning, urban forestry

Influence of biochar on the Mariana landfill vineyard

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The vineyard at Čepirožská Spoil heap is located near the town of Most. As part of the reclamation, a vineyard was established on the south-facing slope of the dump, which had problems with local landslides from the beginning. In the easternmost part of the vineyard is the Mariana vineyard, where there is a high number of deaths of young seedlings. In order to find out the interest of the seedlings, the Czech winery Chrámce, which manages the area, decided to create an experimental planting plant in cooperation with the Faculty of the Environment. The aim of the diploma thesis is to evaluate the influence of added substrates: mixtures of biochar, kompoChar and compost on the attractiveness of newly planted vine seedlings. In the area of interest. Samples of soil chemical composition and soil moisture are also examined. The practical part was carried out at the Mariana landfill vineyard, where the planting of new vine seedlings was carried out in the spring of 2021. Soil probes were placed at selected seedlings to determine soil moisture. The resulting values of yield were related to the measured soil moisture. The highest measured humidity of 63.3 % was found for the KompoChar substrate at a depth of 50 cm, at the same time most of the seedlings out of the total number of seedlings planted in the given substrate survived. In the analysis of moisture and absorbency, the values of the biochar mixture were slightly lower than those of kompoChar. In the biochar mixture, 28 % of the total number of planted seedlings survived and a moisture content of 412 % was measured at a depth of 50 cm. The lowest values of soil moisture and yield were found for the compost substrate. Of the total number of planted seedlings with compost, only 20 % survived, the humidity at a depth of 50 cm was also the lowest at 36.4 %. The results showed that kompoChar and a mixture of biochar have a positive effect on moisture retention in the soil and contribute to better soil properties.

Keywords: biochar, grapevine, Čepirohy, spoil tip, soil moisture

Early detection of stress factors in a forest stand using a drone with an electronic nose

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In the last decade, European forests have been extensively disturbed, which include fires, windthrow events, and outbreaks of insect pests (mainly bark beetle). As a result, the trees lose their vitality, and their health deteriorates. To avoid enormous economic and ecological losses, timely identification of forest stand stress is essential.

The bark beetle attacked tree produces a several times higher amount of volatile organic compounds. At the same time, the bark beetle produces an aggregation pheromone to attract the female for mating to the nuptial chamber. These substances can be detected using conventional chemical methods (solid-phase microextraction fibers and cartridges). The disadvantage of these methods is the long sampling time in the forest, and at the same time, the results must be analyzed in the laboratory using a gas chromatograph. A potential device appears to be an electronic sensor nose, which detects dangerous gas leaks or measures concentrations above landfills, volcanic activity, etc. We verified the possibility of early-stage detecting stress in the forest stand using unmanned aerial vehicles with an electronic nose. The electronic nose measures and analyses the concentration of gases in the air in real-time. We experimented with a heavily attacked forest near the Vyžlovka (60-100 years old Norway spruce trees). We used the DJI Matrice 600 Pro multi-copter for the measurements with the Sniffer 4D v2 electronic nose. We used conventional chemical methods for data validation. Data were collected at three heights. We evaluated the data statistically and displayed the results in 2D odor and 3D odor maps. Our results confirmed the applicability of the electronic nose for stress mapping in the forest ecosystem.

Keywords: electronic nose, unmanned aerial vehicles, 3D mapping, natural disturbance, bark beetle outbreaks, early detection

Optimizing agricultural biomass application to enhance nitrogen removal in vertical flow constructed wetlands for treating low-carbon wastewater

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Agricultural biomass waste in rural areas has been identified as an economical solid carbon sources in constructed wetlands (CWs) for treating low C/N ratio domestic sewage. However, little information is available regarding its optimal utilization as a media amendment for enhancing nitrogen removal in CWs. In this study, vertical flow CWs with different walnut peel amendment proportions (0%, 25%, 50%, 75%) were developed to explore the effects of biomass dosage on the treatment performance, nitrous oxide (N_2O) emission and microbial metabolites. Results showed that the addition of biomass significantly enhanced the denitrification performance in all CWs, and the higher total nitrogen (TN) removal efficiency (91.14-97.16%) was achieved in CWs with the optimal dosage of 25%. While the addition of biomass resulted in a slight increase in N_2O emission (20.56–270.13 µg m^{-2} h^{-1}) compared with control systems. Additionally, the biomass addition increased the accumulation of extracellular polymeric substances (EPS) by facilitating microbial processes. Higher total EPS production was observed in CW with 25% biomass, and the proportion of tightly bound EPS (48%) dominated in the total EPS in different CWs.

Keywords: Agricultural wastes, Constructed wetland, Denitrification, Extracellular polymeric substances

Heavy metal profiles in structure of environmental samples deciphered using solid state instrumental microanalysis

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This presentation sums up efforts in multi-disciplinary and multi-instrumental approach to chemical microanalysis with focus on metal accumulation in living systems and environmental sciences. It was designated to investigate the content and distribution of metals of interest in tissue of Antarctic lichens Usnea Antarctica from the James Ross Island and study their relationship with the surrounding environments and discuss bioaccumulating mechanisms in which, for example, Hg levels exceeded levels of 2.5 mg kg^{-1}, high above other parts of the Antarctic Peninsula region. The influence of habitat and environmental conditions play an important role in the bioaccumulation of contaminants rather than simple presence of sources of contamination. Burial of biological tissues and its significance in deciphering the relationship between the environment as an elemental source and the sample and the elemental profile as an environmental proxy is discussed in biominerals, such as prehistorical teeth and bones. Application of probing techniques as a tool of quasi-direct chemical microanalysis with retained spatial information and significance of bioimaging in modern chemical analysis is discussed using examples of hyphenation of laser and ion probes to mass spectrometry.

Keywords: Antarctica, heavy metal, lichen, bioimaging, tooth, bioaccumulator, pollution, LA-ICP-MS, ToF-SIMS

Salt over gold – who is messing around in the Congolese jungle

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Baïs, clearings in forest of the Congo basin, represent an important landscape feature for ecology and ethology of forest animals. These natural open spaces in the dense lowland equatorial evergreen rain forest mainly atract mammal species, including arboreal ones, which can use unobstructed habitat with direct sunlight. Baïs often contain sources of soil minerals unearthed and consumed by African forest elephants or created by fallen uprooted trees. Such a source becomes an attractant for other mammals, e.g. the Western gorilla, the African forest buffalo or the mantled guereza, due to their mineral deficiency caused by a dominant herbivore diet. Baï serves as a stage for intra- and interspecific social interactions of a variety of species but also as notorious hunting grounds, their conservation priority is therefore of the utmost importance. We present the preliminary results of our camera-trap based survey conducted since August 2021 in the core zone of the proposed conservation area of Messok-Dja, Republic of Congo. Six month data from four mineral sources on three different baïs provide insight into a wildlife in the wet and dry seasons. A total of 16 species of mammals visited the sources, the most common of which were elephants with 78 visits and buffalo with 75 visits. Both apes, gorilla and chimpanzee, were recorded in 57 and 56 events, dominantly within one heterogeneously overgrown baï. The number of species visits differed substantially between the mineral sources types and baïs, indicating specific spatiotemporal preferences. The observed nocturnality of the largest hoofed species may be a behavioral response to humans, and therefore a signal to intensify anti-poaching patrols. Ongoing survey recently covers all mineral sources on

two baïs for a whole year. We assume that the results will significantly contribute not only to the knowledge of the mammal ecology of the Congo Basin, but also to the effective protection of the Messok-Dja.

Keywords: Baï, ecology, Congo basin, megafauna, conservation, camera trap

Distribution of micro- (Fe, Zn, Cu, and Mn) and risk (Al, As, Cr, Ni, Pb, and Cd) elements in the organs of *Rumex alpinus L.* in the Alps and Krkonoše Mountains

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Rumex alpinus is a native plant in the mountains of Europe whose distribution has partly been affected by its utilization as a vegetable and medicinal herb. The distribution of micro and risk elements in its organs is not well-known. The study examined the safety of consuming *Rumex alpinus* from the Krkonoše Mountains, the Czech Republic, and the Alps (Austria and Italy). We determined the total and plant-available content of Fe, Zn, Cu, Mn, Al, As, Cr, Ni, Pb, and Cd in the soil and the total content in organs of *Rumex alpinus*. The uptake and distribution of elements by plants were characterized by bioaccumulation (BF) and translocation (TF) factors. The level of elements accumulation by *Rumex alpinus* is considerably different, depending on local geological substrates and environmental conditions. *Rumex alpinus* has considerable tolerance to Zn, Cu, As, Cr,

Ni, with an easy accumulation strategy. High Al and Cd content in belowground biomass (rhizome) indicate a defensive mechanism for them. Although the aboveground biomass (emerging, senescent, mature leaves, petiole) has some degree of accumulation of risk elements, the results showed that *Rumex alpinus* is an excluder. *Rumex alpinus* does not accumulate risk elements in organs (leaf and petiole) that are consumed based on the permissible limit according to World Health Organization (2001) and can therefore be used without concern. Caution must, therefore, be taken when consuming these plant parts in heavily contaminated soils.

Keywords: Weed, Above/belowground biomass, Bioaccumulation/Translocation factors, Excluder, Micro/risk element

Detection and quantification of *Puccinia graminis* and *Puccinia triticina* in host plant tissue by real-time PCR

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Leaf rust, caused by *Puccinia triticina* Eriks. and *Puccinia graminis* Pers. are one of the other most devastating diseases of wheat and other grown cereals worldwide, often resulting in significant yield losses. This work aims to determine the quantity of the given rust in host plant tissue (*Triticum aestivum*). Tubulins are well conserved in eukaryotes and are molecular targets of MBC fungicides, effectively controlling many plant diseases caused by ascomycete fungi. Therefore, the B-tubulin gene was selected

as a molecular marker, and primers and probes were developed for it. The symptomatic evaluation was performed using image analysis and real-time PCR quantified pathogen content. Results of the detection and quantification of *Puccinia* spp. in wheat tissue can be used for disease monitoring, for timely fungicide application, and in wheat breeding programs for rust resistance.

Keywords: Fungal diseases, Genomic selection, Plant breeding, Molecular markers

Validation of molecular markers for the identification of resistant plants to *Hyaloperenospora parasitica in* commercial crops of *Brassica oleracea* L.

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Molecular marker technology is integrated into existing plant breeding programs, and resistant genotypes selected using molecular markers can be used for hybridization. This study evaluated the association of the *BODM1* molecular marker with resistance to *Hyaloperenospora parasitica* for the set of 24 (resistant, susceptible) *Brassica oleracea* genotypes. Using the SSR marker *BODM1*, the tested samples' observed sections were cloned, sequenced, and then evaluated. The marker did not show length polymorphism between resistant and susceptible varieties. However, sequencing of these samples indicated a 96% variability in the tandem ATC sequence located in the 3rd intron of the glucosinolate pathway of *Brassica* species, which could be used as a molecular marker in future studies.

Keywords: *Brassicaeae*, Sequencing, Fungal diseases, Microsatellites, Plant breeding

Effect of input data on the estimation of the rooftops solar potential

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Modeling solar energy in the urban environment is crucial for the potential location of solar energy installations. Given that solar radiation is considered to be the most advantageous renewable source in the geographical environment of the Czech Republic, the work describes the possibilities of use and their impacts. An important part for the effective use of solar radiation for the calculation of input data and their overall quality. The work therefore provides a comprehensive view of the possibilities of using the effects of input data, which are freely available DMP 1G or individually modified LiDAR. The aim of the diploma thesis is to compare and evaluate the impact solar energy (global, direct, diffuse) depending on various input data sets of potential solar radiation. The amount is solved by a computational model, which is part of the ArcGIS. In the overall measurement of the prediction of the impact of global radiation up to small fluctuations of marginal fluctuations in values. The calculated solar potential using a less accurate surface model (DMP1G) can achieve significant deviations for the individual roofs from the potential estimated using accurate data. The overall work demonstrated the minimal influence of the measured input data in determining the impact solar energy, including individual types of solar radiation (global, direct and diffuse) during the individual months of the calendar year. This knowledge can be used, for example, in solar energy planning.

Keywords: photovoltaics, LiDAR, solar radiation, DMP 1G

Surface waters quality development in the Czech Republic

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This work is concerned with determining the extent of water pollution around us. I mainly focused on water pollution in the country. To measure their pollution I selected basic measured variables such as BOD5, COD, Nitrogen, Phosphorus, dissolved and insoluble substances in water. I followed the legislation that is followed to assess water quality and detect pollution. In the work is described as closely as possible, how the quality of surface water has changed over the years, what substances have been most polluting surface waters. Water pollution has an impact on the economic function of water. and landscape, as well as on the recreational functions of water (e.g. for bathing). Pollution surface water pollution has increased over time and as a result of increased environmental concern our area has changed in various ways, with modifications to watercourses and changes in management, which has had a positive effect on the gradual improvement of water quality. In my thesis I point out possible ways of reducing water pollution, while using individual scientific articles and statistical data obtained from measurements by professionals for to illustrate the results of my investigations. The aim of the thesis is to evaluate the development of pollution of surface water pollution in the Czech Republic over the years. I believe that my work can be beneficial in further procedures of competent authorities aimed at the protection of environment.

Keywords: Surface water, water quality, nutrients, organic matter

Precocial birds with different lifestyles in contrasting climates differ in chick´s thermal demands and efficiency of parental brooding care

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Chicks of precocial birds hatch well-developed and can search actively for food but their homeothermy develops gradually during growth. This makes them dependent on heat provided by parents ("brooding"), which is then traded off against other activities, mainly foraging. Although brooding has been documented in many precocial birds, little is known about the differences in the amount and efficiency of brooding care, brooding diel rhythmicity, and impact on the chick's growth, particularly between species living in different climatic conditions. We used multisensory dataloggers to evaluate these brooding patterns in two related species inhabiting contrasting climate zones: temperate Northern lapwing (*Vanellus vanellus*) and desert-dwelling Red-wattled lapwing (*Vanellus indicus*). In both species, night brooding prevailed even during warm nights, suggesting a general brooding rule among birds. On the contrary, the desert lapwing chicks were brooded less, less efficiently, and in higher ambient temperatures than the temperate lapwing chicks. We found no negative effect of a high brooding rate on the growth rate in either species. We discuss that a faster lifestyle with species-specific life history traits of birds breeding in harsher climates accompanied by more efficient metabolism may reduce the thermal demands of chicks and increase the efficiency of parental brooding care.

Keywords: brooding, shorebirds, accelerometer, multisensory datalogger, Hidden Markov Models

Effect of Hydraulic Loading Rate And C:N Ratio on Wastewater Treatment in Constructed Wetlands Inoculated with Arbuscular Mycorrhizal Fungi

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Constructed wetlands (CWs) are systems widely used to treat industrial and domestic wastewater and non-point water pollution from agricultural production. The effect of hydraulic loading rate (HLR) and carbon to nitrogen ratio has an important role in constructed wetlands nutrient removal efficiency. In this study, we assessed the effect of hydraulic loading rate and C:N ratio on nutrient removal efficiency, using 8 constructed wetland reactors inoculated with *Rhizophagus irregularis*. Prepared wastewater was simulated municipal sewage with 4 different C:N ratios (2, 2.2, 2.9, 3.4) applied at high and low hydraulic loading rates. After passing through reactors, wastewater samples were analyzed for total carbon, total organic and inorganic carbon, and total nitrogen concentrations using Formacs[HT-I] TOC/TN analyzer (SKALAR). Concentrations of ammonium were measured using Cary 60 UV-VIS spectrophotometer (Agilent Technologies). Phosphate, nitrate, and sulfate concentrations were measured using 883 Basic IC plus ion chromatograph (Metrohm). The conducted experiment showed that a low hydraulic loading rate benefits TC, TOC, IC, and PO_4^{3-} removal. High HLR was beneficial for NO_3^- and SO_4^{2-} removal, while NH_4^+ and TN removal were similar for both HLRs. An increase in C:N ratio increased NO_3^- removal efficiency, but only at a high hydraulic loading rate. Arbuscular mycorrhizal fungi inoculation in reactors possibly had a positive effect on phosphorus removal efficiency. Results showed that all eight constructed wetland reactors during the experiment conducted from April 13th until June 10th, 2022, had adequate nitrogen, carbon, phosphorus, and sulfate removal efficiencies, even higher for certain nutrients than those reported in other research.

Keywords: wastewater treatment, optimization of constructed wetland reactors, nutrient removal efficiency, arbuscular mycorrhizal fungi

Thermic activity around Černá hora

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The thermal activity in the boundary layer of the atmosphere is a vertical motion based on temperature differences between air particles and the surrounding air mass. It has a major effect on the development of clouds, air circulation, and the transport of humidity. This thesis aims to explain the concept of thermal activity, why this atmosphere effect exists, and what the ideal conditions must be for the thermal activity to form. The area of interest chosen for the thesis is located in the Krkonoše Mountains, a description of the site and the distribution according to orographic changes is given. The practical part of the thesis is devoted to modeling the ideal places for the formation of the thermal activity, in different atmospheric conditions. Different values of humidity and air temperature enter the model. Furthermore, the model is then affected by orographic changes in the terrain, such as slope, orientation to the world sides, and terrain elevation. The thesis concludes with a comparison of the modeled conditions and real measured values obtained from GPS records of paraglider pilots.

Keywords: The atmospheric boundary layer, thermic activity, thermal activity modelling, solar radiation, thermal activity per time period, comparing results with reality

The combined application of biochar and high phosphate fertilizer promoted the mobilization and redistribution of cadmium in rhizosphere soil

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The changes of rhizosphere soil properties caused by root exudates affect the migration and morphology of cadmium (Cd). The Cd speciations in rhizosphere soil were investigated by pot experiment and adsorption experiment. Four treatments were designed: no fertilization (CK); phosphate (P) fertilizer application (PF); biochar application (BC); and combined P fertilizer and biochar application (PF+BC). After 60 days of cultivation, the content of DTPA (diethylenetriamine pentaacetate acid)-Cd in PF, BC and PF+BC treatments were significantly reduced by 17.3%, 36.2%, 23.9% compared with CK treatment, respectively. We found that the pH of rhizosphere soil was significantly lower than that of non-rhizosphere soil in all treatments. The order of pH in rhizosphere soil was BC > PF > PF+BC > CK. The content of organic acid in PF, BC and PF+BC treatments were significantly reduced by 39.8%, 71.1%, 25.3% compared with CK treatment, respectively. The rhizosphere soil in PF+BC treatment had the largest available P (36.32 mg kg^{-1}) and the largest adsorption capacity (7409 mg kg^{-1}). The results of Energy dispersive X-ray (EDX) mapping confirmed that Cd^{2+} and PO_4^{3-} to form bond bridges or precipitates such as $Cd_3(PO_4)_2$ on the surface of soil or biochar in PF+BC treatment. When P is sufficient, although it increases the availability of Cd, the high adsorption capacity produced by the addition of biochar can re-precipitate the Cd dissolved by organic acids.

Keywords: Rhizosphere soil, Cadmium availability, Soil pH, Low molecular weight organic acids (LMWOAs), Available phosphorus, Re-precipitation

Phylogenetic revision of genera within the crown lineage of the subfamily Silphinae (Coleoptera: Silphidae)

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The crown lineage of the subfamily Silphinae consists of the genera *Silpha* Linnaeus, 1758, *Aclypea* Reitter, 1885, *Ablattaria* Reitter, 1885, and *Phosphuga* Leach, 1817. In this study, we present preliminary results of molecular phylogeny within the group based on two mitochondrial genes – COI and 16S (mtDNA). DNA was extracted from total of 8 individuals which were either dry (museum specimen) or stored in 96 % EtOH. Additional sequences of additional species within Silphidae were obtained from NCBI. In total 19 species were analysed, and the total length of concatenated sequences was 1094 bp. Molecular phylogeny was constructed under maximal likelihood (IQ Tree) and Bayesian interference (Mr. Bayes). The results show four well supported monophyletic groups – *Aclypea, Ablattaria, Silpha,* and *Phosphuga*; *Ablattaria* being sister group to the other three genera.

Keywords: Coleoptera, phylogeny, mtDNA

Frozen detritus as nutritious food for river pearl mussel (*Margaritifera margaritifera*)

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The freshwater pearl mussel (*Margaritifera margaritifera*) is a specially protected critically endangered species in the Czech Republic, occurring in our oligotrophic waters, which are generally poor in calcium. As part of the action plan, artificial breeding and increasing of populations in the wild has been carried out in recent years, but these activities are demanding not only financially and timewise, but mainly physically. The main goal of our experiments was to reduce the time and physical demands of these rearings, because today the breeders have to provide fresh organic detritus (food for pearl mussels) every day throughout the year. They obtain it from springs and small streams, which, however, sometimes dry up in the summer, are overlap by fallen leaves in the autumn, and freeze and get covered by snow in the winter. The use of frozen and freshly collected detritus (from the same spring collected at the same time) in bioindication tests showed that freshly refrozen food is not only suitable for juvenile pearl mussels), but even more nutritious than fresh detritus – freshwater pearl mussels grew even more! We assume that this is because ice crystals break down cells in the detritus (which under normal conditions would pass intact through the mussel digestive tract), making the detritus much more nutritious for pearl mussels. Our data also confirms the long-term observations of malacologists who routinely use frozen food for land snails.

Keywords: Freshwater pearl mussel, *Margaritifera margaritifera*, detritus, Pearl mussel action plan, mussel breeding, frozen detritus

Large scale tree mortality monitoring using machine and deep learning methods

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Large scale tree mortality due to different reasons (drought, beetle and other disturbances) and especially its dynamic in time represent valuable information for scientists and forest managers for estimation of behavior and predict future activity. Thanks to remote sensing technologies different imagery is available for assessment of this information. In large scale the main problem is automatization of the analysis. Automatic detection of dead trees is a current problem not only in the Czech Republic and many work exist for this purpose (Grodzki, 2016; Stereńczak et al., 2017). This research provide benchmark between machine learning and deep learning methods for the detection of dead trees. It is a supervised classification based on the object image analysis (segments), using the Random Forest (RF) algorithm and convolutional neural networks (CNN). The CNN classification was based on heat maps. The classification was performed on two dataset types, namely satellites and aerial imagery. We use Sentinel images and Planet images in corresponding dates, and aerial imagery from the available periods with human operator verification is used as ground truth data. The classification was performed in eCognition software. Both methods showed an accuracy of over 90%. We describe the advantages and disadvantages of each method.

Keywords: random forest, CNN, eCognition, image classification, forestry, tree mortality

Differential roles of seed and sprout regeneration in forest diversity and productivity after logging

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Forest regeneration is critical part of forest development after disturbance. Woody plants after disturbances either are killed and replaced by another individual (nonsprouters) or resprout from vegetative tissue (sprouters). Both these modes of regeneration often co-occur together and both are important in the early forest successional stage. However, what proportion of tree diversity and productivity arises from each of the regeneration modes, what affect these proportions and how these modes interact with each other remains unknown. We used data from two logging experiments in the Czech Republic, where we measured and mapped both sprouts and seed regeneration 11 years after the logging. Sprout regeneration represented great majority of total above ground biomass and both productivity and diversity of sprouts were much higher compare to seed regeneration. Productivity and diversity of both sprouts and seed regeneration was negatively affected by density of standards but the effect was much stronger for seed regeneration. Proportion of sprout regeneration increased with increasing density of standards. Seed regeneration did not affect sprout growth and sprouts did not pose any competition for seed regeneration either, as they positively affected seed regeneration occurence. While diversity and composition of sprout regeneration was simillar to original stand before logging, seed regeneration brought in new species and increased total species pool and beta diversity. Sprout regeneration was primary driver of woody productivity and diversity in the early forest successional stage. However, seed regeneration increased species pool and beta diversity of the stand by triggering establishment of new species in the forest, enriching also genetic diversity. Therefore, both modes of regeneration play differential but important roles in forest regeneration.

Keywords: tree regeneration, forest diversity, forest productivity

Development of Online Real-time Early-warning System for Drinking Water Supply

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Drinking water quality monitoring is an essential part of the drinking water supply chain. Drinking water suppliers used to monitor quality of produced water via time-consuming and costly laboratory methods. Nowadays, on-line monitoring of selected parameters finds its way to supplement current, already established methods to ensure better quality control and further mitigate potential risks for customers. However, these currently used on-line monitoring systems has some disadvantages. High price, need for reagents, toxic waste generation and often just single parameter monitoring worsen their rise in practise, especially for smaller suppliers or even for their customers for on-site monitoring. There are several reagent-free real-time monitoring systems already in use among small number of drinking water suppliers and their use is rather considered as experimental. Development of real-time early-warning system based on statistical modelling and utilisation of sensors already available on marked can provide a cheaper, more suitable alternative and fill the gap in the market. This presentation deals with our preliminary study and pilot testing of selected optical sensor. Our lab-scale pilot considers the need for use of methods that do not need chemical reagents and thus do not produce unnecessarily toxic waste, therefore provides a sustainable alternative to commercially available monitoring systems. Future work is needed to verify and up-scale this approach with an appropriate validation methodology considering potential risks.

Keywords: Drinking water monitoring, Drinking water supply, Early-warning systems

Evaluation of the effectiveness of implementation and environmental impacts of the implementation the Partnership Agreement

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In recent decades, anthropogenic activity has degraded the environment across all continents or ecosystems and has affected the quality of life of animals, plants and local people. We sort among the most significant environmental problems not only the issue of climate change but also the loss of biodiversity, exceeding air pollution limits or the acidification of the oceans. Most of the above-mentioned serious environmental problems can be improved to some extent through the implementation of environmental tools in practice and their subsequent evaluation. One of these tools is the Strategic Environmental Assessment (SEA), which assesses strategies in terms of environmental impact and seeks to guide the strategies towards the principles of sustainable development. To measure and evaluate the fulfilment of the environmental goals in the strategies, set of indicators are developed, which help to measure changes in conditions of the negative impact. As part of this thesis, the effectiveness of the implementation of the Partnership Agreement document, the development of the specific goals of the concept and its impact on the environment for the 2014-2020 operational cycle were evaluated. For the purposes of the evaluation, the strategic indicators of the fulfilment as well as the indicators of the SEA evaluation were used. The real impact of the implementation of Partnership Agreement 2014-2020 has a positive impact on the environment and the objectives of the Partnerships Agreements are consistent with a noticeable focus on improving the environment goals.

Keywords: Planning process, effectiveness, indicators, sustainable development

Molecular Underpinnings of Bark Beetle Resistance Against Conifer Chemical Defense

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The Eurasian Spruce Bark Beetle (ESBB, Ips typographus), is a primary forest pest in Europe. ESBB attack the bark and inter-cortical regions of the host, Norway spruce (Picea abies), where they are exposed to plant chemical defenses comprising majorly of terpenes. Previous studies have revealed that mono-terpenes play a major role as defense compounds induced during biotic stresses, such as pest attacks. Here we assess the toxicity of a monoterpene (1S)-(+)-3-Carene found in Norway spruce. In this study, we exposed adult ESBB with 3-carene at the LC70 for 48 hours via fumigation to study the host-pest chemical interaction at the molecular level using -omics-based approaches. Differential gene expression analysis of ESBB revealed 1737 differentially expressed transcripts ($p<0.05$, fold change ± 2). Many genes related to detoxification, defense, digestion, and metabolism were found to be over-expressed in 3-Carene treated beetles. Relative higher expressions of Cytochrome P450 enzyme, Glutathione-S-transferase, UDP-glucuronosyltransferase, Esterase, ABC-transporter, and other anti-oxidant enzyme coding transcripts were reported. Further validation of results was made using qRT-PCR. This study provides the first insight into the molecular mechanisms of detoxification in I. typographus and provides a catalog of promising target genes for the management of this insect at the field level.

Keywords: *Ips typographus*, Bark beetles, Detoxification, Monoterpenes, Pest-management

Characterization of tardigrade tubulins

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Background: Tardigrades are microscopic ecdysozoans that can withstand extreme environmental challenges. Several tardigrade species undergo reversible morphological transformations and enter an ametabolic state called cryptobiosis that helps them to survive periods of unfavourable conditions. However, underlying molecular mechanisms are mostly unknown. Tubulins are evolutionary conservative components of microtubule cytoskeleton that plays critical roles in many cellular processes. We hypothesize that microtubules are necessary for morphological changes associated with entering and exiting cryptobiosis. Molecular composition of microtubule cytoskeleton in tardigrades is unknown. Therefore, we decided to analyze and characterize tardigrade tubulin genes.

Methods: We prepared a local BLAST+ database from available genomes and transcriptomes of eight tardigrade species. After removing redundant sequences, we performed sequence and phylogenetic analysis of found putative tardigrade tubulins that allowed us to assign them to individual isotypes and isoforms. To clarify whether *in silico* identified tubulin proteins are present in tardigrades, we isolated tubulin coding sequences from adults of *Hypsibius exemplaris*. We amplified and sequenced predicted coding sequences and tagged them with fluorescent proteins for visualization in mammalian cells.

Results: We identified 80 unique tardigrade tubulin sequences including three ε-tubulins. We found three α-tubulin and seven ß-tubulin isoforms, one γ-tubulin and one ε-tubulin isoform in tardigrades. We were able to amplify and sequence 9 out of 10 predicted tubulin coding sequences from *H. exemplaris*, including the ε-tubulin.

Sequence and splice site analyses revealed that γ-tubulin was incorrectly annotated and we isolated a different coding sequence, a product of which localized properly to the centrosomes in human U87 MG cell line.

Conclusions: We developed a simple-to-use pipeline for tardigrade gene analysis based on a local BLAST+ database that can be expanded for newly sequenced omics data. Although tardigrade tubulins are highly conserved, they possess several unique sequence signatures. The phylogenetic position of tardigrades within the Ecdysozoa is still controversial. The presence of tardigrade ε-tubulins is interesting, since Nematoda lost their δ- and ε-tubulin, however, some groups of Arthropoda still possess them. Thus, our current data suggest that the placement of tardigrades to Panarthropoda is correct.

Keywords: tardigrades, tubulin, isotypes, cytoskeleton

Evolution of the coastal pollution sources in the last 3 decades using lead isotopes in brown algae

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Lead isotopic ratios demonstrated to be an efficient tool for tracing the sources of pollution. Here, we measured the isotopic ratios of ^{206}Pb/^{207}Pb and ^{208}Pb/^{206}Pb over ca.500 samples of brown algae collected from 1989 to 2021 in Galicia (NW Spain), to know the relative contribution of the different pollution sources to metal exposure, availability and accumulation and its evolution over time. The results revealed the patterns of the isotopic ratio along time caused by the differences in pollution sources, improving the knowledge regarding this issue.

Keywords: Marine pollution, brown algae, lead, isotopes, biomonitoring

Does *Retinia resinella* galls harbor constant fungal microbiota?

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Retinia resinella (Lepidoptera: Tortricidae) is a widespread pest of pines (*Pinus sylvestris, P. mugo,* and *P. pinaster*) throughout Europe. Adult individuals lay eggs on a young pine shoots, which trigger the secretion of resin, which creates a gall around the egg. After hatching, the larva feeds on the resin gall. The resin contains a large amount of difficult-to-decompose substances, especially terpenes, and intestinal endosymbionts probably help the larva digest it. Previous studies have focused mainly on endosymbiotic bacteria (Vilanova et al. 2014), while fungi have been neglected. Our research focuses on determining the species spectrum of symbiotic fungi of *Retinia resinella* galls and their biodegradation potential. The fungi were isolated from different parts of fresh galls (surface, interior, larva) obtained from three locations within the Czech Republic and Poland and cultured on PDA agar with broad-spectrum antibiotics to prevent bacterial growth. The most frequently isolated fungi were *Sydowia polyspora, Cladosporium cladosporioides, Kwoniella pini*, and *Penicillium* sp. Based on our results in combination with other research we consider them to have biodegradation potential, but there are more studies needed to confirm this theory. Elucidating the larva's ability to digest resinous gall could lead to easier disposal of hard-to-decompose substances and thus be beneficial for more sustainable industry.

Keywords: symbiosis, biodegradation, resin, gall, terpenes, microbiome

Restored post-mining areas as a potential ecological trap for Odonata: maladaptive habitat selection can compromise restoration

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Restoration projects are often based on human perceptions of what makes for a suitable habitat for animals. However what if human perceptions of habitat do not accurately reflect how animals perceive and interact with their surroundings? It is possible that restoration unintentionally produces ecological traps – habitats that animals prefer instead of natural habitats, but where their fitness is reduced. The research is focused on restored areas in Sokolovsko. The objective is to determine whether adult dragonflies can distinguish a ‚true' habitat quality or prefer to oviposit in attractive low-quality habitats and fall into an ecological trap. Based on the results, dragonflies recognize a ‚true' quality habitat from a low-quality one. Adult dragonflies mainly chose natural habitats for oviposition and the future development of their offspring. Sympetrum larvae developing in natural habitats contained more fat stores than larvae reared in restored habitats. Larvae in restored habitats had worse body condition than larvae in natural ponds. The low quality of the restored habitat is also evidenced by the high mortality of larvae. Mortality was significantly lower in natural habitats. Furthermore, we also found that the degree of heating (the highest temperature measured) of individual habitats affects attractivity. The most heated habitats were also the most attractive for imagoes. The degree of heating also affects the body condition of the larvae. Larvae reared in higher temperatures had better body conditions. In conclusion, restored areas in Sokolovsko do not function as an ecological trap for Odonata, but at the same time, they do not provide suitable habitats for dragonfly larvae. To better guide future restoration efforts, it is critical to increasing our knowledge of how animals perceive and interact with their surroundings. It is quite evident that what humans prefer may not meet animals' requirements.

Keywords: ecological trap, restoration ecology, post-mining areas, Odonata, habitat selection

Community Ecology Parameter Calculator in R

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Quantitative analysis of ecological data is substantial for recent ecological research. Despite various analytical software being available (free or proprietary) on websites, there is a significant increase of R language and software popularity. On the other hand, the analyses in R software are often considered as difficult and time-consuming for beginners. We developed a package Community Ecology Parameter Calculator in R (ComEcoPaCR) with a focus on basic taxocoenosis parameters. In total, the package ComEcoPaCR includes 11 functions which offer more user-friendly settings and provide both tabular and graphical outputs. These functions calculate and visualize species richness and abundance of samples, structure of species in the sample (dominance and frequency), species richness indices (Margalef and Menhinick index), species diversity indices and evenness for the indices (Shannon index, Simpson and Brillouin index), and calculate similarity of samples (Jaccard and Renkonen index, Sørensen coefficient and Bray-Curtis index). The package will be extended in the future for species accumulation curves and other popular analyses.

Keywords: ComEcoPaCR, R package, abundance, dominance, species richness, diversity indices, similarity of samples, community ecology analysis

Estrogens in the Aquatic Environment and How to Get Rid of Them

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Steroid estrogens belong to the category of pollutants known as endocrine disruptors. When they are present in the environment, even at low concentrations, they pose a potential health risk to wildlife and humans. Human activity has been responsible for the increase in estrogen concentrations above the natural background. It is known that these compounds can cause a variety of defects or diseases, including reproductive disorders, metabolic disorders, various types of cancer, and many others. Also, there is a link between an increased number of patients with breast cancer, the most common cancer in women. In today's world, there is a growing demand to lower the negative impact of humans on the environment. Among the most important topics regarding environmental protection are research and the application of new water and wastewater treatment technologies. Advanced oxidation processes (AOPs) are frequently discussed in connection with estrogens removal. One of the AOPs representatives is a combination of hydrodynamic cavitation (HC) and a dose of persulfate (PS), providing sulphur-based radicals which destabilise organic molecules and cause their degradation. This method is a potentially fast and effective alternative to remove these pollutants from the water matrix. We investigated this technique's efficiency of selected estrogens removal - estrone (E1), 17ß-estradiol (E2), estriol (E3) and synthetic 17α-ethinylestradiol (EE2) - in a laboratory scale, compared it with similar AOPs and proved its high potential for future field applications.

Keywords: Estrogens removal, Hydrodynamic cavitation, Advanced Oxidation Processes, Water Treatment, Persulfate activation

Dependence of the longwave downward radiation on the surface specific humidity in Barcelona

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The water vapour content in the atmosphere is the most important greenhouse gas and therefore, strongly influences the surface radiation budget and thus the temperature and the water cycle. The atmospheric longwave downward radiation (LDR) at the surface varies with the amount of atmospheric greenhouse gases, especially the water vapour, but also according to the presence of clouds and their characteristics. Using surface observations from the meteorological station of the Faculty of Physics of the Universitat de Barcelona, such as LDR and surface specific humidity (q) the relationship between these variables has been analysed. In addition, cloudiness is an important factor that modifies this dependence. A second-degree polynomial model is used to adjust the dependence, with a good performance for monthly averages in all sky conditions and for the summer data while for winter the results are poorer. The comparison of the power law model adjusted in a cold mountainous region has shown the important limitations of the second order polynomial expression to correctly predict very cold and dry conditions and very warm and humid situations.

Keywords: Water vapour, LDR, specific humidity, power law model, second-degree polynomial model

Prediction of iron oxides content in soil B-layer from different types of smartphones based on multiple machine learning algorithms

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Compared with the complicated operation of traditional laboratory methods or expensive spectral instruments, soil iron oxides (SIOs) content prediction based on smartphone photos has recently received heightened attention. However, the imaging characteristics of smartphone cameras are quite different, which may affect the relationship between the photo colors and SIOs content. Whether the models built based on different machine learning (ML) can be applied to other types of smartphones is still an open question. This study verified the potential applied capabilities of different types of smartphones as proximal soil sensors for predicting iron oxides, and provided a theoretical basis for selecting the optimal smartphone and ML for constructing a high-precision inversion model. In total, 5 smartphones and Imaging spectroscopy were selected for the study, and dried soil samples were imaged in an optical dark chamber. The photo and spectral data were pretreated, and back propagation neural network, support vector machine, random forest and partial least squares regression models were built. The spectral response curves of the 5 smartphone cameras were also obtained separately to clarify their imaging characteristics. Results indicated the RGB color distribution conditions of soil photos obtained by different phones were different, which affects the correlation between the color parameters and SIOs. The prediction ability of the models constructed by the 5 smartphones were similar to the spectral devices, achieving an R^2 of 0.30-0.72 and an RPD of 1.22-1.90. Although the ML may be limited by the size of the training dataset, the ML constructed iron oxides inversion model has stronger nonlinear fitting ability compared to the nonlinear regression model, which can enhance the utilization of spectral data. The results of this study showed that by applying smartphones to soil spectral data acquisition, quantitative inversion of SIOs by ML can be achieved.

Keywords: Smartphone, Machine learning, Soil color, Soil iron oxides, Model construction

Research on new methods of processing critical raw materials in the Czech Republic

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As a result of a serious global problem with the supply of rare earth elements from the monopoly producer China, pressure has arisen from the European Commission to create a list of critical minerals. This list was last updated in 2020 and contains 30 different critical materials that modern industry cannot do without. It shows that, with a few exceptions, the European Union is completely insufficient in the production of critical raw materials and that a strategy is needed to meet the growing demand for these raw materials. With increasing pressure on the availability of critical minerals for modern industrial applications, and at the same time pressure to protect the environment, the question of appropriate technologies for the extraction of critical minerals is increasingly being addressed. In the future, technologies that do not consume large amounts of water and do not require hazardous chemicals to produce concentrates of raw materials will be preferred. Processing technology of rocks containing critical raw materials, which was invented at the Czech Geological Survey, meets the economic and ecological criteria for future application.

Keywords: EU, critical raw materials, processing technology, ecology

Impact of the shelterwood density on dimensions of the Scots pine regeneration individuals

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Considering the ongoing changes in climatic conditions, it is necessary to address the varying composition of forest stands, as well as the change from traditional forest management to alternative methods using natural processes to a greater extent. In response to these changes, new options for the cultivation of the main coniferous economic tree species are currently being considered. This article focuses on Scots pine (Pinus sylvestris L.) which represents one of the most widespread tree species in Europe. The aim of our study is to determine the optimum shading of natural regeneration individuals by the parent stand under natural pine habitat conditions at different levels of parent stand involvement. For the sake of completeness, let us adduce here the fact that this study was carried out on the property of Military Forests and Estates, s.p., division Mimoň, near the town of Doksy. For the research purposes, we measured 32 pine trees, i.e. 8 individuals, in four different locations: area without mother stand, 0.4 (i.e. 40% mature stand density); 0.6 and 0.8. Statistical analysis of the obtained data yields that the stemming by the mother stand influences the number of branches in different orders and the height of individuals in the first stage. In terms of branching, it can be concluded that the largest branching is in the area without mother stand (and from 64%), while the smallest one is in the area 0.8 (and from 5%). From the point of total height of 16. 89 m, the highest percentage is on the area without parent vegetation (namely from 50%), while the lowest is on the area with parent vegetation with a shading of 0.8 (namely from 10%). Finally, it was found that there is no correlation between the third order and the height of the individual.

Keywords: 3D model, Scots pine, shelterwood, mature stand, natural regeneration, Fastrak Digitizer

Biodiversity in natural systems

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Biological diversity represents variety (disparateness) of life. World Wild Fund for Nature (WWF) defines biodiversity as "richness of life on Earth, millions of plants, animals and microorganisms (including genes they contain) and complex ecosystems, which create natural environment". Natural environment of human is that part of the world a human is in mutual influence with, i.e. uses it, affects it and to which one adjusts to. More generally it can be said that natural environment (not only for human, but for all organisms, populations and societies) is a set of all agents the living subject comes in contact with and conditions that surround it. We differentiate three levels of biodiversity: 1. genetic (gene variability within population or the whole species); 2. specific (variety at the level of species); 3. ecosystematic (variety at the level of societies and ecosystems). Genetic biodiversity means that variability of nature can be expressed not only by number of species but also by number of genes contained in those species. Even in one species there is larger or smaller variability which causes that no two individuals are completely identical. Biologic diversity is presently disrupted also by genetic manipulations, bringing foreign genes in cells. Human uproots certain species of animals and plants from their natural environments, places determined for them by long-lasting development, where they are controlled by regulation mechanisms created over thousands of years and transplants them into totally new conditions. Such species then either die there (the most often) or freed from the constant pressure of its enemies, competition and diseases they multiply unbelievably quickly. And that is how the most dangerous enemies of human appear. However any species can overpopulate even without migration into other areas. It happens when thoughtless activity of human changes "balance of powers" in societies and disrupts natural balance. Overpopulation of many forests and fields pests is the result of existence of monocultures, often on massive areas with natural balance intentionally disturbed by preference of one species.

Keywords: nature, diversity, biodiversity genetic, species, environmental, hostile species

Analysis of horizontally polarized light as an important factor in habitat selection of dragonflies

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Polarised light is widely recognised as one of the main drivers in habitat selection for many freshwater bound invertebrates. Thus, visualisation and analysis of polarised light may help understanding the mechanisms behind these selections. There are many factors influencing polarised light reflected from water surfaces, among the most important are the composition and cover of vegetation. It is known that dragonflies use polarised light as cue for identification of suitable habitat, but the mechanisms of polarisation used for distinguishing these sites remain unknown. This research aims to identify these differences in polarisation and design an analysing software (SW) for measuring polarised light using polarisation filter, which allowed to acquire photos of multiple degrees of polarisation. Firstly, a measuring method was designed to capture polarised light using a special filter. Total of 15 potential habitats of different substrate and vegetation cover were selected, including one ecological trap. In addition, 18 experimental ponds of 3 different types of substrates and 3 types of vegetation cover were analysed simultaneously. For each group, a set of photos ranging in 5 degrees of polarisation was taken for analysis. Polarised light was visualised and analysed using a specialised SW developed for this experiment. Each picture was analysed with this SW and data of colour code from all photos were compared using statistical method and determined the most influential differences among them. The result of this study emphasizes the importance of understanding the polarisation of light reflected of the water surfaces of different ponds with distinct properties in term of habitat colonisation and selection of many freshwater invertebrate species. This new SW has proved to be an efficient way of visualising RGB colour spectra in histograms and provide a strong support for further research on polarisation.

Keywords: polarized light, analysis, invertebrate, software, freshwater, habitat selection, colonisation, dragonfly, odonata, vegetation cover, substrate

Climate Change Impact on Temperature and Precipitation by opting suitable bias correction method: A case study in Thailand provinces

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Across the globe climate change (CC) has severe impact on environment as well as its ecosystem. Past evidences and recent research show that impact will be more severe in the future. Two meteorological parameter precipitation and temperature (responsible for change in hydrological cycle) show drastic changes in temporal as well as spatial variation in past decades. It is necessary to access the quantitative change for both parameter in the future. Primarily in this case study suitable bias correction techniques (lapse rate regression) were selected out of three widely used methods and applied on CMIP6 datasets. Further bias corrected datasets were used to assess precipitation and temperature for NF (2022- 2045), MF (2046-2070), FF (2071-2095) for SSP-126, -245 and -585 scenarios. Interpretation shows decrement in precipitation by 10%-40% corresponding baseline period (1991-2021). Each province subjected to decrement but the % of decrement is different for each province. Similarly for each scenarios temperature increment was found which ranges from 0^0C – 4^0C. For all scenario changes are different for each season as well as for each province. Obtained results from this case study is associated with certain uncertainty at every step in this study. Moreover this research gives the brief idea about change in precipitation and temperature which can beneficial for the policymaker's, adaptation strategies in agriculture, environmentalist etc.

Keywords: Climate Change, Climate Change impact, SSP Scenarios, CMIP6 data

Effect of different cutting intensity and ash application on soil characteristics, plant species composition and diversity in the mountains hay meadow in Jizerské hory Mts.

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Application of wood ash has been going for many decades in the mountain areas. It is traditional way, how to bring back nutrients into the upland grasslands after their regular removal with biomass that follows yearly cutting of the sward. Therefore, upland grassland experiment arranged in a complete randomised block design with four replications was established in 2017 to test an effects of ash application and different cutting intensities on soil characteristics, plant species composition and diversity. The treatments were: (A) unmanaged control; cutting once per year at the end of June (B) or at the end of August (C); two cuts per year at the end of June and August without ash fertilization (D) with low (E) 0.4 kg of ash fertilization per plot (11 kg P ha^{-1}; 131 kg K ha^{-1}; 145 kg Ca ha^{-1}; 26 kg Mg ha^{-1}) with high (F) 0.8 kg of ash fertilization per plot (22 kg P ha^{-1}; 262 kg K ha^{-1}; 290 kg Ca ha^{-1}; 52 kg Mg ha^{-1}). The percentage cover of all vascular plant species was visually estimated in June in each plot every year from 2017 to 2022. Soil samples were taken in autumn 2020 to extract plant available nutrients. High dose of ash fertilizer (0.8 kg per plot) significantly increased pH/CaCl$_2$, pH/H$_2$O, mean soil nutrient concentrations of Ca, K and Mg, mean total cover (%), mean sward height, mean number of species ≥ 1%, Shannon diversity index and Shannon evenness index. Low ash fertilisation (0.4 kg per plot) increased mean soil Mg, mean sward height and Shannon evenness index. Multivariate data analyses testing the effect of individual treatments, ash fertilization and defoliation intensity revealed significant changes in plant species composition. It seems, that ash fertilization if applied in sufficient doses can not only improve soil and sward characteristics but can also change plant species composition and positively affected plant species diversity of upland grasslands.

Keywords: cutting, ash fertilization, Shannon diversity index, Shannon evenness index, rising plate meter, vascular plant species

Flower constancy, innate and learnt preferences as prerequisites for effectiveness of generalist pollinators

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Changes in land use and landscape configuration disproportionately affect specialised pollinators and cause their declines. This increases the role of generalist pollinators for plant reproduction. However, generalised pollinators are thought to be less effective due to presumed low rates of pollen transfer between individuals of the same plant species. Flower constancy and development of preferences for different plant species at different sites have been proposed as mechanisms that could improve generalist pollinator efficiency. In the presented work, we investigated the strength of learnt preferences and flower constancy for two important groups of generalist pollinators – hoverflies and bees. We used the interview stick method and examined preferences and flower constancy at pairs of sites which differed in their plant species composition. We chose the tested meadow species in pairs, where one of the tested occurred at both tested sites, while the other was missing in order to test for the presence of learnt preferences. First results indicate high variation in levels of learnt preferences as well as flower constancy between individual species studied and it cannot be said there are any common differences between the pollinator functional groups. Honeybees showed strong flower constancy while bumblebees did not. On the other hand, hoverflies in general showed very low flower constancy except for *Eristalis tenax*. We concluded that it is hard to generalise about efficiency of generalist pollinators both in terms of pollinator functional groups. There are potentially effective and ineffective pollinator species among both bees and hoverflies.

Keywords: generalist pollinators, pollinator preferences, flower constancy, bees, hoverflies

Calm before the storm in Balikpapan Bay: A large and stable proboscis monkey population in the shadow of megaproject

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Anthropogenic activities, mainly habitat destruction and hunting, have driven more than half of all primates to the road towards extinction, including the proboscis monkey (*Nasalis larvatus*) - an endangered endemic primate of Borneo Island. Although recent studies successfully report population trends, estimates of population size are burdened with extrapolation, which largely affects the total estimated abundance of proboscis monkeys. We conducted a full census of a large proboscis monkey population in Balikpapan Bay and located a total number of 292 harem groups and 67 all-male units in 2022. Using data on average group size, directly from Balikpapan Bay, we estimated a total population size of 3907 individuals. We furthermore confirmed slow and constant habitat loss (0.69% per year) of proboscis monkeys in Balikpapan Bay. However, a future prospect of the new Indonesian capital city construction in Balikpapan Bay may stir up the situation. A total number of 1449 individuals (37.08% of the population) were found on 80.55 km^2 (41.29 %) of habitat that overlapped with current spatial plans. Although the new capital should cover a total amount of 2560 km^2 across various habitats until 2045, with residence for up to 1.9 million inhabitants, the government made claims of the "smart, green, beautiful and sustainable city". We therefore also include our implications to mitigate the impact of the construction, which may help the responsible government to embrace the importance of this endangered primate, to develop the new capital city with respect to the local biodiversity, and thus become a pioneer in a new direction of the proboscis monkey conservation.

Keywords: *Nasalis larvatus,* population census, population size, Balikpapan Bay, New Indonesian Capital

Incubation rhythms of the Woodcock (*Scolopax rusticola*) and Common Snipe (*Gallinago gallinago*)

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Incubation rhythms consist of bouts of incubation and gaps when parents are out of the nest. The way how the bouts and gaps are alternating (i.e. the incubation rhythm) differs considerably among the species as well as among the individuals. One of the most important drivers of diversity in incubation rhythms is the incubation strategy (uniparental/biparental). Here, we present the comparison of incubation rhythms of two uniparental shorebirds, Eurasian Woodcock (*Scolopax rusticola*) and Common Snipe (*Gallinago gallinago*). Factors influencing incubation rhythms were assumed to be time of the day, incubation period, season, and rate of hiding the nest in the vegetation. All of 11 nests of model species from 6 localities were analysed. The overall nest attendance was higher in the Eurasian Woodcock (85,1 %, vs. 80,5 % for Common Snipe) and was much higher during the night than during the daylight. During the day, Eurasian Woodcock typically had 5-7 gaps of 15-30 minutes long, while Common Snipe had more (15) gaps, which were shorter (9 minutes on average). To sum up, the typical uniparental incubation patterns were found in both model species.

Keywords: incubation rhythm, uniparental incubation, shorebirds, Eurasian Woodcock, Common Snipe

How do the fish see: Visual system and its developmental changes in European cyprinid fishes (family *Cyprinidae*)

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Vision plays a key role in life history of vertebrates. It is mediated by a photoreceptor cell layer in retina containing rods and cones sensitive to specific wavelengths of visible light spectrum. In the retina of teleost fishes, cones allow for colour perception, also known as photopic vision, thanks to the expression of four types of opsin genes (SWS1, SWS2, RH2 and LWS). In rods, one type of opsin gene is expressed (RH1) allowing for scotopic vision in dim-light conditions. During evolution of cyprinid fishes, some acquired multiple copies of these genes (predominantly RH1 and RH2 opsins), and they express alternative opsin combinations specific to different developmental stages of the fish. Such plasticity in expression may serve for adaptation to specific environmental conditions, e. g. influencing their trophic ecology or habitat preference. In this study, we focused on larvae, juveniles and adults of cyprinid fishes, majority of them from subfamily Leuciscinae, living in Central Europe. We sequenced retinal transcriptomes and identified the opsin genes participating in colour perception, further confirmed by genomic data. Cyprinids (21 species studied) express four types of cone opsins, as is known from other teleost fish species. We report the plasticity of the visual system comparing data of adults and juveniles of 11 species. In adults, the most abundant opsin in retina is the long wavelength sensitive LWS opsin, which may be a result of adaptation to a higher level of water turbidity in European rivers. Larvae and juveniles, however, predominantly express shorter wavelength-sensitive opsins (SWS1, SWS2) as they linger close to the surface on shallow riverbanks. This pattern may also represent a developmental constraint shared among teleost fishes. Furthermore, we employed FISH in-situ to visualize the distribution of single- and double cones in the photoreceptor mosaic in the cyprinid retina.

Keywords: vision, adaptation, opsin, freshwater fishes, Cyprinidae

Non-crop habitats are essential for the overwintering of ground-dwelling arthropods in agricultural landscapes

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Only a few studies focus on the importance of non-crop habitats to provide valuable resources to beneficial arthropods during winter, despite their potential significance for our understanding of agricultural landscape functioning. In this study, we assessed the distribution of ground-dwelling arthropods overwintering on arable land. Data for myriapods, spiders, carabids, and rove beetles were collected using a combination of pitfall trapping and soil sampling. Our results revealed the importance of both grassy and forest non-crop habitat islands for overwintering arthropods: abundance and species richness were remarkably lower on arable land for all the investigated taxa; only carabids and rove beetles overwintered more on non-crop habitat island boundaries than interiors; grassy, and forest non-crop habitat islands hosted different assemblages of myriapods, carabids, and rove beetles. We recommend preserving all existing non-crop habitat patches and creating new permanent non-crop habitat patches in intensively managed agricultural landscapes.

Keywords: Insect biodiversity, Landscape design, Semi-natural habitats, Spatial distribution, Winter survival, Woodlot

How remains of long Late Neolithic barrows affect growth of crops and properties of soils

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A 5,800-year-old prehistoric long barrow from the Siřem phase of the funnel-beaker culture, from the Late Neolithic period, was discovered in the Podřipsko region according to crop marks on aerial photographs. The influence of this prehistoric barrow on the present-day landscape, soil chemistry and stratigraphy, and plant growth was investigated as part of an archaeological-environmental study. The barrow was subjected to both a non-destructive investigation using soil samples taken by the soil probe and above-ground biomass sampling, and an archaeological excavation. The main part of the barrow investigation focused on the content of selected elements. The elemental content of the soil samples collected from the barrow and its surroundings was determined using an XRF spectrometer. Furthermore, the relationship between the content of elements in the soil of the barrow and crop marks was investigated. Plant analysis revealed the expression of crop marks on all observed parameters of the above-ground parts of wheat plants. That is, on their length, spike length, number of grains per spike and weight of grains per spike and 1,000 kernel weight. Biomass sampling and archaeological excavation revealed a correlation of the expression of crop marks depending on the depth of the soil profile on the barrow, which is closely related to the greater availability of water and nutrients for plants that are often stressed by drought in the Podřipsko region. Plants in this case were mainly affected by the depth of the soil, not by their chemical signal. Thus, it can be said that the long Late Neolithic barrow still affects the present-day landscape, mainly through the change in soil depth, which is reflected in plant growth. Thus, the prehistoric barrow continues to affect contemporary agroecosystems even after several millennia.

Impact of Altered Sewage Sludge Amendments on Permanganate Oxidizable Carbon Fraction of Soil

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There is a growing concern about using sewage sludge for agriculture due to its potential to increase soil fertility and productivity in terms of high organic matter content and the presence of macro and micronutrients. Composting and pyrolysis are considered popular pre-treatment strategies to minimize the potential ecotoxicological risks and transform unwanted waste into a safe product that can be utilized in sustainable agriculture. Five sewage sludges were selected from different localities in the Czech Republic (CZU-K01-P, CZU-K02-HB, CZU-K03-L, CZU-K04-HK, and CZU-K05-T) and subjected to composting and pyrolysis before application in agricultural plots located in Blíževedly and Údlice. After six months of application of altered sewage sludge, soil samples were collected. This study investigated the short-term implications of two pre-treated sludge amendments on soil quality. Labile fractions of soil organic carbon, such as permanganate oxidizable carbon (POXC), may provide an early indication of soil improvement in response to management practices. The permanganate oxidizable active carbon fraction of soil organic carbon is a rapid, inexpensive method that shows a significant relationship to soil microbial activity. Therefore, the short-term impact of altered sewage sludge on soil quality was measured in terms of POXC. Potassium Permanganate solution oxidizes easily accessible soil carbon fraction due to the conversion of Mn^{7+} to Mn^{2+}. Therefore, a more significant diminishment of the purple colour can be observed, which is proportional to POXC, measured as absorbance at 550 nm. In Údlice experimental field, both altered sewage sludge amendments in all five sludges have increased POXC relative to the control plot without any sludge amendments. At the same time, there is a significant difference in CZU-K02-HB and CZU-K03-L between control and pyrolyzed amendment. In the Blíževedly field, both sludge

amendments increase the soil labile carbon fraction of POXC in all five sludges with a significant difference between amendments in CZU-K01-P and CZU-K03-L. This suggests that sewage sludge amendments increase the soil quality in agricultural soil, which is revealed from the initial stage of the soil management process. However, other soil fertility indicators should be studied to better understand the altered sewage sludges in soils. The samples should be analysed for heavy metals and micropollutants to evaluate possible ecotoxicological risks. In addition, the experiment should be continued to assess the long-term impact.

Keywords: Composting, Permanganate Oxidizable Carbon, Pyrolysis, Sewage Sludge, Soil fertility, Soil quality

The role of gender differences in the use of forested recreational areas through the perspective of women in Slavonice, Czech Republic

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Forested areas are an essential component of natural and cultural landscapes. As such, they play a prominent role in how people of different genders make use of these important recreational areas. Differences in gender can influence how each perceives their surroundings and experience them. This is particularly true when it comes to decisions on where to walk or hike. Accordingly, women demonstrate a significant preference for how they wish to arrive at forested recreation areas, and once there, they demonstrate different preferences for the type of activities that they wish to engage in. The aim of this research was to assess the variety of preferences expressed by women for how and when they reach or arrive at the forested areas based on their

age, level of education, expectations for recreational activities, overall reasons for the visit, how often and during which season of the year they come, with whom and how many people they travel, their mode of travel, perceived risk, and the quality of the forested recreational area. The research team conducted an online survey that was accessible to the respondent via unique QR codes linked to multilingual web pages. This allowed an individual to complete specific survey questionnaires at nineteen different locations situated along hiking trails and forested areas close to the town of Slavonice, Czech Republic. The survey was conducted for twelve weeks during the high season of summer recreation. This research analyzed the women's preferences for how they might reach the forested areas by walking. The greatest reason for women to visit the study area was for passive recreation while the greatest reason for men was for enjoying nature. The most common activities for women are mushroom gathering and berry picking while men demonstrated a preference to engage in active sports, such as running or cycling. Overall, females were more concerned about the environment and nature than men and spent more time outdoors.

Keywords: Gender Differences, Forested recreational areas, Women preferences, Hiking trails

The function of Polycomb Repressive Complex 2 (PRC2) in plant retrograde signalling pathway

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In *Arabidopsis thaliana*, histone 3 lysine 27 tri-methylation catalysed by PRC2 is playing essential functions in the regulation of plant development, growth and reproduction[1-2]. Despite numerous studies related to the role of PRC2 in developmental control, how PRC2 works in the operational control in plants is unknown. In the present, the evidence that PRC2 probably participates in the regulation of retrograde singalling pathway in *Arabidopsis* is found. Firstly, we observed that the rosette size and biomass in PRC2-depletion mutants (*clf-29* and *swn-3*) is significantly higher than WT under medium light condition (ML: 125 μmol m^{-2} s^{-2}), while under medium high light condition (MHL: 300 μmol m^{-2} s^{-2}), the increase was reverse. Under ML condition, the photosynthesis related parameters determined by fluorCam did not show significant differences between WT and mutants, while the pigments concentration increased in the leaf of PRC2-depletion mutants, especially in *swn*. The dynamic of light-responsive genes and circadian clock genes expression by RT-qPCR within 24 hours in the mutants were comparable to WT. However, we observed upregulation of photosynthesis-associated nuclear genes in the PRC2-depletion mutants under chloroplast damaging condition (treated by lincomycin), corresponding to the so-called genome uncoupled (gun) phenotype. Here, we will present our results describing these phenotypes and our suggestion and outlook for studying the involvement of PRC2 in chloroplast-to-nucleus retrograde signalling.

Keywords: PRC2, Light response, Retrograde signal, Genome uncoupled

Sex specific lifespan in insects: a rigorous meta-analysis

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Determinants of lifespan (= longevity) are of broad theoretical and applied interest. There are large intraspecific differences as well as vast variability among related species, e.g., between sexes. While lifespan patterns and determinants in vertebrates are well understood, similar studies on invertebrates, including insects, are scarce. In this presentation, I focus on sex differences in adult lifespan in insects, i) synthesizing patterns across major insect orders, and ii) asking to which extent are these sex differences in adult lifespan driven by sex differences in body size (sexual size dimorphism). I conducted a meta-analysis focused on patterns and determinants of sex differences in longevity. For this purpose, I collated a detailed database of published sex-specific data on insect longevity. Across the examined insect taxa, females had a significantly longer lifespan. When focusing on specific orders, this trend could be confirmed for two orders out of five studied - Hemiptera and Hymenoptera. In the rest of the orders, the sexes showed no obvious differences in lifespan (Coleoptera, Lepidoptera), or there was a tendency for a longer female lifespan (Diptera). The last part of my presentation aims at the relationship between sexual size dimorphism (SSD) and sexual differences in longevity. While we can find many publications predicting this association (larger-bodied individuals live longer, which could also be expected at the interspecific level), no significant relationship was found, although there was a tendency for sex differences in longevity to increase with sexual size dimorphism.

Keywords: lifespan, longevity, body size, insect, sexual dimorphism, SSD, aging, life history, biodemography

Stretching physiological limits to environmental stress: Mechanisms of thermal plasticity in insects

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Environmental stress has a major impact on the performance, survival, and fitness of organisms. Ectotherms, especially small-bodied insects, are heavily influenced by the thermal environment, particularly rapid variation in temperature. Increasing global temperatures and the increased frequency of extreme weather events (e.g., heat waves) are likely outpacing the phenological, behavioural, or adaptive shifts needed for most taxa to survive. Therefore, it is imperative to understand how temperature affects insect performance to effectively preserve and protect biodiversity in agricultural and natural ecosystems. An individual's phenotype depends on the interaction between their genotype and the environmental conditions they are exposed to. The thermal environment is one such condition, and although the magnitude of thermal exposure on future performance is often considered, the timing and duration of thermal exposure has received less focus. Here, I will describe research on insects that characterizes how developmental and adult thermal environments influence an individual's future thermal stress tolerance. I will describe how such exposures during development can have lasting or diminishing effects on thermal tolerance and other important traits. In addition, I will show the extent to which heritable genetic components and short-term shifts in gene expression contribute to an individual's ability to respond to thermal stress. And finally, I will show how transcriptome profiles correspond with thermal tolerance and thermal tolerance plasticity. Taken together, this research provides mechanistic explanations for how gene by environment interactions contribute an organism's thermal performance and fitness. Moreover, this information allows us to better predict the impact of extreme weather on insect populations by considering how preceding thermal environments impact future performance (e.g., how a warm autumn impacts the survival of extreme cold in winter).

Keywords: Acclimation, transcriptomics, thermal limits, GxE interactions, phenotypic plasticity

Distribution and population structure of Wallacea's threatened ungulates, anoa (*Bubalus* spp) and babirusa (*Babyrousa* spp)

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The biodiversity hotspot of Wallacea, Indonesia, is an important zoogeographic transition zone between Asian and Australasian biotas. Wallacea's complex evolutionary and palaeogeographic history has culminated in unparalleled levels of species endemism. However, this unique biodiversity is threatened by increasing deforestation, agriculture and poaching affecting the chances of long-term survival of many of the iconic but endangered animals. This is especially the case for large forest ungulates, endemics such as Anoa (*Bubalus* spp.) and babirusa (*Babyrousa* spp.). The overall aim of our project is to use spatial and genetic analyses to investigate distributions and ancestry patterns across Sulawesi (the largest Wallacean island) and the smaller surrounding islands. To achieve this, we used taxa-specific models of habitat suitability to investigate the impact of current and future forest loss and climate change on the potential range of these taxa. Then we generated whole genome sequences (WGS) from individuals of both contemporary and historic populations. The WGS from historic samples are generated using new palaeogenomic techniques, allowing us to get high quality data from museum specimens. Importantly this gives us the ability to track population genetic changes through time. We find that the predicted forest loss will impact both taxa with a loss of approximately 30% of suitable habitat but with potentially resilient habitat patches on the small islands. Genetic analysis of the modern genomes shows that the two taxa have different signals of population divergence.

Population divergence in babirusa appears stronger across the islands compared to anoa. This indicates the possibility that recent anthropogenic disturbances have had taxa-specific impact. Understanding the differences as well as the future stability of these populations is likely to have direct conservation impacts, including affecting decisions regarding funding, translocations and reintroductions.

Keywords: biodiveristy hotspot, deforestation, habitat suitability models, Indonesia, mammals, population genetics, population structure

Linking genomics and ecology to understand the origin of butterflies in the American tropics

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Biodiversity is the variation and interaction of life on Earth, encompassing species, genetic, and functional diversity. In the face of rapid biodiversity loss, research programs unifying evolutionary and ecological studies are important to investigate different facets of biodiversity. To understand the origin and maintenance of biodiversity, we focus in one of the largest insect global radiations, butterflies, in one of the regions with highest documented biodiversity on Earth, the American tropics (neotropics). We use genome wide nucleotide polymorphisms to study evolutionary processes at the species and population levels. By integrating phylogenetic and population coalescence processes, we revealed species diversification patterns, including lineages in bioregions that have radiated rapidly and recently, and others that have accumulated diversity over millions of years. To better understand selection-driven phenotypic (butterfly wing colors and shapes) convergences, we carried out predator-prey experiments in a rainforest locality in Peru. We corroborated that avian predation rates over aposematic, unpalatable butterflies are lower compared to palatable ones, while there is indication that evasive, palatable butterflies suffered less predation compared to slow, cryptic, butterflies. Signaling evasiveness might, thus, provide additional protection against avian predation and may explain convergences of phenotypes associated with butterfly escape ability. Altogether, we are starting to reveal how extant neotropical butterfly species, genetic, and functional (evasive signaling) diversity have been shaped by evolutionary and ecological mechanisms.

Keywords: Neotropics, Lepidoptera, macroevolution, population genomics, predator-prey interactions, behavioral experiments

Radical Approaches to Sustainability: From Informal to Formal Urban Greening

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With populations and urban areas expanding, there is an urgent need to consider more radical ways of enabling sustainability within our cityscapes. In the post-COVID built environment, there is an increased appetite amongst an array of key actors to upscale more creative approaches to embedding urban greening initiatives. This talk reflects on innovative solutions, from the grassroots with guerrilla gardening, to large-scale urban farming and high-tech solutions. Based on research in Africa, Europe and North America, the talk urges more innovative approaches by urban decision-makers and calls for further research into the field.