ČESKÁ ZEMĚDĚLSKÁ UNIVERZITA V PRAZE

FAKULTA ŽIVOTNÍHO PROSTŘEDÍ

KOSTELECKÉ INSPIROVÁNÍ 2018

Sborník abstraktů

10. ročníku konference 22. – 23. listopadu 2018

Harabiš Filip (Ed.)

Pořadatel konference:

Katedra ekologie, Fakulta životního prostředí,

Česká zemědělská univerzita v Praze, Kamýcká 129, 165 00 Praha 6 – Suchdol

ISBN 978-80-213-2894-5

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PLENÁRNÍ PŘEDNÁŠKA

Living with invasive species in Anthropocene rivers: search for missing links

Douda Karel

Faculty of Agrobiology, Food and Natural Resources, Czech University of Life Sciences Prague, Kamýcká 129, Prague 6, 165 00, Czech Republic; k.douda@gmail.com

Nepůvodní druhy se stávají všudy přítomnou součástí většiny člověkem vytvořených, pozměněných i přírodních biotopů. Často způsobují zásadní změny na životním prostředí i přímé ekonomické škody, ale možnosti jak bránit negativním dopadům jsou většinou omezené a vyžadují prioritizaci. Na příkladu sladkovodních mlžů, kteří patří k celosvětově nejproblematičtějším invazním druhům, bude ilustrován proces hledání příčin a souvislostí v biologických invazích, bez jejichž zohlednění není možné kvantifikovat dopady na sladkovodní společenstva. Invazní biologie ve sladkých vodách je rychle se rozvíjející obor, který vyžaduje získávání nových dat pro vytvoření praktických konceptů řešení s ohledem na rychle se měnící podmínky prostředí.

What do BABIES, CAGES and STREAMS have in common? Find it out in a Czech premiere of the 8-minute CULS feature film!

Barák Vojtěch[1], Bílý Michal[1], Douda Karel[2], Simon Ondřej[1,3], Švanyga Jan[1], Němčíková Simona[1], Dort Bohumil[1]

[1]Faculty of Environmental Sciences, Czech University of Life Sciences Prague, Kamýcká 129, Prague 6, 165 00, Czech Republic (email: barakv@fzp.czu.cz)
[2]Faculty of Agrobiology, Food and Natural Resources, Czech University of Life Sciences Prague, Kamýcká 129, Prague 6, 165 00, Czech Republic
[3]T. G. Masaryk Water Research Institute, Podbabská 30, Prague 6, 160 00, Czech Republic

Freshwater mussels are an essential part of aquatic ecosystems (water purification, nutrient recycling and storage as well as other ecosystem services). Unfortunately, these species are often critically endangered due to their complex life cycle and changes in the environment. In the past, the freshwater pearl mussel (Margaritifera margaritifera) occurred in many oligotrophic streams and rivers throughout Europe. However, their abundance has decreased during the 20th century across the occurrence area (water pollution, watercourse regulations, habitat fragmentation by dams etc.). Moreover, the reproductive cycle has been practically interrupted. In the Czech Republic, conservation activities for freshwater pearl mussel protection have been conducted since 1980´s (thanks to Jaroslav Hruška and his colleagues). A "Czech Action Plan for Freshwater Pearl Mussel" was developed which includes, among other things, a unique semi-natural breeding program. Many young mussels rising from this program can be released into streams and rivers – but firstly, it is necessary to choose a suitable locality and habitat. Therefore, in situ exposure experiments ("bioindications") to evaluate the growth and survival rate have been performed over more than 15 years. Mesh cages and sandy cages belong to the most frequently used devices. In this year (2018), a detailed protocol for performing in situ

bioindication tests with young mussels was published in the Journal of Visualized Experiments. This study is focused on the Upper Vltava River within the Šumava Mountains which has a great potential for mussel conservation. Suitable conditions for freshwater pearl mussel development were confirmed at selected localities in the Upper Vltava River. Above all, a methodical video was realized and will be presented during this conference (see https://www.jove.com/video/57446 and/or

https://www.researchgate.net/profile/Vojtech_Barak2)!

Keywords: Margaritifera margaritifera, young mussel, bioindication, growth rate, survival rate, mesh cage, sandy cage, the Upper Vltava River

Reintroduction of the Hermit in the České středohoří: Nature conservation in practice

Eliška Baranovská, Pavel Moravec

Nature Conservation Agency of the Czech Republic, Biodiversity Monitoring Department, Michalská 260/14, Litoměřice, 412 01; eliska.baranovska@nature.cz

The Hermit (*Chazara briseis*) is one of the most threatened butterflies in the Czech Republic. The butterfly typically inhabited rocky habitats in warm regions of the country. However, many populations of the Hermit have died out due to changes in management since the mid-20th century. The last surviving population inhabits neighbourhood of the peak Raná in the České středohoří. Specific management is necessary for surviving of the species; specifically, they are well adapted to grazing ungulates. Project LIFE+ which main goal was a renewal of the steppes in the Lounské středohoří in years 2011 - 2017 had a positive impact for many species of butterflies and probably allowed to survive the last population of the Hermit on the hill Raná. Metapopulation restoration of species is necessary for preservation viability of the population. Therefore, it is important to

reintroduce the Hermit at appropriate localities. One of them is the hill Dlouhá that lies close by Raná. Habitat conditions were managed before reintroduction. The locality was mowed and thoroughly grubbed for vegetation loosening. Grazing goats and sheep followed in April 2018 and it will be repeated every year. 13.000 eggs of the Hermit were placed to the habitat during years 2015 - 2017. 273 caterpillars of 2nd to 4th instar were released in the start of May 2018. Eggs and caterpillars came from artificial breading that was established from individuals of the population in Raná. It seems that releasing of caterpillars had a much bigger effect on the number of individuals present at the locality. In previous years, only units of butterflies were spotted or caught on the hill. However, 135 adults were marked in July and August 2018. Even two labelled butterflies from the hill Dlouhá were caught on the nearby hill Číčov. The results of reintroduction are very positive but only time will show whether the Hermit is able to create and maintain a viable population on the hill Dlouhá. In the coming years, reintroduction should continue on the hills Písečný vrch and Křížové vršky.

Keywords: repatriation, management, *Chazara briseis*, Lepidoptera, Satyrinae, mark-recapture, steppes.

Analysis of the relationship between the bud blight infestation (*Gemmamyces piceae*) of Norway spruce stands in the Ore Mountains and its characteristics

Baťa Daniel

Czech University of Life Sciences Prague, Faculty of Forestry and Wood Sciences, Kamýcká 129, CZ - 165 00 Praha 6 - Suchdol, Czech Republic; bata@fld.czu.cz

In 2008, a gemmamyces bud blight (*Gemmamyces piceae*) has been discovered in the Czech Republic after a half century of disappearance. After its initial spread on Colorado blue spruce (*Picea pungens*) the infestation was reported more frequently on Norway spruce (*P. abies*). Due to the spreading infestation on Norway spruce a four-year project focused on the pathogen monitoring and research was supported by the Grant Agency of Forests of the Czech Republic, State Enterprise. In order to perform a recurring assessment of the infestation 90 permanent forest plots were established in the Ore Mountains between 2016 and 2017. The aim of the research was to analyze the relationship between the degree of infestation obtained after the first year of evaluation and the natural conditions and vegetation characteristics of the permanent forest plots. An analysis was performed in Weka v. 3.8.2 software using the J48 classification algorithm. Using the most accurate classification model a map layer of infestation in the Ore Mountains was created. As a result, it was found that the age of stands was the strongest determinant for classification. The most affected are those aged 30-60. The second most significant factor were the location within or outside of the outbreak zone and the influence of water on the plot. Third level of classification rules were connected with geomorphology and altitude. The maximum percentage of affected trees lies between altitude of 750 m and 920 m. Some other attributes related to geomorphology, such as Topographic Position Index, or exposure have also proved to be significant in some models. From the combination of the results and information from the reference literature it was assumed that the main determinant of damage to the Norway spruce in the area could be the occurrence of late frosts or periods of warm weather during the winter.

Key words: gemmamyces bud blight, *Gemmamyces piceae*, Ore Mountains, epidemic

Comparison of attractiveness of various pheromone component blends for spruce bark beetle *Ips duplicatus*

Beránková Kateřina

Excelentní tým pro mitigaci, Fakulta lesnická a dřevařská, Česká zemědělská univerzita v Praze, Kamýcká 129, 165 00 Praha 6 - Suchdol; berankovak@fld.czu.cz

In Central Europe the importance of the double-spined bark beetle *Ips duplicatus* as a pest of the Norway spruce (*Picea abies*) has grown considerably over the last 30 years, and therefore it is in the focus of interest to develop more efficient management methods including population control using pheromone evaporators. The aim of this work was to compare the attractiveness of various pheromone component blends for *Ips duplicatus* and also commercially available pheromone mixtures were compared with these newly developed. The methodology for determining the sex of *Ips duplicatus* according to the external morphological signs was also developed. We designed a field test to compare commercial pheromone mixtures for *Ips duplicatus* and mixtures of active substances these newly mixed in the laboratory based on the summarized information. We installed the experiment in 2017 in the advanced season with the expected second raid of *Ips duplicatus* in the area with a calamitous occurrence of bark beetle. After evaluating the number of beetles caught on various baits, we decided that commercial evaporators have in the advanced season higher efficiency than mixtures prepared on the base of literature research. The statistical analysis showed that the most beetles of *Ips duplicatus* were captured by a commercial evaporator Pheagr-IDU followed by a variant with a blank evaporator and further was evaporator from Romania ID-Romania. Altogether 1 086 bark beetles of *Ips duplicatus* and 2 008 bark beetles of *Ips typographus* were captured. More females than males of *Ips duplicatus* were determined by dissection, namely 52%. The different efficiency of commercial pheromone evaporators can be explained by the

difference in their chemical composition which was determined by chemical analysis. During the evaluation of the experiment, the methodology for determining the sex of *Ips duplicatus* was developed according to the external morphological signs which allows to sort living individuals by gender.

Keywords: *Ips duplicatus*, ipsdienol, E-myrcenol, pheromone mixture

Cultivation of medicinal mushrooms on spruce sawdust fermented with a liquid digestate from bio-gas production

Brezáni Adam[1], Svobodová Kateřina[4], Jablonský Ivan[2], Tlustoš Pavel[3]

[1]University of Life Sciences, Department of Forest Protection and Entomology, CZ-160 00, Prague 6, Czech Republic; [2]University of Life Sciences, Department of Hurticulture, CZ-160 00, Prague 6, Czech Republic; [3]University of Life Sciences, Department of Agroenvironmental Chemistry and Plant Nutrition, CZ-160 00, Prague 6, Czech Republic; [4] Laboratory of Environmental Biotechnology, Institute of Microbiology of the Czech Academy of Sciences, CZ-14220 Prague, Czech Republic

This work reports a successful use of a liquid digestate from bio-gas production in spruce sawdust fermentation for conversion of the wood material into a growth substrate for medicinal mushrooms. On the fermented spruce sawdust *Pleurotus ostreatus*, *Pleurotus eryngii,* and *Ganoderma lucidum* showed mycelial growth rates similar to control beech sawdust with values ranging from 4.1 to 5.54 mm/day. A six week-fermentation was demonstrated sufficient for removal of volatile extractives from the spruce sawdust (76 % removal efficiency) which content was shown to be most critical for fungal growth. Simultaneously, a 47 % removal of resinous compounds and a decrease in C:N ratio of the growth substrate were observed in the sawdust fermentation in the presence of the liquid digestate. Among the ligninolytic enzymes, the produced growth substrates favored laccase production by tested fungi, indicating the growth substrates could be used for enzyme production as well. From all of that it follows that the utilization of wastes from bio-gas production for the reuse of softwood wastes could make an environmental-friendly and economically viable biotechnology for mushroom production.

Keywords: medicinal fungi, mushroom cultivation, alternative growth substrates, fermented conifer saw dust, *Pleurotus* sp., *Ganoderma lucidum*

Delusory parasitosis – under siege of invisible pests

Bubová Terezie, Kulma Martin

National Reference Laboratory of Health Pest Control, National Institute of Public Health, Šrobárova 48, 100 42, Praha 10; terezie.bubova@seznam.cz

Delusory parasitosis is an infrequent psychotic illness, when individuals incorrectly believe they are infested with parasites as insects, mites or other arthropods, whereas in reality no such infestation is present. Generally, the symptoms are described as involving perceived parasites crawling upon, biting or burrowing into the skin. The patients suffering this disease may injure themselves in attempts to get rid of their parasites. Therefore, bruises, nodular pruritis, ulcers and scars can occur on the skin of sufferers. Moreover, delusory parasitosis is often accompanied by states of anxiety such as depression or social isolation. The patients may also compulsively gather evidences to present to health professionals as dermatologists or entomologists for help. The collected samples are then usually identified as a common household insect species, dust, grains, fibers, scab, or debris excoriated from the skin. In order to confirm the infestation, negative investigation is only the further motivation to continue in gathering evidences. Sufferers also contact professional pest control services and repeatedly ask them to perform treatments against the arthropods. At the Department of Public Health Pest Control, we regularly meet patients suffering delusory parasitosis, who ask us for the determination and advices in their situation. Usually, the patients already underwent investigations at general practitioners, dermatology ambulances and often also spent much money for pest control services. This contribution will aim to inform about typical case reports and also about our attempts to help patients to escape from the vicious circle in which they are trapped.

Keywords: delusory parasitosis, psychotic illness, invisible bugs, entomological determination

High Latitude Dust: Dust storms in Iceland and Antarctica

Dagsson Waldhauserova Pavla[1,2]

[1]Czech University of Life Sciences Prague, Faculty of Environmental Sciences, Czech Republic; [2]Agricultural University of Iceland, Faculty of Environmental Sciences, Hvanneyri, Iceland, pavla@lbhi.is

The Arctic and Antarctic regions include large areas of high latitude dust sources, from where dust is transported long distances. The first estimates are that all high latitude dust sources cover > 500,000 km^2 and contribute to at least 5 % of global dust budget. Iceland is the largest Arctic as well as European desert with high dust event frequency (>135 dust days annually). Icelandic volcanic dust can be transported distances >1000 km towards the Arctic and deposited on snow, ice and sea ice. Icelandic deserts are located both in the arctic and subarctic areas. Total extent of the deserted areas is about 44,000 km^2. This represents that > 40% of Iceland is poorly vegetated and with high erosion rates, not including the 10% extent of the glaciers. These areas used to be, however, vegetated while forests covered at least 25% of the country about 800 years ago. Woodlands were reduced due to medieval agricultural methods to almost total elimination about 100 years ago. Cold climate and massive erosion caused a collapse turning vegetated ecosystem into desert. Today dust events frequently occur in the winter and during sub-zero temperatures. We have measured dust plumes in Iceland in vertical high altitudes profiles, *in situ*, in transects, as well as implemented camera network around the most active dust sources. We measured extreme wind erosion events of volcanic ash, snow-dust storms, dust storms during moist and low wind conditions. Our experiments showed that volcanic dust is reducing snow albedo and increases snow melt similarly as Black Carbon. Measurements in Antarctica showed that the air is polluted by local dust sources, as well as due to long-range transport from Patagonia. The PM_{10} concentrations in Antarctica are higher than in

natural areas of the Northern Europe. Impacts of High Latitude Dust on climate should be investigated and incorporated into climate scenarios.

Keywords: Volcanic dust, air pollution, cold deserts.

Effects of Land Cover Changes on Surface Urban Heat Island (SUHI) Using CORINE Land Cover Change (CLC) Products: The Case of Prague

Dogan Tugba, Hanel Martin

[1]Czech University of Life Sciences Prague, Faculty of Environmental Sciences, Czech Republic; tubadogan@live.com

Urban heat island refers to temperature differences between urban and rural areas due to alteration of the natural surfaces and their replacement by artificial urban surfaces which trap heat inside city. Since land cover changes are one of the most important causes of urban heat island, it is important to analyze effects of different type of changes on land surface temperature during different time intervals. In order to accomplish this goal, this study uses CORINE Land Cover Change (LCC) products for the periods 1990-2000, 2000-2006 and 2006-2012. Surface urban heat island (SUHI) which also called skin level UHI, is calculated based on land surface temperature (LST) and measured by satellite images. Landsat images from the selected periods, were used to extract land surface temperature. After normalization of the LSTs, surface urban heat island maps were created and compared with CORINE Land Cover Change (LCC) data. The results indicate that changes in land cover have been caused to exacerbation of surface urban heat island in Prague for the selected time periods. For this reason, decision makers and planners should consider the consequences of land cover changes in order to mitigate urban heat island.

Keywords: Land Surface Temperature; Urbanization; Thermal Band

In vitro culture as a method for the conservation of endangered freshwater mussels with a special focus on the methodological constraints

Juan Felipe Escobar Calderón, Vodáková Barbora, Douda Karel

Department of Zoology and Fisheries, FAFNR, Czech University of Life Sciences Prague, 16500; xescj001@studenti.czu.cz

The freshwater mussels are one of the most endangered groups of animals in the world in part due to their complicated life cycle which includes a parasitic stage in a host fish. Because of this, the disappearing of host fishes in many rivers can greatly affect mussel populations. The alternative of *in vitro* culture, can be extremely helpful for the conservation of species in which there is no sufficient knowledge about the host species or for places where the host fish has disappeared. However, in vitro culture poses a series of methodological challenges, currently, the calculation of metamorphosis rate is largely based on juvenile activity. Factors like time and dilution of medium can affect the observed activity of the juveniles and is not known if this can have an effect on the observed metamorphosis rate. Additionally the medium composition needs to be enhanced for some species where in vitro culture has not been successful. This contribution presents the results from our experiments carried out in glochidia of *Anodonta anatina* and *Margaritifera margaritifera*. For *A. anatina* we studied the effects of different count times and dilutions on the perceived metamorphosis rate of larvae subjected to different medium types and antibiotic concentrations. While the *M. margaritifera* experiment aimed to test the effects of taurine addition , serum type (horse or newborn calf) and source of lipids (cod liver or emulsified lipid mixture) in the early development of larvae. Our conclusions point out that the measure of metamorphosis success in *in vitro* experiments can be affected by both dilution and time of counting and shows the importance of considering additional methods for assessing *in vitro* metamorphosis success. Alternatively we found

that early development of larvae from *M. margaritifera* is not enhanced by the addition of taurine, while horse serum appear to have a positive effect in the proportion of glochidia closed after exposure to the medium.

Keywords: freshwater mussels, conservation, metamorphosis success, *in vitro*.

Settlement relocation after flooding: how long do people remember the disaster?

Fanta Václav, Šálek Miroslav, Sklenička Petr

Faculty of Environmental Sciences, Czech University of Life Sciences Prague, Kamýcká 129, Praha – Suchdol, 165 00, Czech Republic; fanta.vaclav@gmail.com

We studied the reaction of human communities to floods. According to various papers, when a flood or wetter times came in the past, people usually moved their settlements to higher (safer) positions in the landscape, or at least stopped to build new houses in the dangerous floodplain. This process has been documented in various part of the world. But how long did they stay in the safer places? And did they pass this knowledge to younger generations? When dealing with such "flood memory", a key-question is how long a community can keep information (and whether this information will affect its behaviour). In other words, how long after a flood are people still settled in a higher or safer place and when they begin to settle backwards near the river? And does this change over centuries? We tested several flood-events on scale of centuries and we also looked at duration of human/social memory on a sample of 1601 individual towns and villages in the Czech Republic.

Keywords: historical memory, disaster adaptation, Central Europe, long-term memory, medieval colonization

Volcanic eruptions and collapses of civilisations

Hejcman Michal

Department of Ecology, Faculty of Environmental Sciences, Czech University of Life Sciences Prague, Kamýcká 129, Praha – Suchdol, 165 00, Czech Republic; hejcman@fzp.czu.cz

Big volcanic eruptions are able to generate volcanic winter, which can be on the northern, southern or both hemispheres depending on the position of the volcano on the planet Earth. Toba eruption 74,000 BP was the biggest eruption during the last 100 000 years. This eruption devastated forests in SE Asia and was probably responsible for bottle-neck effect on human as well as many animal populations. Campanian Ignimbrite Eruption 39,280 BP coincided with the final decline of *Homo neanderthalensis* in Europe. There are examples of many large Holocene eruptions which affected collapses of civilisations and helped to change political regimes. Minoan eruption of Thera in 1627 BC caused tsunami in Mediterranean Sea and helped to destabilise Minoan civilisation on Crete. Extreme weather event in Europe and Asia in 535 -536 AD and following famines in China, Meso-America and plague in Constantinople was connected with Tierra Blanca Joven eruption of the Ilopango caldera in central El Salvador. Also Migration period in Europe was probably the result of this eruption causing drought in steppe regions. Laki eruption on Iceland in 1783 AD caused volcanic winter on the norther hemisphere and extreme drought in Egypt and India with approximately 2 000 000 casualties. Tambora eruption in Indonesia in 1815 AD caused the year without summer on the northern hemisphere and following famines in Europe, Asia and Northern America. Krakatoa eruption in Indonesia in 1883 caused global cooling and emigration of many peasants from Iceland into Canada. Although we have modern and highly productive agriculture able to withstand 10 billion inhabitants on the planet Earth under normal climatic conditions, we can not eliminate possibility of famines caused by unpredictable extreme volcanic eruptions which will followed by severe climatic events.

Impacts of sludge retention time on membrane fouling in membrane bioreactor

Bo Hu, Chen Zhongbing

Department of Applied Ecology, Faculty of Environmental Sciences, Czech University of Life Sciences Prague, Kamýcká 129, 16500, Prague, Czech Republic; zhongbing.chen@gmail.com

Membrane bioreactor (MBR) is a biological wastewater treatment process by using a membrane process instead of a secondary sedimentation tank, which can upgrade the standard of sewage treatment thus exhibit advantages for water reuse. However, membrane fouling does hamper its' application, and the mechanism of membrane fouling is one of the most urgent research hotspots need to be revealed. This study, therefore, aimed to investigate the impacts of four different sludge retention times (SRTs) (10, 20, 40, and 90d) on membrane fouling as well as the main removal mechanism under different SRTs. The results showed that MBRs reached the best performance at the medium SRT (40d), with a higher organic pollutants removal efficiency and a less membrane fouling. In addition, the type of dissolved microbial products (SMP) and their concentration may be the main reasons to cause membrane fouling. The average concentration of SMP both in the supernatant of MBR and foulants on the membrane surface and pores were in this order: SRT10d<SRT20d<SRT90d<SRT40d. Protein was the major metabolic product, accounting for 39.14%~50.38%, which contributed significantly to the formation for cake layer fouling, but it hadn't highly corrected with membrane irreversible fouling. Furthermore, a higher concentration of humic acid, polysaccharide and inorganic ion were detected in foulants of irreversible fouling, indicating that the metabolic products, especially likes humic acid, polysaccharide, can cause seriously membrane fouling at a too low or too high SRT (10d, 20d or 90d) because of the capability of interaction with ion. Based on membrane fouling models, cake, intermediate and standard blocking were the main mechanism of membrane

fouling in MBRs. The combined models of cake-intermediate and intermediate-standard blocking could accurately describe and predict MBR membrane pollution.

Keywords: SRT, MBR, membrane fouling, membrane models

Effect of plants on sludge treatment under different loading rates and feeding frequencies in sludge treatment wetlands

Hu Shanshan, Chen Zhongbing

Department of Applied Ecology, Faculty of Environmental Sciences, Czech University of Life Sciences Prague, Kamýcká 129, 16500, Prague, Czech Republic; zhongbing.chen@gmail.com

As an environmentally friendly sludge treatment technology, sludge treatment wetlands (STWs) have the advantages of low investment and low energy consumption, have attracted more and more attention around the world. However, detail information of this technology is still not well known compare to conventional technologies. In the present study, two STWs (planted and unplanted STWs) were investigated under seven sludge loading rates and feeding frequencies. The results showed that plant plays an important role on sludge dewatering, sludge mineralization and leachate treatment in the STWs. The best sludge dewatering and mineralization was observed at the loading rate and feeding frequency of 10L/4d in the planted STW, which were 29% and 25% for total solids and volatile/total solids, respectively. The best loading rate and feeding frequency for leachate treatment was 12L/4d in the planted STW, with chemical oxygen demand, ammonia, total nitrogen (TN), and total phosphorus (TP) were 99.8%, 91.1%, 98.6%, and 91.5%, respectively. Nutrient contents (TN, TP and total potassium (TK)) in the accumulated sludge fulfilled the standard of Chinese sludge for agriculture reuse (TN+TP+TK>30 g/kg). Cu, Mn, Ni, Zn, Cr, Fe, and Pb in the accumulated sludge were not a threat for plants and soil based on the determination of their contents and fractions. The content of Cd (>5 g/kg) was higher than the standard of Chinese sludge for agriculture reuse, and its bioavailability was high due to the high proportion in reduction state (around 50%). Overall, the content and bioavailability of Cd needed to be reduced before the sludge can be applied in agriculture.

Keywords: Bioavailability, Sludge dewatering, Sludge mineralization, Sludge treatment beds

Modelling of forest microclimate from remote sensing proxy variables

Kašpar Vít[1, 2], Hederová Lucia[2], Kopecký Martin[2], Macek Martin[2], Müllerová Jana[2], Wild Jan[1, 2]

[1]Czech University of Life Sciences Prague, Faculty of Environmental Sciences, Department of Applied Geoinformatics and Spatial Planning, Prague, Kamýcká 129, 165 21 Praha 6 – Suchdol, Czech Republic; [2]Institute of Botany of the Czech Academy of Sciences, Zámek 1, 252 43 Průhonice, Czech Republic; kasparvit@fzp.czu.cz

Bioclimatic models forecast redistribution, assemblage change and extinction risk for many species as a result of the anthropogenic climate change. However, these predictions mostly rely on coarse interpolated standard meteorological measurements and neglect microclimate heterogeneity relevant for species living near the ground. To not take into account that aspect can lead to overestimation of potential impacts of climate change. In our study, we point out that even within a 20-ha temperate forest air temperature varied greatly, showing nearly 2° C differences for a vegetation period average, and even more for temperature extremes. Contrary to expectations, geomorphometric parameters showed minimal variability, suggesting the dominant role of forest canopy cover in modifying its inner environment. To confirm the link between canopy cover and forest microclimate, we assessed canopy openness properties from the analysis of hemispherical photographs. However, this method provides purely discrete information about the local forest canopy architecture and difficult to scale up. Therefore, we discuss several alternative forest structural metrics derived from UAS laser scanning as spatially continuous and highly detailed proxies of surface temperature. Overall, though our results showed the medium strength of statistical relationship (probably because of partial stochasticity of microclimate), we consider the remote sensing of microclimate proxy variables capable to determinate a critical function of forest in buffering regional climatic condition and can thus improve future bioclimatic modelling at a landscape scale.

Keywords: forest microclimate, climate change, bioclimatic modelling, remote sensing, UAS laser scanning

Bird assemblages of forest ecosystems in Šumava NP

Kebrle Dominik, Zasadil Petr, Ludvíková Vendula, Köstelová Linda

Depatment of Ecology, Faculty of Environmental Sciences, CULS Prague, Kamýcká 129, 165 00 Praha 6; kebrle@fzp.czu.cz

Overall, 120 plots in different types of forest biotopes were monitored during the nesting season of 2017. Totally, 71 bird species were recorded. The most frequent type of forest stand was spruce forest (64 plots), with 56 bird species. Attention was paid mainly to the influence of natural disturbances on forest avifauna. The degree of disturbance is dependent on the altitude. The disturbed areas dominated in the higher altitudes (above 1000 m.a.s.l), whereas in lower altitudes undisturbed forest stands prevailed. In forests with small-scale disturbances the number of bird species seems to be the highest, in large – scale disturbed areas the lowest, respectively. Also the number of hole nesters and species nesting in canopy is low in large – scale disturbed areas. Analyze of the altitude influence showed lower numbers of species in higher altitudes that nests in tree canopies. Meanwhile number of bird species of opened habitats increase with higher altitudes. In spite of non-significant results, the large - scale disturbed areas seems to be important for protected bird species. The degree of disturbed area is related to amount of deadwood. Abundance and number of bird species decrease with increase amount of deadwood that may be caused by predominant species of live forest stands.

Keywords: National park, disturbances, deadwood, forest avifauna

The importance of the radiation balance for water retention of the landscape

Kofroňová Jitka

Ústav pro hydrodynamiku AV ČR v.v.i.; Univerzita Karlova (UK); kofronova@ih.cas.cz

As part of the radiation balance, longwave radiation is one of the factors needed to estimate potential evapotranspiration (PET). Since the longwave radiation balance is rarely measured, many computational methods have been designed. In this study, we report on the difference between the observed longwave radiation balance and modelling results obtained using the two main procedures outlined in Manuals 24 and 56 of the FAO. The performance of these equations was evaluated in the warmer months (April to October) over eight years at the Liz experimental catchment in the Bohemian Forest (Czech Republic). The coefficients of both methods were also calibrated based on

local conditions. Four commonly used methods were used to calculate the PET (Penman-Monteith, Pristley and Taylor, Kimberley-Penman, Thom and Oliver). The use of default coefficient values gave errors of 40–100 mm and 0–20 mm for the seasonal PET estimates for FAO56 and FAO24, respectively (the PET was usually overestimated). Parameter calibration decreased the FAO56 error to less than 20 mm per season (FAO24 remained unaffected by the calibration). The FAO56 approach with calibrated coefficients proved to be more suitable for estimation of the longwave radiation balance.

Vanishing trees in Czech urban areas

Kozina Václav

Centrum pro otázky životního prostředí, José Martího 407/2, 162 00 Praha 6; vaclav.kozina@gmail.com

Trees are a substantial part of the environment in urban space. But there are some indications of tree-vanishing in Czech urban areas. The presentation based on the qualitative research outlines the problem of tree-vanishing in the case study on the example of a small town in south-western Bohemia. Another approach how to get to the problem is interviewing people engaged in the protection of urban greenery (office workers and civil activists). The objective of the research is the description of the problem and the identification of key factors. The research concludes that trees vanish significantly in Czech urban areas. Main factors of tree-vanishing in Czech urban areas are the incompetency of officials, the hostile approach of parts of the population, the bad care for trees, the rigid standards and the reduction of space for trees.

Invasive potential of pet-traded crabs from genera *Geosesarma* and *Parathelphusa*

Krausová Anežka

Department of Zoology and Fisheries, Faculty of Agrobiology, Food and Natural Resources, Czech University of Life Sciences Prague, Kamýcká 129, 16500 Praha-Suchdol; krausovaanezka@af.czu.cz

Currently, biological invasions are a globally highlighted problem. Animals can spread, among others, via international trade. The popularity of aquarium decapod crustaceans, including ornamental crabs, has grown within recent years. The aim of this study was to evaluate the invasive potential of crabs from genera *Geosesarma* and *Parathelphusa* in a global context. Biological invasions cause biodiversity decline, ecosystem disruption, and economic losses. Native fauna is threatened by introductions of non-native species and their diseases also regarding the aquarium trade. Freshwater ecosystems in tropical areas are inhabited by numerous endemic crab species, including *Geosesarma* and *Parathelphusa* crabs from South-eastern Asia. The invasive potential of aforementioned crabs was evaluated using the Climatch v.1.0 tool, which compares the climatic conditions in the source region (*Geosesarma* and *Parathelphusa* native range) and selected target regions (continents). The highest climatic similarity was assessed in South and Central America, Africa and northern Australia. The lowest match was evaluated in Europe and North America. Crabs from Taiwan, eastern Thailand, and central Java have the highest probability to establish new populations in the target areas. These include species *Geosesarma hednon*, *G. krathing*, *G. dennerle*, *G. hagen*, and *G. rouxi*. The evaluated species of the genus *Parathelphusa* (*P. ferruginea* and *P. pantherina*) are native only in Sulawesi, so they would potentially establish populations on a more restricted area than species from the genus *Geosesarma*. South America, Florida and Indonesia (out of the native range of evaluated crabs) were identified as the areas where these crabs could be introduced and where they potentially could establish new populations. To prevent future invasions of these species it is necessary to mitigate intentional release or unintentional escape of the animals during transport, trade, and keeping.

Keywords: biological invasion, alien species, ornamental aquaculture, climate matching, risk assessment

Nōmen est ōmen" - Translocated *Syngnathus* sp. From Black Sea to Tbilisi "Sea"

Kuljanishvili Tatia, Kalous Lukáš

Department of Zoology and Fisheries, Faculty of Agrobiology, Food and Natural Resources, Czech University of Life Sciences Prague, 165 00 Prague, Czech Republic; Kuljanishvili@af.czu.cz

Introduction of non-native species is considered one of the main reason for biodiversity loss and aquatic environment is one of the most affected by human activities on Earth. Besides well-known motives for introductions of aquatic species (intentional or unintentional), such as aquaculture, recreational fishing or ornamental purposes, not much is known about cultural or even linguistic reasons. Here we demonstrate on the example of Syngnathus sp., how the name of the place can be a driver for new species introduction resulting in the successful establishment of a non-native species on a new locality with invasive potential. Thus we proposed to call this unusual but vivid driver for intentional introductions as "Nōmen est ōmen phenomenon".

Keywords: "*Nōmen est ōmen*", *Syngnathus sp*. Introduction, non-native species

The invasive grey silver fish (*Ctenolepisma longicaudata*) recorded in the Czech Republic

Kulma Martin[1, 2], Vrabec Vladimír[2], Patoka Jiří[2]

[1] National Reference Laboratory for Vector Control, National Institute of Public Health, Šrobárova 48, 100 42 Praha 10, Czech Republic; [2] Department of Zoology and Fisheries, Faculty of Agrobiology, Food and Natural Resources, Czech University of Life Sciences Prague, Kamýcká 129, 165 00 Praha 6, Czech Republic; martin.kulma@szu.cz

The silverfish *Ctenolepisma longicaudata* (Escherich) (Zygentoma, Lepismatidae) is invasive, synanthropic, warehouse and economic pest, probably of Central American origin. During recent decades, its establishment has been recorded from several European countries. In comparison with endemic silverfish species, it has lower requirements on temperature and humidity, and so, it has a potential to become dominant silverfish species within household environment. Here, we report the established populations of *C. longicaudata* within the territory of Prague, Czech Republic. In the autumn 2017, the first established population was discovered in a warehouse and surrounding office

buildings. Then, another probably introduced population was found damaging exhibition in the National Gallery Prague in June 2018. Since this species causes damage to starch components and fabrics as well as food contamination, we strongly recommended the eradication.

Keywords: Lepismatidae, insect, invasive pests, biological invasion, Prague

Mycorrhizal inoculation of Norway spruce seedlings: experimental results in the area of Klášterec nad Ohří

Lísková Aneta

Department of Forest Protection and Entomology, Faculty of Forestry and Wood Sciences, Czech University of Life Sciences Prague, Kamýcká 129, 165 00 Prague 6 – Suchdol, Czech Republic; liskovaa@fld.czu.cz

The aim of the work was to evaluate the effect of mycorrhizal product ECTOVIT® from Symbiom, s. r. o. company on basic growth and mycorrhizal characteristics of *Picea abies* seedlings. The experiment was performed in Ore mountains (in Krušné hory), LZ Klášterec nad Ohří. This experiment with mycorrhizal inoculated (treated) and control (uninoculated) seedlings was establish in May 2015. Sixty (60) seedlings were removed from this research area in July 2017. On each of them it was measured the length of the above-ground and underground parts and thickness of the root neck. Gently roots to average 1 mm were separated and then thickness of active and inactive mycorrhizal peak was evaluated and their percentage quotient was evaluated too. After evaluation mycorrhizal characteristics roots and the above-ground parts of spruce seedlings were dried at 105°C. Then their dry matter was determinated. The obtained data were statistically processed. Based on the results statistically significantly higher thickness active mycorrhizal on treated seedlings was detected. The thickness of inactive myccorhizal was higher in control seedlings. The results showed that mycorrhizal preparation ECTOVIT® it works positively on development of mycorrhizal peak, but after evaluation 2 years old experiment it was not detected positive influence on growth characteristics of seedlings of *Picea abies*.

Keywords: *Picea abies*, ectomycorrhiza, softly roots, inoculation, mycorrhizal symbiosis, seedlings, mycorrhizal preparation

A comparative study on the development of traditional hedgerow landscapes in Prachatice, Czech Republic and Herefordshire, United Kingdom from 1953 to 2016

Lowther-Harris Frederick

[1]Czech University of Life Sciences Prague, Faculty of Environmental Science, Department of Land Use and Improvement, Kamýcká 129, Praha 6 – Suchdol, Czech Republic; [2].Faculty of Science, University of Copenhagen, Bülowsvej 17, 1870 Frederiksberg, Denmark; lowther-harris@fzp.czu.cz

Hedgerows have developed independently in the Czech Republic and the United Kingdom, creating unique characteristics. Between 1953 and 2016 under communist and capitalist farming systems respectively, both saw significant declines in hedgerow coverage. These declines in hedgerow quality, length and value can be a reflection of the political, economic and environmental forces. Marginal areas with hedgerow remnants were studied in field surveys, around Prachatice, Czech Republic and Herefordshire, United Kingdom. And GIS analysis was used to show the specific nature of their decline during the time period. Policy for the protection of rural landscapes and hedgerows was analysed at all levels, throughout the study period. This revealed similarities in communist and market forces in removing hedgerows through intensification of agricultural landscapes, and the need for current EU legislation to include small farms. United Kingdom hedgerows were seen to provide well supported protection and management over hedgerows, and their recognition in landscapes, whilst the Czech Republic was found to have little knowledge of their presence, however, local zoning plans and rural development programmes provide policy to build on.

Keywords: Historical landscape conservation, Medieval field pattern, Plužina, Hedgerows, Agricultural policy, Czech Republic, United Kingdom.

The importance of pathogenic organisms from Oomycetes in agriculture and forestry

Macháčová Markéta

Czech University of Life Sciences Prague, Faculty of Forestry and Wood Sciences, Department of Forest Protection and Entomology | Faculty of Agrobiology, Food and Natural Resources, Department of Plant Protection, Kamýcká 129, CZ - 165 00 Praha 6 - Suchdol, Czech Republic; machacovam@fld.czu.cz

The pathogens of the Straminopiles kingdom, Oomycota group, belong to the most important plant pathogens worldwide, having significant economic impact. Particularly the oomycete genera *Phytophthora* and *Peronospora* cause severe damages in agriculture and forestry. *Peronospora destructor* is an example of a pathogen that causes the most serious disease of onion, downy mildew of *Allioides*. This pathogen needs the presence of a live host for its development. Spores of this pathogen stay alive for only 2–3 days, and they need high relative humidity (min. 95%) and temperatures between 15–20°C for germination. Inappropriate climatological conditions will not allow the disease to develop, which was demonstrated during the diploma field experiment in 2017. This confirms the dependence of *P. destructor* on specific temperature and humidity conditions. Based on the results of the artificial inoculation of onion plants, spores of *P. destructor* do not survive outside the host tissue and their germination is significantly limited in time. This results in considerable difficulty in optimizing the method of cultivation of this pathogen. In recent years the problems caused by the genus *Phytophthora* appear also in forestry. For example the riparian stands are seriously affected by *Phytophthora alni* causing the decline of black and grey alders. This pathogen is primarily dispersed by water where it can infect the root system of alder trees. The trees decline and therefore the stabilizing and ecological functions of riparian stands are damaged. Within the dissertation thesis I deal with the isolation and cultivation of this pathogen and further study of pathogen and plant interactions. The research will be based on experiments in growth chambers where seedlings of selected tree species will be cultivated under determined stress conditions (drought, excessive radiation, low pH and mycorrhizas).

Key words: Oomycota, *Peronospora destructor*, *Phytophthora alni*, isolation of pathogen, artificial inoculation

Hydric reclamation in the post-mining landscape - Kristýna Lake

Major Vladimír

Department of Landscaping and Improvement, Faculty of Environment, Czech University of Life Sciences Prague, Kamýcká 129, 165 21 Prague 6 – Suchdol; major@fzp.czu.cz

As a result of population growth and the consequent development of industry and agriculture, many natural habitats have been extinct in the past. In the Czech Republic, the development of coal production has been underway since the second half of the 18th century. And this activity led to a radical change in the landscape during the second half of the 20th century. These post-industrial places represent the great potential of natural succession. The important landscape forming element, which fundamentally influences the reclamation of the landscape, is water, the important water elements are becoming flooded with the residual pits of former mining sites. These pits are usually flooded by mining water, or water from surface streams. An example of reclamation is the Kristýna lake near Hrádek nad Nisou. Lake have been originated since 1970 by slow flooding of former lignite mine. The site began to be examined for the first time in 1786, and after the discovery of a lignite bearing, the Christian mine was opened, which was closed after the bearing was exhausted. The mining was resumed after the Second World War, and after a geological survey, surface mining in an open quarry took place since 1952. Mine was flooded during the flood in 1958 and dewatered. As a consequence of the continuous large leak of water, the mine was closed in 1972 and the residual excavation pit was filled up by groundwater during three years. The bottom and the walls of the pit were not modified. The banks were reclaimed (hardening), new sandy beaches were created and the surrounding terrain was adapted for recreation. The lake currently has an area of 14 hectares and reaches a depth up to 32 m. From the available water quality measurements from the years 2015-2018 it follows that the water achieves an optimal value with minimal microbial stress. I consider this item to be very beneficial. Any study has not been carried out to this day here, which would monitor the impact of hydric reclamation on the ecosystem and the climate around Kristýna Lake, so I will continue to engage this.

Key words: Water, hydric reclamation, post mining landscape, flooded mining pit, Kristýna Lake.

Parental duties of male and female great tits *(Parus major)*: a methodology and preliminary results

Míšková Jana, Zárybnická Markéta

Katedra aplikované geoinformatiky a územního plánování, Fakulta životního prostředí, ČZU v Praze, Kamýcká 129, 165 21 Praha 6 – Suchdol; miskova@fzp.czu.cz

We designed, developed, and tested so-called smart nest box (SNBox), i.e. a regular wooden nest box with embedded technical components including a computer, camera, motion detector and auxiliary sensors (e.g. temperature sensor or light intensity sensor). We deploy the SNBoxes under the project called "Ptáci Online" (Birds Online, FES, CULS Prague), and collect a large amount of biological data without the necessity of nest visiting and disturbing nesting individuals. We have preliminary analysed one nest of great tits (*Parus major*) in 2017 to find the differences between the male and female parental care. Significant differences between male and female behaviour were found, for example, in the manipulation with the nestling's faeces. The structure of food delivered to the nestlings also differed between sexes. In the future, we are going to collect data from other nests monitored using SNBoxes and find the effects of environmental factors, including weather and urbanization, on the reproductive success of great tit and parental duties of male and female parents.

Key words: Environmental factors, great tit, nesting, parental care, SNBox, tits, urbanization

The friendship between predators and plants alias importance of predatory vertebrates for plant performance

Mrazova Anna[1,2], Nevo Omer[3], Ayasse Manfred[3], Sam Katerina[1,2,4]

[1]Biology Centre of the Czech Academy of Sciences, Institute of Entomology, Ceske Budejovice; [2]Faculty of Science, University of South Bohemia, Ceske Budejovice; [3] Institute of Evolutionary Ecology and Conservation Genomics, University of Ulm; [4]The laboratory of multitrophic interactions, Institute of Entomology, Biology Centre CAS, Branisovska 1160/31, Ceske Budejovice, 37005, Czech Republic; katerina.sam.cz@gamil.com

It is well known that herbivore-induced plant volatiles (HIPVs) released by plants can serve as cues for arthropod predators of herbivorous insect searching for food. This way, the plants are able to communicate with the third trophic level directly. In the last ten years, it has been shown that not only invertebrate predators but also birds and bats can be guided by HIPVs to herbivore-rich plants. However, the mechanisms of the entire system and factors influencing tritrophic systems are still

only little explored. We conducted two years long exclosure experiment on six tree and shrub species in a temperate region of Podyjí National Park in the Czech Republic. Half of the experimental plants were covered with a net to preclude birds and bats feeding on herbivores. This study is unique in an amount of investigated factors potentially influenced by predators exclusion. We focused on a difference of herbivory rate, inner plant structures, volatiles compounds, the composition of insect communities (mesopredators, herbivores and their insect predators such as parasitic wasps) and changes in leaves' UV spectrum visible by birds and bats.The aim of this study was to at least partly uncover mechanisms standing behind tritrophic systems. Individual pieces of all factors accompanying tritrophic systems such as defence strategy in different plant species and changes in production of volatile compounds in time scale should lead to wider knowledge about how important is the induced defence for individual plant species. At this symposium, we are offering a summary of the preliminary results of this study.

Key words: exclosers, herbivorous insect, HIPVs, plant defence, predators, tritrophic interactions

Medieval hillfort as an island of extraordinary fertile Archaeological Dark Earth soil in Central Europe

Opare Asare Michael, Hejcman Michal

Katedra ekologie, Fakulta životního prostředí, Česká zemědělská univerzita v Praze, Kamýcká 129, 165 21 Praha 6 – Suchdol; asare@fzp.czu.cz

Archaeological Dark Earth (ADE), a category of Antrosols, has gained global attention as it exhibits high nutrient content, organic matter stocks, characteristic dark colour, and enable high crop yields. However, not much is known about the chemical properties of ADE in Central Europe. We studied ADE in the teritory of an early medieval hillfort Dřevíč (Czech Republic) aiming to compare chemical properties with control soils not affected by settlement activities. Black colour of ADE highly contrasted with reddish colour of Cambisols in the surrounding. Soil reaction and content of P, Ca, Mn, Fe, Cu, and Zn was substantially increased in ADE in comparison to the control soil on the same geological substrate in the surrounding. Phosphorus in the hillfort was approximately 4.5x higher than unfertilized soil, 2.5x higher than soils treated with NP and P fertilizers, 6.5x than soils treated with N, and 3x than NPK fertilizers. Calcium increased in the hillfort by approximately 10x and 3.5x in comparison to unfertilized and fertilized soils respectively, and approximately 28x for N fertilized soil. Iron increased in soil from the hillfort by approximately 2x and 2.5x in comparison to unfertilized and fertilized soils respectively. Increased contents of these elements together with

charcoals visible in the soil indicate deposition of organic wastes and biomass ashes during the existence of the hillfort from 8th to 12th century. Medieval hillforts thus, represent extraordinary nutrient rich islands in the cultural landscape of Central Europe. The chemical signatures generated by medieval settlement activities are such prominent that they cannot be masked by modern fertilizer application.

Keywords: Cambisol; Mineral Fertilizer; Iron; multi-elemental analysis; Phosphorus; Settlement activity.

Long-term performance and potential of an adaptive management system for effective law enforcement in protected areas

Owusu Afriyie Jerry, Opare Asare Michael, Osei-Mensah Jones, Hejcmanova Pavla

Law enforcement in protected areas is critical for ensuring the long-term conservation and viability of specific conservation targets. Hence, in 2004, a new adaptive management system of law enforcement was implemented in protected areas in Ghana. The aim of this study was to assess the long-term trends and dynamics of patrol staff performance and the effectiveness of the law enforcement system in the Kogyae Strict Nature Reserve in Ghana. The assessment was based on patrol data collected between January 2006 and August 2017. Along the patrol routes, the patrol officers recorded all encounters with illegal activities associated with hunting, capturing or harming animals, and all mammals within the visual range of the observer. These encounters were examined in terms of monthly man-days of patrol effort and distances walked (km), providing indices of encounter. Across all years, staff performance was lowest in 2006 but highest in 2010 as a result of learning the management system's routine and motivation through logistics support from international donors. Staff performance subsequently decreased due to annual leaves taken by most patrol staff. Neither rainfall nor seasonal activities had any influence on patrol performance. The encounter rate of illegal activities was highest in the first years after the implementation of the new law enforcement management system as a result of improved staff performance and longer distances patrolled. After six years (2011), the encounter rate of illegal activities decreased and remained stable. Snares were the most common illegal activity type because it is silent, time-efficient, and less risky than other forms of hunting. Encounter rates of mammals followed the dynamics of patrol staff performance. The long-term assessment indicates that the effective and high-performing patrol system is apt to achieve desired conservation targets through logistics support, motivation and experience of staff.

Keywords: Ghana; illegal wildlife hunting; monitoring and assessment; patrol staff performance; West Africa; wildlife conservation.

Aerated Floating Wetland For Domestic Wastewater Treatment: System Design and Results

Rous Vít, Belušová Vladimíra

Faculty of Environmental Sciences, Czech University of Life Sciences Prague, Kamýcká 129, Praha 6 – Suchdol, 165 21, Czech Republic; rous.vitek@gmail.com

In January 2018 an experimental system of aerated floating wetland has started to operate at the site of a wastewater treatment plant near city Ústí nad Labem in the Czech Republic. The system consists of pretreatment with the anaerobic baffled reactor (ABR) and secondary treatment with the aerated floating wetland (AFW). The system is designed for the daily flow of 300 liters (ca two people equivalent). Hydraulic retention time in ABR is approximately 2.6 days and of 3.3 days in AFW. The inflow wastewater is pumped into the system with a small submersible 12V pump. The pump operation is controlled by a digital timer in 17 short intervals which simulate the variability in daily flow from a normal household. Aeration of the floating wetland tank is provided by a 12V air pump with a nominal flow of 80 l/min and three different aeration elements. The intermittent aeration is controlled by a digital and the aeration scheme has been changed in several phases to find out the best scheme. The whole system is powered by a battery charged with a photovoltaic panel. It is part of the experiment to address the possibility (and feasibility) of operating such intensified system in places without an electric power distribution throughout the whole year with changing climatic conditions. The observed results vary greatly by the aeration phase. The average inflow values for COD, BOD, $N\text{-}NH_4$, TN, and TSS are 1102, 459, 37, 65 and 177 mg/l, respectively. Average values for the outflow from ABR for COD, BOD, $N\text{-}NH_4$, TN, and TSS are 423, 171, 36, 46 and 45 mg/l, respectively and average values for the outflow from the system are 206, 69, 21, 41 and 30, whereas for the values for aeration phase VI (longest aeration) are 76,6, 3,9, 8,0, 33,4 and 6,5 mg/l, respectively.

This publication was created with the support of Internal Grant Agency (IGA) of Faculty of Environmental Sciences CULS, Prague, No 20174211 – New Approaches For Treatment Wetlands Intensification.

Evaluation of the development of attack *Picea abies* caused by *Gemmamyces piceae* in Ore mountains in 2016-17

Samek Michal

Czech University of Life Sciences Prague, Faculty of Forestry and Wood Sciences, Kamýcká 129, CZ - 165 00 Praha 6 - Suchdol, Czech Republic; samekm@fld.czu.cz

Gemmamyces piceae Borthw. which was first discovered in the Czech Republic on *Picea pungens* Engelm. in Kladská in the Slavkovský forest in 1917, has expanded on our native spruce in recent years. Pathogen which infecting buds and causes their severe twisting is possible to find for the entire vegetative season. As part of the GS LČR project, an evaluation of the extent of damage and attack of spruce stands in the Ore mountains is ongoing. 112 permanent research plots with 50 marked and monitored trees was based across six forest administrations. The defoliation and extent of the attack caused by pathogen were evaluated on total 4 587 trees in 2017. Plots younger than 30 years were the least affected contrariwise plots aged 30-60 years were affected most, where the 48 % of the individuals were infected. The total part of attacked trees in all forest administrations exceeded 15 % and the worst recorded situation was at LS Litvínov. There was an increase of infected trees in category 4 - a tree attacked by more than 2/3 with distinctive defoliation in comparation to the years 2015 and 2016. The trees in forest border and the research plots with smaller density of trees were more attacked than the plots with bigger density. A potential solution in forest areas 30-60 years old could be to maintain a bigger dense connection, where is the highest infection and removal of highly infected individuals, including the surrounding spruce stands created by *picea pungens*. The evaluation was also ongoing in 2018 and, according to the initial results, infection continues to spread, and the condition of health status of some research plots has been deteriorated.

Keywords: *Gemmamyces piceae*, *Picea* spp., health status, buds, Ore mountains

Utilization of hydrogel in order to support the growth of forestry important timber species in Central Europe

Svatoš Michal

Czech University of Life Sciences Prague, Faculty of Forestry and Wood Sciences, Department of Forest Protection and Entomology, Kamýcká 129, CZ - 165 00 Praha 6 - Suchdol, Czech Republic; svatosm@fld.czu.cz

Generally speaking, hydrogels are hydrophilic substances with very high absorption ability (ordinary hydrogels are able to absorb their own weight multiplied by 100, modern hydrogels even more than 400 times of their own weight) based on a natural or a synthetic basis. Utilization of hydrogel is versatile and could be find across each industry, such as medicine, forestry, agriculture, horticulture, viticulture etc. Hydrogel is most commonly used in medicine, where it has the broadest usage, for instance tissue engineering, regenerative medicine, drug industry (drugs with gradually released active substances), production of diapers and menstrual pads, contact lenses, breast implants, special medical glues, burn treatment etc. In foreststry and agriculture, hydrogels are very impontant aid to keep certain level of humidity in dry or nutrient-poor soil. Natural acrylamide hydrogels are used, most often potassium carbonate polymer. This type of hydrogel is suitable for plants and trees, because it can keep water and nutrients not far away from roots for sufficiently long amount of time, thereafter during the process of soil drying the hydrogel distributes water and nutrients back to the roots (common hydrogels provide the plant with up to 95 % of the water previously absorbed). Nowadays the application of hydrogel on soil is executed through three basic methods: dipping root system in prepared gel solution, powder hydrogel is mixed in a certain proportion with soil or substrate which is then irrigated after sowing, or hydrogel powder is directly poured into the prepared planting pit. However, these methods are not suitable for every kind of planting, they are rather suitable for utilization in planting in smaller areas where complex automation is not used. As a part of our research we try to develop methods of planting with the assistance of planting machine modified to applicate hydrogel in large areas.

Keywords: hydrogel, hydrophilic polymer, Stockosorb, forest restoration

System similarities in ecology

Šrobár Štefan

Laurinská 12, 811 01 Bratislava; stefan.srobar@gmail.com

Nature is a whole of the surrounding world left up to its own activities. Natural behaviour is the principle of activities typical in certain way for specific species. The balance in nature is always relative, flexible and changeable, hidden inside the processes and phenomena. The systematic approach is considered holistic, trying to understand the reality at the level of complete, all encompassing and internally interconnected whole. Just as for every relationship, reciprocity is important also for an organism and environment. Communication. Mutual understanding and exchange. Ecosystem is created by mutual synergism of organisms and environment. Together they create a home. The relationships of organisms and their environment is studied by ecology. Ecological thinking views the reality in its relations, changes this reality, my relation to it and also me as a part of it. The whole is more than a sum of individual units. Every individual unit is a component part. The whole is more than a global reality, it is an organisational dynamics. A new view of evolution is created, not as a battle for survival, but as a search for living in coexistence. Something that develops, adjusts, and survives not as an organism but as a relationship. Natural ecosystem is varied and manifold, it does not create a monoculture. It is just its combined nature what makes it more resistant and viable. Landscape is a living system. Landscape is one of organisational levels of life.

Keywords: ecology, system, relations, country

Tracking patterns of pollen transfer under different plant spatial structures

Štenc Jakub[1], Koupilová Klára[1], Janovský Zdeněk[1,2]

[1]Dept. of Botany, Faculty of Science, Charles University, Benátská 2, 128 00 Prague; [2]Institute of Botany, Czech Academy of Sciences, Zámek 1, 252 43 Průhonice; jakubstenc@gmail.com

Pollinator visitation behaviour reflects pattern of plant spatial aggregation to clusters of individuals and this behaviour affects ratio of within- and among-cluster pollen transfer which is crucial for sexual reproduction of zoogamous plants. It may be important, since individuals in clusters are often close kin.The main aim of this study was to investigate ratio of within- and among-cluster

pollen transfer from a focal plant under different spatial distributions of potted individuals of Carthusian Pink (*Dianthus carthusianorum*), a species visited by butterflies and hoverflies. We tracked pollen transfer by applying fluorescent dye as pollen analogue in four different spatial distributions varied factorially in distance of plant individuals within clusters and among them. Our results show, that more compact clusters (individuals within-clusters close) decreased probability of pollen transfer to other clusters and only within-clusters distances affected pattern of dispersal of UV-dye pollen analogue. In future work we would like to compare patterns of pollen transfer under the same experimental conditions but with plant species visited by different dominant pollinator functional groups in order to compare spatial patterns of pollen transfer generated by different pollinator functional groups.

Key-words: pollination, pollen transfer, pollen analogue, spatial distribution of plants, *Dianthus carthusianorum*

From aquaculture to industry: proboscis monkey's habitat changes in Balikpapan bay

Toulec Tadeáš

Czech University of Life Sciences Prague, Kamýcká 129, Prague 6 16500; t.toulec@gmail.com

The proboscis monkey (*Nasalis larvatus*) is endemic to Borneo, an island which has suffered from severe deforestation in recent decades. Highly specified habitat of proboscis monkey is one of the most vulnerable habitats worldwide. In Balikpapan bay, we observed extent, causes and rate of habitat loss between 2000 and 2017. We divided proboscis monkey habitat in Balikpapan bay into two distinct categories: mangrove forest and non-mangrove forest and analysed changes using satellite imagery. Mangrove forest represented majority of habitat – 168 km^2 (72.50 %) in 2000. The habitat decreased from 231.71 km^2 in 2000 to 215.87 km^2 in 2007 to the final 203.01 km^2 in 2017. Annual habitat loss during assessed period was 1.69 km^2 per year (0.78 % per year) with 0.30 km^2 regeneration of habitat per year. Aquaculture (16.85 % of overall habitat loss) was serious deforestation cause until 2007 and affected rigidly mangrove forest. The most decisive cause was oil palm plantations (35.60 %), planted mostly before 2007 on the dry land of non-mangrove forests. Industrial expansion (16.70 %) became major cause after 2007, striking both types of habitat. Predicting forthcoming development, aquaculture is not considered as future risk to proboscis monkey habitat, due to unsuitable environment. In opposition, both palm oil plantations and industrial development are evaluated as risks with high deforestation potential. Those threats are strongly connected, since large portion of produced palm oil is processed directly in refineries

within Balikpapan bay. Another factor is new Indonesian spatial plan, which allocates majority of non-mangroves within Balikpapan city administrative area to industry. As a result of shrinking habitat, proboscis monkey population density would increase, which could lead to depletion of preferred food resources. This phenomenon, connected with mortality of *Sonneratia alba* trees, was already observed in the southern part of Balikpapan bay.

Keywords: proboscis monkey, habitat, deforestation, mangroves, Balikpapan bay

Effect of exposure time on Cs uptake by *Ceratophyllum demersum* L.

Vacula Jaroslav, Komínková Dana

Faculty of Environmental Sciences, Czech University of Life Sciences Prague, Kamýcká 129, Praha – Suchdol, 165 00, Czech Republic (or Czechia)., vacula@fzp.czu.cz

Cesium is an element naturally occurring in the environment. However its radioactive isotopes (^{134,137}Cs) produced by nuclear fission are a threat to the biosphere. Phytoremediation is quite commonly tested method to remove cesium from the environment. While application of terrestrial plants is well studied, utilization of aquatic plants for phytoremediation did not received so much attention. Phytoremediation ability of Hornwort (*Ceratophyllum demersum* L.) were tested under greenhouse condition for 8, 16 and 24 days exposition. Hornwort is a completely submerged, floating aquatic plant with cosmopolitan distribution, growing in lakes, ponds, and slowly flowing streams. Due to these properties, it good candidate for remediation of water habitats contaminated by Cs. The plants were exposed to different concentration of stable Cs provided as CsCl (0, 0,5, 2, 8, 16, 32, 48, 64 and 80 mM). The results of the experiment revealed a significant effect ($p < 0.001$) of exposure time on the Cs uptake from the solution. The results showed Cs removal rate 7.59%, 14.22% and 17.76% for 8, 16 and 24 days. The results indicated that with increasing length of the exposition, the uptake ability are lowering. Hence, indicating that the plant has limited capacity for Cs removal. It was also found that the accumulated amount of cesium by plants is significantly dependent ($p < 0.001$) on the size of treatment and follows a sigmoid curve. Hornwort was also able to resist phytotoxic effects of cesium for 16 days without significant effects ($p > 0.05$) on health. Even after 24 days of exposure plant resisted with no significant issues ($p > 0.05$) until 16 mM treatment concentration was reached, where health started to deteriorate significantly ($p < 0.05$). These results indicate that *C. demersum* have potential for remediating aquatic habitats, especially in case of acute events, where short duration of the phytoremediation may take place.

Keywords: Cs, cesium, accumulation, *Ceratophyllum demersum L.*, phytoremediation

Feeding strategies of larvae of Czech Lycaenid butterflies

Větvičková Anna [1], Zdeněk Janovský[1,2]

[1] Department of Botany, Faculty of Science, Charles University, Benátská 2, 128 00 Prague; [2]Institute of Botany, Czech Academy of Sciences, Zámek 1, 252 43 Průhonice; barusovaa@natur.cuni.cz

Family of Lycaenid butterflies (Lepidoptera: Lycaenidae) is one of the largest butterfly families with diversity centre in tropics. About 50 species live in Czech Republic, including critically endangered species. Central European Lycaenids are well known for their association with ants, so called myrmecophily. However, ecological strategy of the group is very heterogenous in many characteristics, including presence and type of myrmecophily, habitat preference and diet breath, ranging from strict specialists to polyphages. Although lycaenid species (especially genus *Phengaris*) are often studied from entomological point of view, the role of host plants has been so far understudied. Based on literature, we examined dietary requirements of Lycaenid species occurring in the Czech Republic, including host plants preferences, type of association with ants, habitat preference and level of endangerment. Results of our analysis show that facultative myrmecophilous species tend to occure more in drier and more open habitats, e.g. dry grasslands. They are also more frequently specialized to flower consumption and possess wider spectrum of possible host plants. In contrast, larvae of non-myrmecophilous species usually feed on leaves and are more likely oligophagous. Endangered species can be divided into two main groups: 1) monophagous species inhabiting wet habitats 2) species associated with dry and open environment, suffering from habitat loss.We hypothesise that the found relationship between larval habitat, diet breadth and type of consumed plant organ may reflect higher levels of plant defence chemicals in leaves than in flowers. Myrmecophily can be seen as a tool to offset disadvantages of feeding on flowers, i.e. the ephemerality of such food source. Finally, drier habitats may be more suitable for evolution of myrmecophily in lycaenids due to higher overall ant densities.

Keywords: phytophagy, Lycaenidae, Lepidoptera, myrmecophily, habitat conditions, larval diet

Variation of glycogen in bivalve tissues and possibilities of its application in conservation of bivalve populations

Vodáková Barbora, Douda Karel

Department of Zoology and Fisheries, FAFNR, Czech University of Life Sciences Prague, Kamýcká 129, Prague-Suchdol, 165 00; vodakovab@af.czu.cz

Glycogen is a primary metabolic reserve in bivalves and it is suitable for the evaluation of condition and different types of stress. Glycogen level quickly reacts to the environmental and physiological changes, but the use of glycogen as a diagnostic tool in aquaculture and biomonitoring is still relatively rare or based on lethal methods. A modernised non-lethal tissue biopsy combined with a simplified phenol-sulfuric acid method was used to evaluate the inter- and intra-individual variation in the glycogen concentrations among several tissues (foot, mantle, gills, adductor muscle) of the Duck Mussel *Anodonta anatina*. Individuals differ in the spatial distribution of glycogen among tissues, it documents that sampling of different types of tissues can cause different results in the evaluation of energetic reserves at the individual level. A tissue-specific glycogen evaluation can provide more detailed data for the monitoring of the health and condition of mussels and can provide new valuable information for future sampling. A simplified methodology for glycogen analysis was demonstrated to be precise and reliable. The simplification of the method allows its use for routine applications. The results obtained and the simplified methodology provide a new opportunity for researching the energetic reserves and health status of freshwater mussels in various applications.

Keywords: mussels, energetic reserves, glycogen, condition, health status

The detection probability influencers

Vohralík Martin

Department of Ecology, Faculty of Environmental Sciences, Czech University of Life Sciences Prague, Kamýcká 129, 165 21, Prague; mvohralik@fzp.czu.cz

The purpose of the detection probability or detectability is primarily to counter assumed negative bias of collected data via further statistical operations. This makes it a crucial part of any ecological study trying to obtain total population size or biodiversity estimates. The detectability itself stems from CMR (Capture-Mark-Recapture) methods and it is usually obtained in a similar way. The assumptions surrounding CMR methods can be however challenging in field studies, especially

differentiating between open and closed population dynamics. It seems to be given that the detection probability differs among various places and time periods as it was initially described by the authors of this theorem. This problem was studied thoroughly and the conclusion was unilaterally that the detection probability is dependent on many factors including weather conditions and studied species. In recent years however this argument is being slowly taken apart by using standardised methods and optimising the research efforts. The matter can be complicated by inter-population factors such as size fluctuations and mischaracterisation of population dynamics. The detection probability remains still an important part of any ecological study, but the focus slowly shifts from influencing factor to being a tool for diagnosis of proper conduction of a study and data reliability.

Keywords: detection probability, CMR, population size, estimates, data reliability, methodology

Activity rate of the Red-wattled Lapwing (*Vanellus indicus*) chicks in extremely hot subtropical environment

Vozabulová E. ,Sládeček M., Elhassan E. E., Janatová V., Brynychová K., Firlová V., Pešková L., Šálek M. E.

Deparment of Ecology, Faculty of Environmental Sciences, Czech University of Life Sciences Prague, Kamycka 129, 165 21, Prague, Czech Republic; vozabulova@fzp.czu.cz

Circadian activity of precocial chicks is subject to requirements on food intake, rest and antipredation behaviour. However patterns can be affected and/or strongly limited by ambient conditions, e.g. extreme temperatures. We were studied the circadian aktivity of wild Red-wattled Lapwing chicks in the Al Marmoom Nature Reserve, Dubai, United Arab Emirates. The area is specific by immensely high ambient temperatures and chicks have to cope with more than 50 °C particularly around the noon. For activity measurements, we used miniature accelerometers (0.8 g) placed on the back of the chick. We recorded chick activity of all ages, from freshly hatched until fledging continually for 24 – 36 hours and processed it by overall body dynamic acceleration method. Using a combination of light and temperature sensors we compared chick activity during the night and day, under direct sunlight as well as in relation with amount of shading. As the age of chicks can influence chick activity, all the activity measurements were related to chick age. Our study on relation between ambient conditions and the circadian activity of Red-wattled Lapwing chicks can help to clear unknown adaptations to this extremely hot habitat.

Keywords: chicks activity, OBDA, Red-wattled Lapwing, breeding ecology, hot environment

Let's start monitoring the aquatic moths (Lepidoptera: Pyralidae)

Vrabec Vladimír[1], Rybová Veronika[2]

[1]Department of Zoology and Fisheries, Faculty of Agrobiology, Food and Natural Resources, University of Life Sciences Prague, Kamýcká 129, CZ-165 21 Praha 6 – Suchdol, Czech Republic; vrabec@af.czu.cz; [2]Department of Property Management, Lysá nad Labem Municipal Office, Husovo nám. 23, 289 22, Lysá nad Labem, Czech Republic; veronika.rybova@mestolysa.cz

In the Czech Republic, five genera of aquatic moths containing ten species are currently known. Six of them are members of Acentropinae subfamily (*Elophila nymphaeata* (Linnaeus, 1758.), *Acentria ephemerella* (Den. & Shiff., 1775), *Cataclysta lemnata* (Linnaeus, 1758), *Parapoynx stratiotata* (Linnaeus, 1758), *Parapoynx nivale* (Den. & Shiff., 1775) and *Nymphula nitidula* (Hufnagel, 1767)) and they regarded to be Czech-native species. The other three invasive Acentropinae species were revealed during last decades: *Parapoynx diminutalis* Snellen, 1880, *Elophila difflualis* (Snellen, 1882) and *Elophila manilensis* Hampson, 1917. Finally, the fourth introduced wetland species is *Duponchelia fovealis* Zeller, 1847, belonging to the subfamily of Spilomelinae. Moreover, we have recently discovered newly introduced species *Oligostigma polydectalis* Walker, 1859. Interestingly, all the species introduced into the Czech Republic were captured in greenhouses and aquatic plants nurseries. Both invasive and some of native species are known to be pests of cultivated plants, and so monitoring of their ecology and distribution is the crucial tool to prevent further invasion and damage. Authors will be also grateful for providing samples or data on aquatic moths.

Keywords: Acentropinae, Spilomelinae, *Oligostigma polydectalis,* monitoring, invasive species

Biogeochemical Oceanography in seawater and sediment of the Gulf of Prigi, Indonesia

Wijaya Anugrah Ricky[1], Semedi Bambang[2]

[1]Chemistry Department, Faculty of Mathematics and Natural Science, Universitas Negeri Malang (UM) / State University of Malang , Jln. Semarang No. 5 Malang, Jawa Timur 65145, Indonesia;anugrah.ricky.fmipa@um.ac.id; d_v_n_a_98@yahoo.com; [2]Marine and Fisheries Department, Faculty of Marine and Fisheries Science, Brawijaya University (UB), Jawa Timur 65145, Indonesia, Email: bambangsemedi@ub.ac.id; bambangsemedi@gmail.com

In order to monitor seawater and sediment in the Gulf of Prigi, we investigated the biogeochemical oceanography characters using the assessment of the character physics, heavy metal contents and Pb isotopes in the floating house. Samples were directly measured using analytical instruments for temperature, salinity, DO, EC, pH, COD, turbidity, sulfate and Chlorophyll *a*. Seawater and sediment samples were totally digested using strong acids and then measured Ca, Fe, Mn, Cu, Fe and Pb concentrations by ICP-MS. In order to detect the source of natural or anthropogenic sources, we continue measured of seawater and sediment samples by Pb isotopes and then investigated by $^{208}Pb/^{206}Pb$ and $^{207}Pb/^{206}Pb$ in the Pb growth curved. Based on the level value of physical characters, metal concentrations tended to follow the values of WHO and the Pb isotope ratios reflected in the natural sources. This investigation possibly supports people in the coastal regions to detect the media of natural sources surrounding the Gulf of Prigi for increasing the fish, coral, lobster and shrimp productivities.

Keywords: seawater, sediment, Pb isotopes, natural, the Gulf of Prigi

Can short-term exposure to sertraline affect the behavior of freshwater mussels' larvae and the interaction with their fish hosts?

Zhao Shuran[1], Douda Karel[1], Horký Pavel[1], Grabic Roman[2], Grabicová Kateřina[2], Randák Tomáš[2], Slavík Ondřej[1]

[1] Czech University of Life Sciences Prague, Department of Zoology and Fisheries, Kamýcká 129, 165 00 Prague 6, Czech Republic; [2] University of South Bohemia in České Budějovice, Faculty of Fisheries and Protection of Waters, South Bohemian Research Center of Aquaculture and Biodiversity of Hydrocenoses, Zátiší 728/II, 389 25 Vodňany, Czech Republic; xzhas001@studenti.czu.cz

Many concerns have been raised around pharmaceutics and personal care products (PPCPs) due to their increasing number and concentration in the aquatic environment. Inadequately purified wastewater effluent with PPCPs in nature reservoirs can directly threaten organisms habiting downstream. In this work, an approach based on observing of the behavior response (attachment rate, infection success and proportion rate) of glochidia and fish was used to investigate the effect of sertraline on early stage of freshwater mussels *Unio tumidus (Unionida)* – glochidia. We have included glochidia´s hosts, fish *Squalius cephalus* into our research as well, for monitoring of host-parasite interaction. Sertraline is the most prescribed antidepressant worldwide, used to treat conditions such as depression or anxiety disorders. The results pointed that sertraline was able to affect the highly sensitive life stage of freshwater mussels. Glochidia were positively impacted by sertraline in the encystment whereas fish were negatively impaired in defense mechanism, which gave glochidia more chances for infestation. However, the proved significance in both fish and glochidia cases was tested with the level of contamination exceeding nature relevant concentration, but not by much. Hence, we suggest a long-term exposure of glochidia to assess the impact of sertraline as well as monitoring the trend of concentration of sertraline in natural water bodies using glochidia as a screening tool.

Keywords: Sertraline, SSRI, Bivalve mussels, Environmentally relevant concentrations, Attachment rate, Gills, Fins, Infestation, Ecotoxicology

Development of phosphorus forms in soil chronosequence of the Nordenskioldbreen glacier (Svalbard)

Allaberdina Adel, Tejnecký Václav

Evolution of Soil Science and Soil Protection, Czech University of Life Sciences Prague, Kamýcká 129, 165 00 Prague, Czech Republic; adelallaberdina92@gmail.com, tejnecky@af.czu.cz

Nordenskioldbreen is located between Dickson Land and Bunsow Land. The glacier flows roughly southwestwards and is 25 km (16 mi) long and 11 km (6.8 mi) wide. It has its terminus in Adolfsbukta, a branch of Billefjorden. After the expedition to the glacier in 2015, soil samples were brought to the Czech University of Life Sciences Prague. We have 42 samples from the south and north of the glacier. With each of them we worked in the laboratory during several months, made a filtration and with the help of robotics got the complete chemical composition of each samples. At our work we determined the amount of P-form and other soil properties in soils after the Nordenskioldbreen glacier (Svalbard).The soil properties after the retreat of the Nordenskioldbreen glacier vary with the age of the soil. The amount of accessible P decreases with the age of the soil and the amount of crystalline Fe forms increases. All results of the study are presented in spreadsheet format.

Identification of non-native aquatic organisms - tool for reducing biological invasions

Kuříková P., **Bohatá L.**, Kopecký O., Kalous L.

Katedra zoologie a rybářství, Fakulta agrobiologie, potravinových a přírodních zdrojů, Česká zemědělská univerzita v Praze, Kamýcká 129, 165 00, Praha -6; kurikova@af.czu.cz

Invasive organisms, especially those introduced by human activities, could be very harmful for the biodiversity of local environment. Moreover, some impacts can even affect socioeconomic sectors such as forestry, agriculture or public health. Accurate identification of non-native and invasive species therefore plays a crucial role in order to achieve their eradication to support local biodiversity conservation. To comply with national and international measures, the species identification is

essential as well. Therefore, the robust tools ensuring accurate identification are obviously needed in scientific society, state administrative as well as commercial sector. Optimalisation of methods used for identification of such species, with regard to specifics of aquatic organisms, can also contribute to improve the current situation. Environmental monitoring staff or employees of companies, whose business activities pose high risk of introduction, should be able to recognize invasive organisms to prevent their establishment. The presented project should aim to compile and summarize the information and knowledge necessary for both genetic and morphology identification of non-native species into the brief and user-friendly manual, which would be helpful for people working in risk areas of potential first entrance of such organisms. They thus would be able to recognize invasive organisms immediately after their introduction to the country and prevent their further spread within the country.

Keywords: non-native species, invasive species, biodiversity, determination of species.

Reakce volně žijících živočichů na rušivé jevy a fragmentaci krajiny

Brodská Hana

Česká zemědělská univerzita v Praze, Kamýcká 1176, 165 00 Praha 6 – Suchdol, Fakulta lesnická a dřevařská, Katedra myslivosti a lesnické zoologie; e-mail: brodskah@fld.czu.cz

V okolí Nového Boru (Liberecký kraj) se rozkládá mozaika polí, luk, lesů, travnatých porostů i zastavěného území. Touto oblastí prochází dopravní komunikace I. třídy, kde dochází ke srážkám dopravních vozidel s volně žijícími živočichy. Velmi často sraženým druhem bývá srnec obecný. Proto bylo odchyceno několik jedinců pohybujících se v blízkosti dopravní komunikace I. třídy a pomocí telemetrických GPS obojků s akcelerometrem probíhá monitoring jejich pohybu a reakcí. Snahou je přiblížit život těchto zvířat a napomoci tvorbě opatření, která by zamezila dopravním nehodám způsobeným střetem s volně žijícími živočichy. Během tohoto projektu byly zatím zaznamenány většinou individuální projevy chování označených zvířat, ale u některých i podobné návyky. Poděkování patří členům honitby Pihel za jejich ochotu uskutečnit projekt ve vybraném území a za sběr informací o událostech, které mohou mít rušivý vliv na volně žijící živočichy. Dále

patří poděkování CDV, v.v.i. v Olomouci, za financování telemetrických GPS obojků pro srnčí zvěř. Projekt byl podpořen grantem IGA FLD ČZU v Praze 43200/1312/3121 Monitoring chování kopytníků v blízkosti komunikace ve vybrané lokalitě Pihel a navazujícím grantem IGA FLD ČZU v Praze 43200/1312/3171 Monitoring chování srnčí zvěře v okolí modelové pozemní komunikace pomocí GPS telemetrie.

Klíčová slova: srnec obecný, GPS telemetrie, pachové repelenty, antropogenní činnost

Anyone can be a naturalist! Citizen science project in Prague

Caltová Petra

Národní muzeum, Vinohradská 1 110 00 Praha 1; petra_caltova@nm.cz

The diverse landscape of the city of Prague provides very good living space to a number of species of fauna and flora, including some protected species. However, people in Prague are oblivious to nature in their surroundings or to where they can observe it. The application iNaturalist is a tool that shows people the nature and wildlife around them and excites their interest in it.How does the application work and what benefits does it have for citizen science? Answers can be found in citizen science project called City Nature Challenge, which took place in Prague for the first time in 2018.

Keywords: volunteers in science, citizen science, biodiversity, monitoring, endangered species, invasive species, nature of Prague

Effect of momentary climatic conditions on chick feeding behavior and weight changes in Little Ringed Plover *Charadrius dubius*

Firlová Veronika, Vozabulová Eva, Šálek Miroslav E., Burešová Anna, Sládeček Martin

Department of Ecology, Faculty of Environmental Sciences, Czech University of Life Sciences, Kamycka 129, 165 21, Prague, Czech Republic, xfirv002@studenti.czu.cz

Fast growth rate in precocial chicks is crucial for breeding success, but it can be constrained with environmental conditions, such as temperature or precipitation. Moreover, changes in barometric pressure has been shown to be an important predictor of feeding effort in some bird species. Although that these conditions seem to be more limiting in in-situ conditions, it is interesting to question, how influential can be, when chicks are reared in captivity with ad-libitum food supply. This approach can better distinguish between constraints in food availability or parental care and those arising from physiological reasons. Plover eggs from flooded or abandoned nests were incubated and hatched chicks were reared in captivity. Chicks were weighted daily (2017, N=17), or automatically, during each feeding session (2018, N=19). Meteorological data were obtained from Meteorological station of the Czech University of Life Sciences in Prague. Data was processed in the R program. We described circadian patterns in feeding effort and weight. The statistically significant effect on daily weight changes was proven only for daily amount of precipitation but the influence of temperatures and barometric pressure was not proven.

Keywords: Little Ringed Plover, *Charadrius dubius*, captive-rearing, meteorological conditions, aktivity

Early detection of bark beetle outbreaks using unmanned aerial vehicles

Fogl Michal, Klouček Tomáš, Komárek Jan, Lagner Ondřej

Department of Applied Geoinformatics and Spatial Planning, Faculty of Environmental Sciences, Czech University of Life Sciences Prague, Kamýcká 129, Praha – Suchdol, 165 00, Czech Republic; email: fogl@fzp.czu.cz

Forest disturbances are a necessary part of a forest dynamics and cause changes in the forest ecosystem. Bark beetles are important for (snag) forest ecology and are plentifully represented, tree-specific species assigned into the Scolytinae subfamily. The bark beetle reproduce in the phloem of living or dead trees and hibernate in the host tree or wood debris until conditions are suitable for reproduction. Three ordinary stages of tree infection may be recognized. In green attack stage, the trees are contaminated without any visual demonstration. While in red attack stage, where a visual change in colour is easy to notice, tree needles turn to brown colour and the trees then start to dry. In grey attack stage, trees are completely dry. Therefore, early detection of contaminated trees is needed. Unmanned Aerial Vehicles (UAVs) equipped with proper sensors offer a cost-effective solution for early monitoring of local bark beetle spreading many times in a season. The aim of this study is to present a non-invasive methodological approach for monitoring distribution and seasonal dynamics of bark beetle in detailed scale. This study uses a time series of UAV-borne imagery in very high spatial resolution for the detection of different attack stages in individual trees. For the study, we use four orthomosaics acquired within a low altitude aerial survey using a RGB camera and a modified Near-Infrared RGB camera in June, as well as the first and second half of August, and in October. Results show that even using low-cost cameras it is possible to detect attack stages of bark beetle on an individual tree level and even its seasonal dynamic with sufficient accuracy. An UAV equipped with the proper technology is an easily available tool for precise bark beetle monitoring, however, further studies using superior multi-spectral sensors are still needed.

Keywords: *Ips typographus*, outbreaks detectability, photogrammetry, object-based classification, CHM

Endopolyploidy in floral organs of selected species of the genus *Pulmonaria* L.

Fráková Viera[1], Koprivý Lukáš[1], Mártonfiová Lenka[2], Mártonfi Pavol[1,2]

[1]Department of Botany, Institute of Biology and Ecology, Faculty of Science, Pavol Jozef Šafárik University, Mánesova 23, 041 54 Košice, Slovakia; [2]Botanical Garden, Pavol Jozef Šafárik University, Mánesova 23, 04352 Košice, Slovakia; viera.frakova@student.upjs.sk

Endopolyploidy is a significant feature of many angiosperms. Multiplication of nuclear DNA in a cell occurs, mainly by endoreduplication, which is a modified cell cycle without karyokinesis and cytokinesis (mitosis does not take place). In our study, we investigated four of five species of the genus *Pulmonaria* L. (*Boraginaceae*) growing in Slovakia, namely *P. obscura* Dumort., *P. officinalis* L., *P. mollis* Wulfen ex Hornem. and *P. murini* Májovský, in which endopolyploidy has not been studied yet. These taxa are distributed mainly in Europe, but *P. murini* occurs in Asia, too. The aim of our study was to investigate the presence of endopolyploidy, and to determine its level for all of the four species, as well as to verify chromosome numbers given in literature. Using flow cytometry methods, we determined the level of endopolyploidy, which was expressed by endoreduplication index (EI). For the analysis, we used plant material from the cultivated plants obtained from the field. We estimated mean EI values for the floral organs – calyx, corolla, pistil and stamens. Endopolyploidy was recorded in all the floral organs of the four analysed *Pulmonaria* species, the highest level of endopolyploidy was recorded in pistils (e.g. *P. obscura*, EI = 0,70), and the lowest one was recorded in stamens (e.g. *P. mollis*, EI = 0,22). The highest level of endopolyploidy was observed in the species *P. obscura* in all of the analysed organs. Diploid species *P. obscura* and *P. murini* showed higher levels of endopolyploidy in the analysed floral organs compared to their relative species *P. officinalis* and *P. mollis* with dysploid chromosome numbers. Using karyological methods, we confirmed chromosome numbers as referred to in the literature for *P. obscura*, 2n = 14; *P. officinalis*, 2n = 16; *P. mollis*, 2n = 18 and *P. murini*, 2n = 14.

Key words: endopolyploidy, *Pulmonaria obscura*, *Pulmonaria officinalis*, *Pulmonaria mollis*, *Pulmonaria murini*, chromosome number

Effect of temperature on germination of *Rumex alpinus*, *Rumex obtusifolius* and *Rumex longifolius*

Jungová Michaela, Hejcman Michal

Department of Ecology, Faculty of Environmental Sciences, Czech University of Life Sciences Prague, Kamýcká 129, Praha 6 – Suchdol, 165 00, Czech Republic; jungovam@fzp.czu.cz

R. alpinus and *R. obtusifolius* are problematic weeds around Europe. *R. alpinus* was introduced into the Giant Mountains by colonists from the Alps in the 16th century. It is currently growing in all mountain regions of the Czech Republic. This invasion possibly changes the ecosystem structure and function by occupying many areas, particularly in the high alpine herb communities and on the deforested parts of the subalpine zone, as well as around settlements, pastures and shores of watercourses. *R. obtusifolius* is a perennial plant common in meadows, pastures, abandoned fields, roadside ditches, rural habitats and forest clearings of western and central Europe. *R. alpinus*, unlike *R. obtusifolius,* is a mountain plant and does not grow at an altitude below 500 m. *R. longifolius* is a characteristic plant of Fennoscandia, where it is a common weed. It also inhabits western Russia, the north of the British Isles, the Pyrenees and the mountaineous parts of Central Europe. This study aims to determine effect of temperature on germination of all above mentioned species. We can suppose that optimum germination temperature will be lower for mountain *R. alpinus* and *R. longifolius* than for lowland *R. obtusifolius*. Seed germination was investigated at temperatures of 6, 12, 18, 24 and 29 °C. The germinating seeds were counted and removed at intervals of 1 day for 29 days. All investigated species have similar temperature requirements for the germination. Althought we expected the higher germination under low temperatures for mountain *R. alpinus* and nordic *R. longifolius* in comparison to lowland R. *obtusifolius*, the opposite result was recorded. The lowest germination rate in 6, 12, and 18 °C was recorded in the case of nordic species *R. longifolius*. Although *R. alpinus* is the mountain species, the highest germination rate and speed was recorded for temperatures 24 and 29 °C. Temperature requirements for germination cannot explain different distribution of studied species.

Key words: Alpine dock; Broad-leaved dock; Northern dock; heat strees; seed germination; weeds

How to kill the beast? Development of new eradication methods of *Fallopia* invasive taxons

Kadlecová Martina[1], Vojík Martin[1,2], Berchová-Bímová Kateřina[1]

[1]Faculty of Environmental Sciences, Czech University of Life Sciences Prague, Kamýcká 129, Praha – Suchdol, 165 00, Czech Republic; [2] Institute of Botany, Department of Invasion Ecology, The Czech Academy of Sciences, CZ- 252 43, Průhonice, Czech Republic; martinakadlecova@fzp.czu.cz

This study is focused on knotweed taxa control (*Fallopia,* syn. *Reynoutria*) which has spread uncontrollably in the Czech Republic despite nature conservation management. Not only natural biotops are influenced by the invasion. Knotweeds start to be difficult weed of field cultures. One of the main root causes of such a sucesfull spread is high ability of regeneration from rhizoms. Spraying with systemic herbicide glyphosate is the most effective control method, despite little being known about its efficacy on the rhizome system. The article brings continuous results of project whose target is a development of new methods of chemical eradication of knotweed without using glyphosate. Tested methods are based on comparism of reaction of invasive taxons *Fallopia japonica* var. *japonica* and *F. sachalinensis* incl hybrid *F.* ×*bohemica* to sparying of Roundup Aktiv (8 % of glyphosate active substance) and Garlon New (4 % of triclopyr active substance). The goal of the research is to answer following quetions: (i) Does the reaction results differ according to different spray usage? (ii) Is the effect of herbicide influenced by vegetative phase of plants? (iii) How deep herbicid penetrates into to rhizoms? (iv) Are there differences between taxa in reaction to spraying and in ability of following regeneration? Preliminary results show strong differences of herbicide effects between studied taxons. *F.* ×*bohemica* and *F. japonica* regenerates by 20 % less after Roundup Aktiv than after application of Garlon New. On the contrary, for eradication of *F. sachalinensis* is Garlon New more effective (regeneration is lower by 10 % compared to Roundup). Output from the work is the knowledge that the regeneration from rhizoms is not influenced by deepness of the rhizoms deposition in the soil (i.e. herbicide penetrates equally to all the parts). Analysed data shows that tested summer sprays reduce growth approximatelly by 60 %. Despite of negative influence of both sprays to studied taxons, it is obvious that they are not able 100 % eradicate knotweed growth – at least in terms of tested summer period spraying and in terms of used herbicide concentration. Overall results will be known after autumn and spring terrain work are finished.

Key word: eradication, glyphosate, herbicide, invasive plants, knotweed, triclopyr, vegetative reproduction

Assessing canopy openness in dense forests from photogrammetric canopy height model

Kašpar Vít[1,2], Hederová Lucia[2], Kopecký Martin[2], Macek Martin[2], Müllerová Jana[2], Wild Jan[1,2]

[1]Czech University of Life Sciences Prague, Faculty of Environmental Sciences, Department of Applied Geoinformatics and Spatial Planning, Prague, Kamýcká 129, 165 21 Praha 6 – Suchdol, Czech Republic; kasparvit@fzp.czu.cz; [2]Institute of Botany of the Czech Academy of Sciences, Zámek 1, 252 43 Průhonice, Czech Republic

The amount of solar radiation transmitted through forest canopy controls forest microclimate and its interior environment near the ground, precise information on canopy openness is therefore crucial. Ground measurements of forest structure are laborious and difficult to scale up from point to forest stand. Therefore, remote sensing approach is often applied. Routinely used laser scanning technology provides precise data on canopy structure, but this technique is still expensive. Since recently, a potential of UAS optical-based methods is being explored by the scientific community as an economic alternative tool to quantify tree stand structure and light condition in the forest understory. Most commonly, a density of ground points derived from Structure from Motion algorithm (SfM) is used as a proxy of canopy openness. However, with increasing canopy cover and its shadowing effects, detection of the ground by photogrammetric methods is problematic, and only crown top surface model can be precisely derived. Still, irregular surface of the top forest surface shows pronounced clumping pattern with relative sinks in the canopy surface potentially indicating tree crown gaps, i.e. higher canopy openness. To build on this assumption, we developed an approach based on Canopy Height Model (CHM) to assess the canopy openness in dense oak-dominated forests. To detect canopy gap pixels from CHM, we used the local minimum of canopy height value in relation to neighboring cells. For validation, numbers of canopy gap cells within different buffer zones surrounding ground measurement points were compared to canopy openness estimated from hemispherical photographs. Although the accuracy was limited in case of complex, multilayered canopy, results derived from UAS showed significant positive correlation with ground measurements. Our study thus presents an alternative possibility for a UAS´s SfM-derived model of canopy openness for dense forest stands.

Keywords*:* solar radiation, UAS photogrammetry, canopy openness, forest microclimate

Amphibian malformations from Balkans and the Czech Republic

Koleska D.[1], Žimic A.[2], Holer T.[3], Jablonski D.[4]

[1]Department of Zoology and Fisheries, Faculty of Agrobiology, Food and Natural Resources, Czech University of Life Sciences Prague, Kamýcká 129, 165 00, Praha, Czech Republic. E-mail: koleska@af.czu.cz; [2]Herpetological Association in Bosnia and Herzegovina – ATRA, Urijan Dedina 137, 71000 Sarajevo, Bosnia and Herzegovina; [3]Faculty of Environmental Sciences, Czech University of Life Sciences Prague, Kamýcká 129, 165 00, Praha, Czech Republic; [4]Department of Zoology, Comenius University in Bratislava, Mlynská dolina B-1, 842 15, Bratislava, Slovakia.

Amphibian populations are declining in a worldwide scale. These animals are the most threatened vertebrate group due to numerous factors including body malformations, that are being considered as significant. There are numerous records of amphibian malformations reported lately from all over the world. Plenty of types of malformations are currently recognized (ectrodactyly, polydactyly, syndactyly, oligodactyly, clinodactyly, ectromely, clinomely, phocomely, polymely, symmely, taumely, polyphalangy, microcephaly, anophthalmy, various atypical colorations or translucent skin). However, causal factors responsible for such malformations remain often unclear. Herein we present several cases of amphibian malformations collected during field work in various parts of the Balkan peninsula and the Czech Republic. In some cases we examined the individuals by x-ray to better understand the character of particular malformation. Single reports of amphibian malformations provide us an opportunity to build up a greater knowledge and understanding of this phenomenon. As possible reasons for occurrence of body malformations in amphibians are considered (1) chemical pollutants used in agriculture, (2) parasite infestation or microbes, (3) UV-B radiation and (4) previous attempts of predation. However, without further complex research of amphibian populations, it is unlikely to uncover the origin of these malformations.

Keywords: amphibian, malformation, anatomy, environment

Influence of *Gemmamyces piceae* to Norway Spruce physiology

Krejzková, A., Tomášková, I., Pešková V., Modlinger, R.

Faculty of Forestry and Wood Sciences, Czech University of Life Sciences, Kamýcká 129, 165 00 Praha 6 – Suchdol, ČR; krejzkovaa@fld.czu.cz

In the Ore Mountains (Czech Republic) a massive outbreak of *Gemmamyces piceae* on *Picea pungens* is observed and in the past couple of years also on *Picea abies*. *Gemmamyces piceae* is an invasive cryptogenic fungi pathogen and it is a causal agent of bud blight disease. Trees were divided in 5 categories based on the stage of infection (from 0 - non-infected to 4 – heavily damaged). Measurements of transpiration, assimilation rate and content of photosynthetic pigments (chlorofyll *a*, chlorofyll *b* and carotenoids) were performed. Results of the physiological measurements show that the content of photosynthetic pigments is reduced under stress conditions. Trees affected by this fungi pathogen have lower water use efficiency. Also the measurements based on fluorescence parameters such as Fv/Fm ratio are decreasing and the amount of photosynthetic pigments is lower compared to healthy trees.

Keywords: photosyntetic pigments, bud blight disease, Norway spruce

Supported by grant "EXTEMIT - K", No. CZ.02.1.01/0.0/0.0/15_003/0000433 financed by OP RDE„ and Grant Service of the Forests of the Czech Republic Nr. 9/2016 „Environmental factors influencïng the infestation of Norway Spruce by Gemmamyces piceae and the concept of practice constraining its spreading“

Ecological impacts of alien and native plants on vegetation: does origin matter?

Pergl Jan[1], Hejda Martin[1], **Kutlvašr Josef**[1,2], Petřík Petr[3], Sádlo Jiří[1], Vítková Michaela[1], Vojík Martin[1,2], Pyšek Petr[1,4]

[1] Department of Invasion Ecology, Institute of Botany, The Czech Academy of Sciences, Zámek 1, Průhonice, CZ-252 43, Czech Republic. E-mail: josef.kutlvasr@ibot.cas.cz; jan.pergl@ibot.cas.cz; 2 Department of Applied Ecology, Faculty of Environmental Sciences, Czech University of Life Sciences Prague, Kamýcká 129, Prague – Suchdol, CZ-165 00, Czech Republic; [3] Department of GIS and Remote Sensing, Institute of Botany, The Czech Academy of Sciences, Zámek 1, Průhonice, CZ-252 43, Czech Republic; [4] Department of Ecology, Faculty of Science, Charles University, Viničná 7, Prague, CZ-128 44, Czech Republic

There is an ongoing debate on whether alien invasive species pose a greater threat to biodiversity than native species that are spreading in transformed current landscapes. However, quantitative assessment, for a wide range of species, whether the impacts these two groups of contrasting origins have on biodiversity differ does not exist. The presented project is based on combining above- and below-ground characteristics that can be linked to the impact of dominant plant species. We measured the impacts of invasive alien and native expanding plants in the Czech

Republic, a representative area of temperate Central Europe, on plant communities (species composition, and diversity) and soil ecosystem (chemical properties, activity of soil biota). Quantifying the difference in impact between the two groups of dominant species makes it possible to express the net impact of invasive aliens. In the project we combine field methods to measure impact at the local scale of individual sites with recording the abundance and distribution of the species in the country, by which we quantify and compare the real magnitude of impacts of native and invasive dominants at the regional scale.

Keywords: alien plants, biodiversity, dominant species, native plants, soil properties, species distribution

The presence of Leucocytozoon parasites in nestlings and adults of the Boreal Owl (Aegolius funereus) in the Ore Mountains

Mahlerová Karolina, Zárybnická Markéta

Faculty of Environmental Sciences, Czech University of Life Sciences, Kamýcká 1176, 16500 Prague, Czech Republic; mahlerova@fzp.czu.cz

The endoparasites of the genus *Leucocytozoon* are a globally distributed group of obligatory parasites using birds as hosts. Their presence in the host organism is detectable from blood samples using molecular detection methods. The presented study summarizes the findings of the presence of *Leucocytozoon* parasites in juveniles and adults of the Boreal Owl (*Aegolius funereus*) in the Ore Mountains during the nesting seasons of 2015 and 2016. Blood samples were collected from 138 fledglings and 15 adults. The age of the nestlings was determined based on the methodology by Hörnfeldt et al. (1988). DNA was isolated from the blood and used as a template for determining the sex of the fledglings based on fragment analysis of PCR-amplified CHD1 introns. Further, isolated DNA was used as a template for two-phase nested PCR (Hellgren et al. 2004) to detect the presence of *Leucocytozoon* genus in fledglings and adults. The presence of *Leucocytozoon* parasites was confirmed in 53.0% of adults (n = 8) and in 1.5% of the fledglings (n = 2). The prevalence of *Leucocytozoon* parasites in adults older than 1 year was 53%, which is in agreement with studies such as Synek et al. (2015, 2016). The low prevalence of *Leucocytozoon* parasites in fledglings in the presented study might have been caused by the age of individuals during the blood sampling. Synek et al. (2015) stated that the youngest infected individual was 16 days old, whereas in the presented study the average age of nestlings during the first sampling was 14 days (SD ± 4.1 days; n = 138) and during the second sampling 22.5 days (SD ± 5.3 days; n = 25). The age of the two infected nestlings was 19 and 21 days. The results indicate that age might be the main factor affecting the infection prevalence.

Ecological functions provided by dung beetles in Colombian livestock farms in the Cesar river valley

Montoya-Molina Santiago[1,2]; Girando-Echeverri Carolina[2]; Montoya-Lerma James[3]

[1]Czech University of Life Sciences, Department of Ecology, Kamycká 129; [2] Research Center on Sustainable Systems of Agricultural Production – CIPAV, Cali, Colombia; [3]GEAHNA Group, University of Valle, Cali, Colombia; horomo@gmail.com

Ecosystem function is defined as the capacity to carry out basic processes of energy, nutrient, water and CO_2 transfer; and in turn, determine secondary processes (e.g., decomposition, nutrient cycle) which are moderated by the diversity of plants, animals and microorganisms. The loss or diminution of these organisms, drastically affects the functioning of the ecosystem, being the loss of a species, the elimination of a function that directly affects the community and the ecological system. Dung beetles of the Scarabaeinae subfamily are the main organisms responsible for the removal of manure. During their nesting process, they provide important functions to the ecosystem, helping to recover the physical properties of the soil, as well as the secondary movement of seeds and as part of networks. In the Cesar River Valley, Colombia, intensive silvopastoral systems (SSPi) are established for ecological rehabilitation and protection. These systems offer conditions that benefits the recovery of biodiversity, being also important to understand whether they contribute to improving functional diversity. This research aims analyze whether there is a relationship between the diversity of beetles in three different land uses (Forest, SSPi and Pasture without trees) and ecological function. Diversity and environmental measures were taken, with them, analyzes were made to understand the effect of these on the dung beetle community. A total of 721 species belonging to 12 genera and 17 species were collected. It was observed that the greatest diversity was concentrated in the forests with 17 species, followed by the SSPi and the pastures, however regarding to the abundances, SSPi obtained the highest number of individuals with 263. Regarding to the environmental variables that presented a significant relationship with respect to the diversity values and ecological functions were: Canopy cover ($p < 0.0001$), Land use ($p < 0.0001$) and Percentage of bare soil ($p < 0.02$). For the Cesar river valley, there are estimated sixteen native species that are key in the ecological rehabilitation programs, being the canopy and soil cover environmental factors that affect the functions and diversity of the species.

Keywords: Scarabaeinae, biodiversity, tropical dry forest

Total lake water storage on the Tibetan plateau from thermal satellite data

Moravec David[1], Kropáček Jan[1], Lei Yanbin[2]

[1]Department of Applied Geoinformatics and Spatial Planning, Faculty of Environmental Sciences, Czech University of Life Sciences Prague, Kamycka 129, 165 00 Praha 6; [2]Institute of Tibetan Plateau Research, Chinese Academy of Sciences, Beijing, China; dmoravec@fzp.czu.cz

Tibetan Plateau, the largest high elevation plateau of the world is since recently in the focus of attention due to its marked influence on both regional and global climate. Tibetan Plateau hosts the largest high elevation lake systems of the world. It contains hundreds of lakes, with 65 lakes having an area greater than 100 km2. Various symptoms of climate change such as glacier down wasting and permafrost degradation have been pointed out in recent studies. Nevertheless, the total volume of the lakes is still unknown. Bathymetric measurements were published only for several large lakes so far. We analysed the thermal regime of Tibetan lakes using infrared (Sentinel-3 and MODIS) and passive microwave sensors (AMSR-2). From a dense time series of MODIS night temperature product (every 24 hours) we have derived a curve of lake's winter cooling. We found a time period with a significant correlation between lake area and lake temperature. In the present time, we are working on the relationship between temperature, local conditions, and lake depth. We are calibrating remotely sensed data by in situ measurement and verifying the findings on the lakes with known bathymetry.

Keywords: lake volume, thermal remote sensing, Tibetan plateau, lake turnover

Monitoring waterbird population dynamics as well as climatic and environmental changes using waterbirds as bioindicators

Musil Petr, Musilová Zuzana et al.

Faculty of Environmental Sciences, Czech University of Life Sciences, Kamýcka 129, CZ-165 00, Praha, Suchdol, Czechia; p.musil@post.cz

Understanding population changes of the species is important because of its close connection with climate and environmental changes. However, we are hardly able to perform this without the great effort of volunteers producing the long-term annual monitoring data. Much of our knowledge of the changes in numbers and distribution of animal populations as well as habitat-relationships comes from tradition long-term monitoring programmes of birds. Especially, waterbirds are well known as indicators of wetland habitats and could indicate their changes. The large-scale changes in the abundance and distribution of wintering waterbirds are well documented across Europe since 1960s. As an example, herbivorous geese and piscivorous cormorants increase its numbers since this increase seem related to its feeding specialisation and the trophic conditions of wetlands. The food supply is likely important driver of species population dynamics. In addition, the monitoring of population structure (e.g. age and sex ratio) would help us to explain threatened species population dynamics such as Common Pochard, recently decreasing on the flyway level.

Effect of grazing intensities on vertical structure of a semi natural grassland

Teowdroes Kassahun Teka[1], **Pavlů Klára[1,3]**, Nwaogu Chukwudi[1], Pavlů V. Vilém[1,2], Pavlů Lenka[1,2], Gaisler Jan[2] and Homolka Petr [3,4]

[1]Department of Ecology, Czech University of Life Sciences Prague, 165 21, Czechia; [2]Department of Weeds and Vegetation of Agroecosystems, Crop Research Institute, 460 01, Czechia ; [3]Department of Nutrition and Feeding of Farm Animals, Institute of Animal Science, 104 00, Czechia ; [4]Deparment of Microbiology, Nutrition and Dietetics, Czech University of Life Sciences Prague, CZ165 21, Czechia

We evaluated the response of different plant functional groups (living biomass - graminoids forbs, legumes, mosses and dead biomass) subjected to the different grazing intensities at two sward layers of low productive species rich grassland. We hypothesized that grazing changes the composition of the community with graminoids becoming more dominant than other functional groups. The study site is located in "Oldřichov Grazing Experiment" in the northern Czech Republic. The investigation was based on two randomized block experiment with the following treatments: (i) extensive grazing (EG); (ii) intensive grazing (IG); (iii) cutting in June followed by extensive grazing (ECG); (iv) cutting in June followed by intensive grazing (ICG) and (v) unmanaged control (U). Two sward layers bottom (0-3 cm) and upper (>3 cm) of vertical structure were identified from samples and collected during each year from 1998 to 2012. The different functional groups were identified. The effect of different grazing treatments on two sward layers and the ratio of living and dead biomass were evaluated. The differences among individual treatments for each particular year were assessed. The analysis revealed significant differences in distribution of herbage biomass between managed and unmanaged treatments for all functional groups. The groups were significantly affected by year, intensity and their interaction except for mosses. The upper layer (>3 cm) recorded the highest amount of dead and living biomass under all treatments. However, in terms of functional groups 66% of dead biomass were recorded at the bottom layer (<3cm) under unmanaged treatment. Graminoids was found to be the most representative from all functional groups in both layers. This study will contribute to better understanding of changes plant functional groups under different long term management regimes and suggesting appropriate land use management that fulfil nature conservation and forage production.

Keywords: Functional groups, sward layers, pasture, intensive and extensive grazing

Allelopathy effect of lichen extract on germination of selected conifer species

Pizňak Martin, Bačkor Martin

Department of Botany, Institute of Biology and Ecology, P. J. Šafárik University, Mánesova 23, 041 54 Košice, Slovakia; mpiznak@gmail.com

Lichens produce secondary metabolites (SM), which play important ecological and biological roles, including their effects on other plants, through allelopathy. Many of them inhibit the growth of higher plants. Some authors mentioned negative lichen allelopathy effects on the germination and development of conifer trees, whereas others documented neutral or no allelopathic effect. On the other hand, the negative influence was achieved when the plant species naturally not co-occurring with lichens were laboratory treated with usnic acid, one of the lichen SM. They are soluble the most in organic solvents. However, aqueous extracts of certain lichens species possessed cytotoxicity effects on meristematic cells. Particularly *Hypogymnia physodes* synthesize protocetraric acid, physodalic acid and atranorin. Our aim was to measure total germination of *Picea abies*, *Pinus sylvestris* and *Pinus mugo* in the presence of aqueous lichen extracts. The extracts were made from lichens (*H. physodes, Parmelia sulcata, Physcia adscendens, Pseudevernia furfuracea*) collected from fallen branches. For experiment we macerated dried lichens for 24 (1 D) and 72 hours (3 D) in rain water (1:10 mg/ml). We analysed total anion and cation content and pH in rain water and extracts. Besides we monitored secondary metabolites and sugars soluted in the extracts by HPLC. We conclude that aqueous lichen extracts from particular species naturally growing on trees can be considered as a source of nutrients for young emerging conifers from the same habitat. The extracts contained much more anions and cations than pure rain water. Assumpted low solubility of lichen secondary metabolites and sugars in water was confirmed. Our observations show that *P. sylvestris* is more sensitive than *P. mugo* and *P. abies*. Only 3 D extract containing the greatest amount of nutrients, significantly stimulated germination of *P. sylvestris* and therefore overtook possible negative allelopathy effect showed by 1 D extract treatment.

Keywords: allelopathy, extract, lichens, Picea, Pinus

The effect of mulching on some agrophysical properties of soils

Razikova Z.[1], Kholikulov Sh.T.[2], Pardaev S.[2]

[1]Department of Land Use and Improvement, Faculty of Environmental Science, Czech University of Life Sciences Prague, Kamycka 129, 165 00 Praha 6; razikova@fzp.czu.cz; [2]Department of Hydrometeorology, Faculty of Geography and Ecology, Samarkand State University, Uzbekistan. Unviversity blvd,15. 140104, Samarkand

The specificity of agricultural production is its dependence on climatic conditions, which leads to significant variability of the main indicators of crop yields and the sustainability of farming. In recent decades, there has been a trend of climate warming. Obtaining agricultural products in the current environmental and economic conditions requires a transition to the adaptive-landscape principles of territory organization, which will allow more efficient use of global climatic resources, especially in conditions of arid climate. In addition, it is necessary to develop methods and technologies of agricultural production, which must partially or completely eliminate the negative effects of global climate change. In order to overcome the negative impact and adaptation of climate in agricultural practice, various agrotechnical methods are used. One of these agrotechnological methods is soil mulching. Mulching of the soil with a transparent polyethylene film mitigates extreme weather events in a sharply continental climate. Especially contributes to the increase of soil moisture and temperature, improve the agrophysical properties of the soil and increases the yield of crops. Field experiments were conducted on the old-irrigated serozem soils of the Zeravshan Valley of Uzbekistan. In the experiment, as mulch material was used - a transparent polyethylene film on the fields of cotton. The main goal of the study is to identify the effect of mulching on the agrophysical properties and moisture regime of irrigated serozem soils in cotton culture. The results of the study showed that mulching with a transparent polyethylene film slightly improved the soil porosity in both the arable and subsoil horizons. Experiments have shown that in the control area in the spring after the rain, the thickness of the soil crust is 1.47-1.64 cm. At the same time, in the mulched variant, crusting was not observed. The obtained results indicate that the old-irrigated serozem soils under mulching with a transparent polyethylene film has a higher water permeability than in the control variant. This agrotechnical technique provided an increase in moisture reserves in the old-irrigated serozem during the observation period. The moisture reserve during the observation period increased under the film relative to the moisture accumulated in the control. Thus, a transparent polyethylene film as a mulching material improves the agrophysical properties and water regime of the soil. As a result, favorable conditions are created for the growth and development of cotton. In addition, the use of mulching is effectively influenced by the mitigation of the local climate in the arid zone due to the retention of moisture in the soil.

Keywords: Mulching, polyethylene film, light serozem soils, soil permeability.

Overwintering in invasive ladybird Harmonia axyridis: the effect of winter temperature on survival and body mass loss

Řeřicha Michal, Knapp Michal

Department of Ecology, Faculty of Environmental Sciences, Czech University of Life Sciences Prague, Kamýcká 129, Praha 6 – Suchdol, 165 00, Czech Republic. Tel. +420 22438 3853; e-mail: knapp@fzp.czu.cz

Harlequin ladybird, *Harmonia axyridis*, is considered among the most successful invasive insects worldwide. Probable traits that predetermine its success are dominance in intraguild predation, efficient chemical defence and excellent immune system. However, high winter survival could be another potential advantage of this species. We investigated the effect various temperature courses during winter (mild, standard and harsh winter) on winter survival, body mass loss and spring longevity for individuals reared under laboratory conditions and these collected in nature during October. Beetles were individually overwintered in Petri dishes placed in computer-instructed climatic chambers mimicking real temperatures courses recorded in nature (based on long-term data collected at meteorological station situated in Prague-Ruzyně, Czech Republic). Beetles that survived the winter part of the experiment were subsequently involved in experiment measuring their early spring longevity at 20°C without any food. In general, winter survival of beetles reared under laboratory conditions was much lower than survival of beetles collected in nature. Lower winter temperatures decreased survival rate for beetles with laboratory as well as field origin. Body mass loss was significantly higher under regime of mild winter compared to standard and harsh winter conditions and body mass loss was significantly higher in beetles of laboratory origin than in two out of three populations of beetles collected from nature. Early spring longevity was lower in laboratory breed beetles than these collected in nature. Ladybirds which survived harsh winter regime were able to survive for a longer period without any food in early spring than beetles exposed to a warmer regime (harsh > standard > mild). Overall our results indicate that lower winter temperatures cause enhanced mortality in *H. axyridis* due to chill injuries, but warmer winter temperatures results in depleted energy reserves and thus lowered performance during early spring season.

Keywords: body mass loss, *Harmonia axyridis*, invasive ladybird, overwintering, winter survival

Growing suburbs change the shape of rural areas landscape. Case study: Prague suburbs

Salama May, Berchová-Bímová Kateřina

Katedra aplikované ekologie, Fakulty životního prostředí, Česká zemědělská univerzita v Praze, Kamýcká 129, 165 21 Praha 6 – Suchdol, Česká republika l; email: salama@fzp.czu.cz

Czech rural landscape has changed rapidly during the two decades and transformed into an extensive suburban area. The pace and the scope of these changes was influenced by the socioeconomic and demographic aspects. Whereas the flows of immigrants from the inner city towards the rural areas and suburbs causes the changes of the architectural type, landscape character and landscape ecology of the new settled areas. In our study we have started with the largest suburban areas in Czech Republic which are located around the capital city of Prague, The suburbs widespread in two main districts: Prague east district and Prague west district and we compared the increasing of population and the changing of land use through past years. The first results show the different between the districts in (i) population density, (ii) the socioeconomic level of the inhabitants, (iii) number of non-indigenous species (iv) the architectural character. We used socioeconomic and environmental factors which explained many effects of suburban development (e.g. decline of arable land, increase of land fragmentation, changing the character and identity of the traditional landscape in Europe with its ecological and cultural values), based on this study we could predict the following development process in east European cities and its surrounding rural areas future.

Keywords: landscape character, rural areas, socioeconomic aspects, suburbanization, population.

Demarcation of built-up areas for evaluation vulnerability indicators

Seidlová Jana, Hofrajtr Martin, Kochová Tereza

CENIA, Czech Environmental Information Agency, Vršovická 1442/65, Praha 10, 100 10; jana.seidlova@cenia.cz, martin.hofrajtr@cenia.cz, tereza.kochova@cenia.cz

CENIA was tasked with the evaluation of so-called vulnerability indicators, which are part of the National Action Plan on Adaptation to Climate Change. The definition of the built-up area serves as a basis for assessing the vulnerability of cities to the effects of climate change. The phenomena that will be evaluated based on these data are, among other things, the thermal island of the city and the share of urban greenery (or urban green-blue infrastructure). The conditions for defining the boundary of the built-up area of the city were its repeatability and detail. The optimal replication analysis interval, which would guarantee the creation of time series, was determined once in 2-4 years. The possibility of using this analysis in the future to evaluate other indicators was also the acceptable size of the scale. The identification of the built-up area was based on an analysis of several selected partial approaches, while the best solution for the further identification and evaluation of vulnerability indicators was the Supervised Classification of Sentinel satellite imagery and the subsequent use of net (fishnet). The chosen procedure was applied to several selected cities, which varied in both the size and variety of landscape coverage. The identified built-up area was discussed and subsequently approved by experts from the Ministry of the Environment. This demarcation methodology can be repeated and applied throughout the Czech Republic. It has ambitions to be used to compare the entire territory and time series (depending on the availability of images). When applying this methodology on Landsat imagery, it is possible to assess these indicators for up to almost 40 years back into the past.

Keywords: remote sensing data, vulnerability, heat islands, urban greenery, urban green-blue infrastructure, cities, built-up areas

Improvement of Water Quality within Protected Areas: How Catchment Restoration affects Freshwater Pearl Mussel Biotopes within Headwater Streams of the Blanice Nature Reserve?

Staponites Linda R.[1], Bílý Michal[1], Hruška Jaroslav[2], Kladivová Věra[3], Mrázek Vojtěch[3], Horáčková Jitka[1,3], Simon Ondřej P.[1,3]

[1]Faculty of Environmental Sciences, Czech University of Life Sciences Prague, Kamýcká 129, Praha – Suchdol, 165 00, Czech Republic; [2] 383 01 Miletínky 7, Ktiš, Czech Republic; [3]T. G. Masaryk Water Research Institute, Podbabska 30, 16000, Prague 6, Czech Republic; LindaStaponites@gmail.com

Freshwater Pearl Mussels (*Margaritifera margaritifera*) are critically endangered in the Czech Republic and require oligotrophic conditions to survive. It is important to understand how land use has affected water quality and how these changes have impacted Freshwater Pearl Mussel biotopes. Land use and water quality from 1989 to 2016 were investigated within four headwater streams of the Blanice River in South Bohemia, which underwent land use alterations due to the applied management of the nature reserve. Water quality parameters were assessed according to limits proposed by the Czech Action Plan for Freshwater Pearl Mussel. Results confirmed that land use alterations within catchments has reversed eutrophication and improved the water quality of tributaries over the past decades; however, certain water quality parameters are still unsuitable for populations. Additional measures are needed to optimize water quality and aid in the protection of this critically endangered species. Results can be applied as guidelines for future management strategies.

Keywords: Catchment, Restoration, Land use change, Water quality, Long-term monitoring

Distribution and haplotype diversity of *Alnus rohlenae* on the Balkan Peninsula

Šmíd Jan[2], Mandák Bohumil[1,2]

[1] Institute of Botany, Academy of Sciences of the Czech Republic, Zámek 1, CZ-252 43,Průhonice, Czech Republic; [2] Faculty of Environmental Sciences, Czech University of Life Sciences Prague, Kamýcká 129, Praha 6 – Suchdol, CZ-165 00, Czech Republic; smidjan@fzp.czu.cz

In the context of the Balkan Peninsula, *Alnus glutinosa* occurs in two cytotypes. The rarer tetraploid cytotype is restricted only to the area of the Dinaric Alps and Western Greece. This cytotype was described as a new species (A*lnus. rohlenae*) and from diploid *A. glutinosa* differs not only by the number of chromosomes but also by its morphology. A triploid hybrid between these two species was also found. Using analysis of chloroplast DNA in combination with ploidy level estimation by flow cytometry, we prepared detailed comparative study describing geographical distribution and cytotype composition of Balkan populations of these two tree species. Of the 40 populations and 683 individual trees, diploids occurred in 18.01 %, triploids in 1.17 % and tetraploids in 80.82 %. Overall, 86 haplotypes and 15 haplogroups were identified. Comparing the haplotype diversity of both species, the tetraploids on the Balkan Peninsula are much more diverse and are fully adapted to the specific conditions of this area.

Keywords: Polyploidy, haplotypes, flow cytometry, cp DNA, *Alnus rohlenae*

What is a suitable management for suppression of Rumex obtusifolius and Urtica dioica in formerly cattle resting places in mountain areas?

Titěra J.[1,2], Novák J. [3], Pavlů V.[1,2], Pavlů L.[1,2], Gaisler J.[2]

[1]Department of Ecology, Czech University of Life Sciences Prague, 165 21, Czech Republic; email: titeraj@fzp.czu.cz; pavluv@fzp.czu.cz; pavlul@fzp.czu.cz; [2]Department of Weeds and Vegetation of Agroecosystems, Crop Research Institute, 460 01, Czech Republic; email: jan.gaisler@volny.cz; [3]Slovak University of Agriculture in Nitra, Faculty of Agrobiology and Food Resources, 949 76, Slovakia; email: jan.novak [at] uniag.sk

R. obtusifolius infestations and *Urtica dioica* expansions cause serious problems for plant species diversity and ecosystem services in former cattle resting places on long-term unmanaged mountain grasslands. To control these weedy forbs a long term experiment was established in Nízké Tatry Mts (Slovakia) in the year 2004. The treatments were: A. unmanaged control, B. cutting twice per year, C. herbicide application (glyphosate) and grass mixture reseeding in the first experimental year followed by cutting twice a year in all subsequent experimental years. Plants covers (%) were visually estimated in experimental plots in late June every year from 2004 to 2011. The results showed that one-time herbicide application with consequent grass mixture reseeding substantially reduced cover (%) of *R. obtusifolius* to 3% and *Urtica dioica* to 1.5% already after the first experimental year. Cutting twice a year in this treatment during experimental years led to gradually decreasing of both species, and even to their disappearance in 2008. Cutting twice a year without herbicide application led to gradual reduction of *R. obtusifolius* (from 77% to 3%) and *Urtica dioica* (from 14% to 0%) during the experimental years (2004 – 2011). On the contrary in unmanaged treatment the % cover of both species remained relatively stable (76% for *R. obtusifolius* and 15% for *Urtica dioica*) during all experimental years. This long-term experiment showed that single-use herbicide application with subsequent grass mixture reseeding and cutting twice a year in the following experimental years can completely suppress both weedy species and establish grasslands with desirable plant species composition. However, the long term cutting twice per year seems to be enough sufficient for *Urtica dioica* eradication and *R. obtusifolius* infestation control, especially in areas, where herbicide application is forbidden (national parks, I. and II. zones of protected landscape areas).

Key words: infestation, glyphosate, herbicide application, grass mixture reseeding, Nízké Tatry

A framework for classifying plant communities in invaded habitats along the gradients of human disturbances and accessibility to the public

Vojík Martin[1,2], Sádlo Jiří[1], Berchová-Bímová Kateřina[2], Petřík Petr[3], Pyšek Petr[1,4], Pergl Jan[1]

[1]Institute of Botany, Department of Invasion Ecology, The Czech Academy of Sciences, CZ-252 43, Průhonice, Czech Republic, e-mail: martin.vojik@ibot.cas.cz, jiri.sadlo@ibot.cas.cz, petr.pysek@ibot.cas.cz, jan.pergl@ibot.cas.cz; [2]Department of Applied Ecology, Faculty of Environmental Sciences, Czech University of Life Sciences Prague, Kamýcká 129, Prague 6 – Suchdol, CZ-165 00, Czech Republic, e-mail: berchova@knc.czu.cz; [3]Institute of Botany, Department of GIS and Remote Sensing, The Czech Academy of Sciences, CZ-252 43, Průhonice, Czech Republic, e-mail: petr.petrik@ibot.cas.cz; [4]Department of Ecology, Faculty of Science, Charles University, Viničná 7, Prague, CZ-128 44, Czech Republic

Human made habitats in urbanized environment, including chateau parks, are important sources of newly introduced plants. Although the ornamental and escaping flora of cities and villages is a frequent research subject in invasion ecology, an approach capturing the complexity of human influence as well as natural processes acting in various habitats is missing. In a project aimed at recording alien plants in chateau and other public parks we need to compare a wide range of habitats that can be characterized by their position along two gradients: (i) the degree of naturalness, and (ii) accessibility to general public. The result of the study is a framework, that enables to describe each habitat in a three-dimensional space defined by the above axes, and tested it by using data on alien plants' occurrence in the parks and their surroundings. The framework for the description of habitats can be visualized as two triangles, one covering cultural and the other social gradient and each plant community is characterized by its position in the triangles. The axes in the first triangle define the character of the environment – natural, cultural, and ruderal. The second triangle makes it possible to place the community with regard to accessibility of the site to public, i.e. space that is public, private and vague (the latter term refers to usually neglected spaces). Our approach displays the invaded community as a centroid of occurrences of plant species that is very close to vertex of "culture" or is located in the "culture-ruderal" area, if it is dominated by ruderal aliens. In the second triangle invasive species are concentrated both in spaces that are publicly accessible (i.e. where the probability of disturbances and diaspore arrival is higher), but also in those that are high on the vagueness axis (such as abandonment areas, wastelands, brownfields).

Key words: biodiversity, plant invasions, public parks, public accessibility, vague terrain

Seznam účastníků konference

Příjmení	Jméno	Pracoviště	E-mail
Allaberdina	Adel	ČZU	adelallaberdina92@gmail.com
Andrusová	Jana	ČZU	jana.andrusova@seznam.cz
Balvín	Ondřej	ČZU	o.balvin@centrum.cz
Barák	Vojtěch	ČZU	barak.vojtech@seznam.cz
Baranovská	Eliška	AOPK ČR	elisbee@seznam.cz
Bašta	Petr	ČZU	basta@fzp.czu.cz
Baťa	Daniel	ČZU	bata@fld.czu.cz
Bejček	Vladimír	ČZU	bejcek@fzp.czu.cz
Bělunková	Šárka	ČZU	belunkova@fzp.czu.cz
Beránková	Kateřina	ČZU	berankovak@fld.czu.cz
Bohatá	Lucie	ČZU	bohatal@af.czu.cz
Brezáni	Adam	ČZU	brezani@fld.czu.cz
Brodská	Hana	ČZU	brodskah@fld.czu.cz
Bruckner	Petr	ČZU	brukix@email.cz
Březina	Jiří	ČZU	xbrej012@studenti.czu.cz
Bubová	Terezie	Státní zdravotní ústav	terezie.bubova@seznam.cz
Budská	Daniela	ČZU	smolovad@gmail.com
Burešová	Anna	ČZU	buresova.an@seznam.cz
Caltová	Petra	Národní muzeum	petra_caltova@nm.cz
Černá	Marie	ČZU	ma2u.cerna@gmail.com
Dagsson Waldhauserova	Pavla	ČZU	pavla@lbhi.is
Dogan	Tugba	ČZU	tubadogan@live.com
Douda	Karel	ČZU	k.douda@gmail.com
Douda	Jan	ČZU	douda@fzp.czu.cz
Escobar Calderon	Juan Felipe	ČZU	felipe.1092@gmail.com
Fanta	Václav	ČZU	vaclavfanta@seznam.cz
Firlová	Veronika	ČZU	firlova@centrum.cz
Fogl	Michal	ČZU	fogl@fzp.czu.cz
Fráková	Viera	Univerzita Pavla Jozefa Šafárika v Košicích	viera.frakova@gmail.com
Gajdošová	Dorota	ČZU	gajdosova.dorota@seznam.cz
Grohmann	Jakub	ČZU	xgroj005@studenti.czu.cz
Guth	Jiří	Ministerstvo životního prostředí	jiri.guth@mzp.cz
Harabiš	Filip	ČZU	harabis@fzp.czu.cz
Hejcman	Michal	ČZU	hejcman@fzp.czu.cz
Hofrajtr	Martin	CENIA	martinhofrajtr@seznam.cz
Holer	Tomáš	ČZU	holer.tomas@gmail.com
Horníček	Jan	ČZU	jenhornicek@seznam.cz
Hrach	Karel	ČZU	hrach@fzp.czu.cz
Hronková	Jana	ČZU	hronkova@fzp.czu.cz

Hu	Shanshan	ČZU	hu@fzp.czu.cz
Hu	Bo	ČZU	hubo@fzp.czu.cz
Jahelková	Václava	ČZU	jahelkova@fzp.czu.cz
Jakubec	Pavel	ČZU	jakubecp@fzp.czu.cz
Jungová	Michaela	ČZU	jungovam@fzp.czu.cz
Kaderková	Klára	ČZU	kkari@post.cz
Kadlec	Jakub	Univerzita Karlova	jak.kadlec@seznam.cz
Kadlec	Tomáš	ČZU	kadlect@fzp.czu.cz
Kadlecová	Martina	ČZU	martinakadlecova@fzp.czu.cz
Kašpar	Vít	ČZU	kasparvit@fzp.czu.cz
Kebrle	Dominik	ČZU	kebrle@fzp.czu.cz
Klápště	Petr	ČZU	klapste@fzp.czu.cz
Knapp	Michal	ČZU	knapp@fzp.czu.cz
Kofroňová	Jitka	Ústav pro hydrodynamiku AV ČR v.v.i.; UK	kofronova@ih.cas.cz
Koleška	Daniel	ČZU	koleska@af.czu.cz
Komárek	Michael	ČZU	t.svejcarova@gmail.com
Koprivý	Lukáš	Univerzita Pavla Jozefa Šafárika v Košicích	lukas.koprivy@gmail.com
Kozina	Václav	Centrum pro otázky životního prostředí	vaclav.kozina@gmail.com
Krausová	Anežka	ČZU	krausovaanezka@af.czu.cz
Krejzková	Anna	ČZU	krejzkovaa@fld.czu.cz
Křístková	Barbora	Univerzita Karlova	kristkova.bara@gmail.com
Křížová	Kateřina	ČZU	krizovak@tf.czu.cz
Kuljanishvili	Tatia	ČZU	Kuljanishvili.tatia@gmail.com
Kulma	Martin	Státní zdravotní ústav	martin.kulma@szu.cz
Kutlvašr	Josef	ČZU	kutlvasrj@fzp.czu.cz
Kvíčalová	Zuzana	ČZU	kvicalovazuzana1@gmail.com
Lísková	Aneta	ČZU	liskovaa@fld.czu.cz
Lowther-Harris	Fred	ČZU	flowther1@gmail.com
Mahlerová	Karolina	ČZU	mahlerova@fzp.czu.cz
Macháčová	Markéta	ČZU	machacovam@fld.czu.cz
Machynková	Kateřina	ČZU	machynkova@fzp.czu.cz
Major	Vladimír	ČZU	major@fzp.czu.cz
Malečková	Veronika	ČZU	Xmalv019@studenti.czu.cz
Mandák	Bohumil	ČZU	mandak@fzp.czu.cz
Marešová	Jana	ČZU	maresovajana@fzp.czu.cz
Maršíková	Sarah	ČZU	letroll@seznam.cz
Martinková	Alena	ČZU	martinkovaalena@fzp.czu.cz
Maslejová	Martina	ČZU	mmaslejova@icloud.com
Míšková	Jana	ČZU	miskova@fzp.czu.cz
Montoya-Molina	Santiago	ČZU	horomo@gmail.com
Moravcová	Anna	Univerzita Karlova	a.moravcova027@gmail.com
Moravec	David	ČZU	dmoravec@fzp.czu.cz

Mouchová	Veronika	ČZU	verymo@seznam.cz
Mrázová	Anna	Jihočeská univerzita v Českých Budějovicích	anice.manice@gmail.com
Musil	Petr	ČZU	p.musil@post.cz
Myslivcova	Denisa	ČZU	Dmyslivcova@seznam.cz
Neradová	Klára	ČZU	klaraneradova8@gmail.cz
Nikolovová	Adriana	ČZU	a.nikolovova@gmail.com
Novák	Jakub	ČZU	kubajcz@seznam.cz
Novotná	Kateřina	ČZU	hralinka@seznam.cz
Opare Asare	Michael	ČZU	asare@fzp.czu.cz
Owusu Afriyie	Jerry	ČZU	jerryoj@yahoo.com
Pachmann	Aleš	ČZU	pachmann@fzp.czu.cz
Pařezová	Blaňoslava	ČZU	blankaparezova@gmail.com
Pašek	Ladislav	ČZU	pasek-ladislav@seznam.cz
Pavlík	Petr	ČZU	pavlikpetr@fzp.czu.cz
Pavlů	Klára	ČZU	klara.pavlu@oldrichov.cz
Petrus	David	ČZU	dave.petrus@gmail.com
Pfauserová	Nikola	ČZU	pfauserova@af.czu.cz
Pizňak	Martin	Univerzita Pavla Jozefa Šafárika v Košicích	mpiznak@gmail.com
Polák	Jakub	ČZU	polakjakub@fzp.czu.cz
Prudík	Boris	ČZU	xprub002@studenti.czu.cz
Razikova	Zarina	ČZU	razikova@fzp.czu.cz
Rous	Vít	ČZU	rous.vitek@gmail.com
Růžek	Pavel	Vysoká škola ekonomická v Praze	ruzek@centrum.cz
Růžička	Jan	ČZU	ruzickajan@fzp.czu.cz
Řeřicha	Michal	ČZU	michal.rerichaa@seznam.cz
Salama	May	ČZU	salama@fzp.czu.cz
Samek	Michal	ČZU	samekm@fld.czu.cz
Seidl	Miroslav	ČZU	seidlm@fzp.czu.cz
Seidlová	Jana	CENIA	Janaseidlova6@email.cz
Schenková	Jana	ČZU	schenkova@fld.czu.cz
Schwarzbacherová	Anna	ČZU	a.schwarzbacherova@seznam.cz
Sixsmith	Mark	ČZU	sixsmith@fzp.czu.cz
Solský	Milič	Magistrát hlavního města Prahy	milic.solsky@praha.eu
Staponites	Linda	ČZU	LindaStaponites@gmail.com
Straková	Barbora	Univerzita Karlova	baru.strakova@gmail.com
Suchomel	Jan	ČZU	jsuchomel01@gmail.com
Svatoš	Michal	ČZU	svatmi@seznam.cz
Ševčík	Richard	ČZU	sevcikr@fzp.czu.cz
Šikola	Martin	ČZU	sikola@fzp.czu.cz
Šímová	Petra	ČZU	simova@fzp.czu.cz
Šmíd	Jan	ČZU	smidjan@fzp.czu.cz
Šrobár	Štefan	ČKA	stefan.srobar@gmail.com
Štenc	Jakub	Univerzita Karlova	jakubstenc@gmail.com

Štrobl	Martin	ČZU	stroma@atlas.cz
Švejcarová	Tereza	ČZU	t.svejcarova@gmail.com
Tetaur	Adam	ČZU	a.j.tetaur@gmail.com
Titěra	Jan	ČZU	jantita@seznam.cz
Tlušťáková	Adéla	ČZU	Adela.tl@seznam.cz
Toulec	Tadeáš	ČZU	toulec@fzp.czu.cz
Trávníček	Ondřej	ČZU	trava.ondra@czu.cz
Vacula	Jaroslav	ČZU	jaroslavvacula@seznam.cz
Valešová	Martina	ČZU	martina.valesova.97@gmail.com
Vašková	Dominika	Univerzita Pavla Jozefa Šafárika v Košicích	vaskova.nika610@gmail.com
Veselská	Zuzana	ČZU	zuzik1000@seznam.cz
Větvičková	Anna	Univerzita Karlova	abarbus@seznam.cz
Vodáková	Barbora	ČZU	vodakovab@af.czu.cz
Vohralík	Martin	ČZU	mvohralik@fzp.czu.cz

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