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ČESKÁ ZEMĚDĚLSKÁ UNIVERZITA V PRAZE
FAKULTA ŽIVOTNÍHO PROSTŘEDÍ

Česká zemědělská univerzita v Praze
Fakulta životního prostředí

ČESKÁ ZEMĚDĚLSKÁ UNIVERZITA V PRAZE

FAKULTA ŽIVOTNÍHO PROSTŘEDÍ

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PLENÁRNÍ PŘEDNÁŠKA

Biodiversity – Ecosystem Function (BEF) experiments – what do their results say about consequences of species loss in real world

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In Biodiversity – Ecosystem Functioning (BEF) experiments, the artificial random assemblages of species differing in their biodiversity are grown under standardized conditions and their functioning (most often represented by productivity, but also stability and others) is measured as response variable, dependent on diversity. These experiments in their overwhelming majority show that the biodiversity has positive effect on most of the ecosystem functions. This conclusion is often used as a conservation argument. Some of these experiments are the largest long-term ecological experiments in the world (Jena), and their results are published in the most prestigious journals and highly cited. However, there is a more than 20 years tradition questioning their design and relevance for real world. One of the most contentious conclusions of the BEF experiments is the positive relationship between diversity and productivity, which is in obvious disagreement with the field experience of most ecologists, particularly those working in the seminatural meadows. In my presentation, I will try to show what we can learn from the BEF experiments (also from practical point of view), what are the consequences for the real word ecosystems, but also, what are the reasons for the disagreements with the field ecologist experience. The main problems of the transfer of results of BEF experiments are: (1) Unnatural species composition of experimental communities, particularly those of low species richness; the real species poor communities are not random subsets of species rich communities, and their composition is a result of ecological filtering. (2) In the BEF experiments, the sown species richness is used as explanatory variable, the realized species richness can be rather different. (3) Naïve expectations, used for the null model when “biodiversity effects” are calculated. Positive features are connected to the ability to control for the confounding factors.

Keywords: Biodiversity, Confounding factors, Ecosystem Functioning, Experiments, Species pool, Species assembly, Spurious results,

PLENÁRNÍ PŘEDNÁŠKA

Cannibalism in human populations: fact or fiction?

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In many societies, man-eaters are regarded as feared adversaries of humanity, personifying a complete negation of respectful treatment of the dead. At the same time, cannibalism is largely thought to have been prevalent in and intrinsic to "uncivilised" populations. A fierce debate within social sciences has been raging over the past decades whether these statements are true and what functional or symbolic meanings could have been attributed to the phenomenon of anthropophagy. Historical and ethnographic accounts abound with reports of practiced cannibalism and its ecological or ritual justification, seconded by suggestive archaeological discoveries and forensic cases, unfailingly catching the public's imagination. This lecture aims to approach the once-widespread-cannibalism theory from a new viewpoint, de-constructing the traditional arguments and offering a fresh perspective. The most significant obstacle we need to overcome is the semantic ambiguity of the terms anthropophagy, cannibalism etc. Everyone seems to have a clear idea about the meaning of these words but on the second thought, it is extremely difficult to come up with a universal, non-contradictory definition. The lecture argues that cannibalism is a real practice as much as a legendary tale, but above all, it is a semantic field used in the largely selective and subjective classification of phenomena that engage our minds. Cannibalism, real or fictitious, is a classic archetype, if perhaps an extreme one, of encounter with the corporeal materiality of human bodies and their qualities susceptible to the sensory perception of the living. It is an eternal source of fascination and inspiration in fairy tales, literature, visual arts, and political propaganda. It has always been, and it will permanently remain with us as an integral part of the human condition.

Keywords: cannibalism, intraspecific predation, culture, food taboo, medicine

PLENÁRNÍ PŘEDNÁŠKA

Plant behaviour belowground - patterns in root foraging

Weiser Martin (with data of several others)

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Plant roots face dynamic and heterogenenous environment. Although an ability to navigate their roots to nutrients-rich patches might be useful in general, plant species differ in their ability to do so. Here I show an intruiguing link between root foraging (i.e. the ability to place roots to nutrient-rich patches) plant species clonality and environment.

Keywords: plant phenotypic plasticity, foot foraging, clonal plants,

The effect of ivermectin-based antiparasitics on dung beetles: A large scale study

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Anthelmintics based on macrocyclic lactones, particularly ivermectin, are commonly used in veterinary treatment of livestock. Ivermectin residues are excreted in dung up to 16 weeks after application and have negative effect on non-target dung feeding beetles. However, little is known about how the time since ivermectin application affects species richness, abundance, ecological guilds (generalists, dwellers, relocators) and rare and endangered species of dung beetles at larger spatial scale. We compared dung beetle communities from pastures treated recently with ivermectin (<8wks), still containing its residues, pastures treated long time ago (>8wks), and untreated pastures. Dung beetle sampling was conducted on 26 sites in 4 regions across the Czech Republic. We sampled dung beetles from 10 (horse, cattle) or 20 (sheep, game) dung pats on each site in spring, summer and autumn 2018. In total, we sampled 31,587 individuals from 58 species of Scarabaeoidea. Species richness was highest on untreated pastures and similarly low on both treated ones. Abundance was highest on untreated pastures, lower on recently treated and lowest on pastures treated long ago. Abundances of dwellers,relocators, rare and endangered species were again highest on untreated pastures, lower on sites treated long ago and the lowest on recently treated sites, while generalists, whose larvae do not feed on dung and are thus less vulnerable to ivermectin, were the most abundant on recently treated sites, less on untreated sites and the least on sites treated long time ago. The negative effect of ivermectin is therefore most significant on recently treated pastures, due to either active avoidance of treated dung by beetles or by previous elimination of beetle populations due to negative effects of ivermectin on beetle fitness. This may lead to termination of dung decomposition in treated sites due to loss of dwellers and relocators who are the most important for dung removal.

Keywords: anthelmintics, conservation, pasture management, Scarabaeidae

Of mice and men (and ticks) – zoonotic diseases in vectors and reservoir hosts

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We briefly summarize results of two studies aimed at zoonotic diseases, their vectors and reservoir hosts. First part deals with neglected tick-borne diseases, namely bacteria *Anaplasma phagocytophilum* and *Rickettsia* sp. and protozoan *Babesia venatorum*. It sums up preliminary results of their distribution mapping in the Czech Republic and development of new duplex qPCR detection method for *Anaplasma* and *Rickettisa*. Second part is focused on research of small mammals (rodents and insectivores) as potential reservoirs of various zoonotic diseases. Apart from those mentioned above these include bacteria *Leptospira interrogans*, *Borrelia burgdorferi* s. l. causing Lyme disease, and rabbit fever agens *Francisella tularensis*. This research is carried out on model locality in cooperation with UVPS students who collect and process samples as part of their field trips. Results of these two studies are not important only for veterinarians or doctors, but also for field biologists who get into contact with vectors or reservoirs of these potentially very dangerous diseases. We advise to remember basic safety precautions and not underestimate the risk when working with biological material.

Keywords: *Anaplasma phagocytophilum, Rickettisa, Babesia venatorum, Leptospira interrogans, Borrelia burgdrferi, Francisella tularensis,* duplex qPCR, reservoir, zoonosis

Bioatl.as: Enhanced Online Implementation of the UTM/MGRS Grid for Species Occurrence Mapping

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Presentation demonstrates author's implementation of the UTM/MGRS grid type and its extension at the UTM zones borders according to the Atlas Florae Europaeae. This enhanced network type is unique for its worldwide and scalable use, without significantly affecting the unit area of a given square size. As a result, it can be further used for statistical calculations of aggregated occurence records.

Keywords: grid mapping, UTM, MGRS, square, occurrence records

Mapping soil properties on an agricultural soil strongly endangered by water erosion

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Soil is an irreplaceable element on the planet Earth. Without soil there would not be life as we know it today. Despite this fact topsoil layer is being degraded and agriculture land is being taken for construction purposes every day. As a result of land consolidation in 1950s emerged enormous fields which are affected by soil erosion. Water erosion can change soil properties and deteriorate or completely destroy the topsoil layer which is important for crops. This presentation focus to determine how the soil properties changed on a sloping land and compare the current properties with a complex survey of soils which was performed in 1960s. The results show that the water erosion changed the slope significantly and the depth of the soil was noticeably reduced compared to the state from 1960s. The material drainage is also evident and the material is sedimented below the slope.

Keywords: Soil, Erosion, Degradation, Clay, Agriculture

Effect of invasive and native plant species on abiotic and biotic soil properties

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Understanding mechanisms of spread of invasive species is key to develop techniques allowing their effective eradication. Many hypotheses explaining their spread assume that interactions of plants with soil are likely to play an important role. Despite the many studies on the effect of invasive plants on the soil, studies comparing effects of invasive and related native species are still rare. By using invasive species, we can compare species of similar growth form and ecology, and detect the differences possibly related to species invasiveness. We studied the effect of four congeneric pairs of invasive and native species (*Bidens, Erigeron, Sisymbrium* and *Rumex)* on biotic and abiotic soil properties in a garden experiment. We cultivated soil with these species over 12 weeks and compared its properties with uncultivated soil. The pH value and C, Ca, K, Mg, N and P contents were considered for the abiotic properties, and content of arbuscular mycorrhizal fungi in the soil and their colonization ability for biotic properties. We also assessed colonization of roots of the experimental species by mycorrhizal fungi and thus their mycorrhizal status, which may explain plant effects on the soil. Soil cultivated by invasive species had significantly lower P and K content than soil cultivated by native species but did not differ in the other properties. The soil properties strongly differed between the genera. Within the plant pairs, soil cultivated by invasive *Rumex* had lower K content than soil cultivated by the native *Rumex*, but the K content was higher in invasive *Bidens* species than in the native. Soil abiotic and biotic conditions strongly depend on genus of the cultivated plant, and not species invasiveness. The differences between native and invasive species seem to be largely genus specific.

Keywords: invasive plants, native plants, abiotic soil properties, biotic soil properties

Biochar – (il)legal friend of soil

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The recognition of soil as an important part of our environment that deserves protection on the EU level resulted in adoption of the Soil Thematic Strategy in 2006. The objective of the Strategy is to protect the soil while using it sustainably, through the prevention of further degradation, the preservation of soil function and the restoration of degraded soils. Based on a need to tackle soil productivity, risks to human health and the environment, and to provide opportunities for climate mitigation and adaptation, the Commission proposed a Soil Framework Directive in 2006, which also addresses the transboundary nature of soil degradation. The European Parliament adopted its first reading on the proposal in November 2007 by a majority of about two thirds. At the March 2010 Environment Council, a minority of Member States blocked further progress on grounds of subsidiarity, excessive cost and administrative burden. No further progress has since been made. Similar struggle appears at national level. Current legislation barely protects soil against its complete removal due to urban development and industrial expansion. The protection of soil's properties and quality is provided only indirectly through Good agricultural and environmental conditions standards which are required if direct payments should be received by farmers. But the inorganic fertiliser business represents 80% of the estimated total value of the EU fertilising product market. That is despite generally acknowledged fact the organic matter is crucial to improve various soil characteristics, including water holding capacity, biodiversity, resistance to erosion, etc. Biochar is legally recognized as a soil improver. It is often combined with conventional inorganic fertilisers or animal manure to reduce green house gases emissions from those fertiliser inputs. Use of biochar could thus be the tool to tackle the excessive cost and subsidiarity, arguments preventing the legislation truly protecting soil.

Keywords: Biochar, EU legislation, Soil amendment, Soil Thematic Strategy

Root foraging: is it important to see under the ground?

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Plants species differ in their ability to exhibit root foraging behaviour as a response to soil nutrient heterogeneity. This is at least true for the pot experiments conducted under artificial conditions. In the field, the role of root foraging is much less clear. Several problems need to be faced when exploring such phenomenon in natural communities: measuring the heterogeneity, observing the response and disentangling the causes of the observed response are just a few of them. In my field experiment, I planted seedlings of Rumex acetosa L. into a mesic semi-natural meadow, adding fertilizer to half of them and leaving the other half without treatment. I also collected species identity as well as biomass data on higher plants in close neighbourhood of the seedling. During the vegetational season, I visited the study site repeatedly, collected soil samples once and three times recorded study plants' "visible fitness". The phosphate ion concentration in soil seemed to be slightly higher in the close proximity of the fertilizer than farther, indicating an actual increase in nutrient concentration caused by the treatment application. However, I found no relationship between the fertilizer treatment and fitness of study plants neither during nor at the end of the season, regardless of the productivity of specific microsites (as measured by close plants' biomass). I also obtained Ellenberg indicator values (EIVs) based on species presence data and I will discuss their relevance in terms of estimating the soil heterogeneity.

Keywords: root foraging, soil heterogeneity, study plants‘ survivorship, field experiment, Ellenberg indicator values

The change in virulence of nematode *Heterorhabditis bacteriophora* during storage

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Entomopathogenic nematodes are parasites of insect. Their infective stage – infective juvenile (IJ) – lives freely in the soil and seeks for insect host. After penetration into the host via natural openings or via cuticle, the nematodes release their symbiotic bacteria which they carry in their gut. Together they are capable to kill the host within two days for which they are used in agriculture as pest biocontrol. As the virulence of this nematobacterial complex is important for its effectivity, this study is focused on the change of virulence during IJs storage.It is known that nematodes produce and secrete mix of proteins containing proteases and substances with different biological functions. These excreted/secreted products (ESP) help nematodes and their bacteria to overcome insect immune system and enable nematodes to reproduce and develop. However, there is lots of unknown as the mix of proteins changes according to various factors, e.g. nematodes species, host species, phase of infection or age of infective juveniles.In this work, nematode *Heterorhabditis bacteriophora* strain Az148 with its symbiotic bacteria *Photorhabdus luminescens* was studied. For virulence test we used larvae of greater wax moth *Galleria mellonella* infected with *H. bacteriophora* and recorded their mortality after 48 hours. We compared newly emerged IJs with those stored for 7, 14, 21, 28 and 35 days. We observed that the mortality of *G. mellonella* larvae was low when newly emerged IJs and IJs stored for 7 days were used and significantly increased when we used IJs stored for 14 and more days. Furthermore, we tested correlation of the proteolytic activity of isolated ESP with virulence development. This knowledge can help to effectively use *Heterorhabditis bacteriophora* in fight against the insect pest. Also, the work on ESPs can bring deeper understanding of the process of infection and overcoming insect immunity.

Keywords: Entomopathogenic nematodes; *Heterorhabditis bacteriophora*; excreted/secreted products; *Galleria mellonella*; insect immunity; virulence; ageing; proteolytic activity

Strips: Suitable modification of mowing for insect diversity?

Jor Tomáš, Šípek Petr, Eršil Lukáš, Benda Daniel, Brož Vojtěch, Dvořák Tomáš, Hadrava Jiří, Kouklík Ondřej, Rothová Helena, Sommer David, Schweiner Ladislav, Šípková Hana, Záleská Josefína, Šimon Zeman

Insect biodiversity of hay meadows seemingly decreased during the last fifty years due to the land abandonment and radical intensification of agriculture. In contrast to the traditional mowing regime and techniques, nowadays farmers are able to harvest hay from large areas of grasslands with modern machine mowing in a very short time period. This results in a uniform vegetation structure with low food resources for the vast majority of insect species bound to the hay meadows. In order to contradict these trends the European agro-environmental schemes were established. In the Czech Republic these schemes determine specific time and homogenous regime of mowing. Here, we present the primary results of our ongoing study of the effect of uncut grass strips as a compensation measure to promote biodiversity on commercial hay meadows Pitfall traps, yellow pan traps, window traps and individual transects walks were used for monitoring diversity and biomass of intercepted insects and arachnids on 21 sites located in the Český ráj region. The statistical analyses show a (i) significant positive effect of uncut strips on insect biomass and species richness on the treatment sites, (ii) no significant results in the total insect biomass in comparison of meadows with and without uncut strips. On the other hand, (iii) strongly significant positive effect of uncut strips was shown when insect biomass and species richness were compared before and after moving. Multidimensional analysis (RDA) showed (iv) a positive significant effect of uncut strips on species composition for all studied insect taxa. Overall, the sites with uncut strips were more diverse in species richness and had more insect biomass even in the first year of the study, thus this modification of mowing regime is a good solution for supporting the insect on production hay meadows, but still further research is recommended.

Keywords: Mowing, Strips, Biomass, Insect, hay meadows

Distribution and resorption efficiency of macro-elements (N, P, K, Ca, and Mg) in organs of Rumex alpinus in the Alps and the Krkonoše Mts

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R. alpinus is a troublesome weed in many European mountains. Although an excellent example of alpine nitrophilous species, soil properties, distribution of elements in its organs and resorption efficiency for N, P, K, Ca and Mg has never been studied. The aim of this study was to answer. How variable, are soil chemical properties on different localities? How different are contents of N, P, K, Ca, Mg, and N:P, N:K, P:K ratios in organs *R. alpinus* on different stands? How intensive is resorption of N, P, K, Ca and Mg between leaves? We collected soils and *R. alpinus* on four localities in the Krkonoše and three in the Alps. We determined the total and plant available content of N, P, K, Ca and Mg in soils and content of N, P, K, Ca, Mg in emerging, mature and senescent leaves, petioles, stems, rhizomes. We recorded high variability in the content of total N, P, K, Ca and Mg in soil and high differences in availability of P, K, Ca and Mg. *R. alpinus* is evidently able to tolerate wide scale of soil chemical properties with generally good P availability compared to mountain grasslands.There was a significant effect of locality, organ and locality*organ interaction on the content of all elements indicating that there are high differences in *R. alpinus* nutrition on different localities. There was a significantly higher content of N and P in emerging and mature leaves compared the high content of Ca and Mg in the senescent leaves. There was a significant effect of locality on N:P, N:K, K:P ratios between leaves. The N:P and N:K ratios in the mature leaves were within the normal range in plant tissues, however also indicative of comparatively higher demand for P. The mean resorption efficiency for N, P, K was 52, 50 and 22%. These values were lower than mean values for terrestrial plants (62, 65 and 70%). High availability of macro-elements in soils and high contents in plant organs together with low N, P, and K resorption efficiency indicate that *R. alpinus* is high N, P, and K demanding alpine species.

Keywords: Alpine dock; weed; nutrients; retranslocation, plant organs

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Habitat trees and their microhabitats as source of forest birds diversity in production forest

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Habitat trees with microhabitats (e.g., canopy deadwood, cavities) play an important role for forest biodiversity, but management practices in production forests caused decline of this important parts of the ecosystem. Many species is dependent on tree microhabitats during their life-cycles because of source of food, shelter, or breeding habitat. Tree microhabitats plays role as good biodiversity indicators. I explored the relationship between occurrence of habitat trees and forest bird assemblages. In addition, I try to identify importance of tree microhabitats for the diversity of forest avifauna. The study site is situated on 12 localities in production forest and 11 control forest reserves in Czech Republic. In each locality (6 km^2) live old trees (>70 cm DBH), standing dead trees (>50 cm DBH) and lying deadwood (>50 cm diameter) were monitored. On each live or standing dead tree, tree microhabitats were inventoried: trunk cavities (divided into lower and upper cavities), dead branches, trunk deadwood, saproxylic insect cavities and conks of fungi. We surveyed forest birds in breeding season of 2019 on plots located inside localities (10 - 12 plots on each locality) and one in each forest reserve (totally 147 plots). The plots represent gradient of live or dead trees and lying deadwood occurrence from zero to maximum in each locality. Totally, 44 bird species were recorded. For analyses, microhabitat data from 1 064 live and dead trees were used. Number of live and dead trees together (but not separately) positively affected abundance and species richness of forest birds, including cavity-nesters and bark-gleaners. Tree microhabitat richness positively affected all forest birds and cavity nesters abundance. Microhabitat richness was better predictor of bark-gleaners abundance than number of live and dead trees. Canopy and shrub nesting birds were not affected by these two factors. Individual old live trees in production forest may have equal importance for bird richness as standing dead trees and their protection is important.

Keywords: Old trees, production forest, deadwood, bird assemblages

Mycorrhizal symbiosis or roots – plant strategies to exploit heterogeneous resources

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The distribution of nutrients in soil is very heterogeneous at different scales relevant to plant roots and plants respond to this heterogeneity by the architecture of the root system. However, the ability to form the root system in terms of the most effective nutrient uptake differ among species. Over 70% of terrestrial plants create arbuscular mycorrhizal symbiosis (AMF) which helps them to acquire nutrients from the soil. It has been shown that plant with mycorrhizal symbiosis acquire nutrients from heterogeneous soil differently than plant without mycorrhizal fungi. The aim of my studies is to estimate the link between the root foraging of heterogeneous sources, presence of AMF and root traits of herbaceous plant species. I show that species with various root traits differ in foraging of heterogeneous sources, but root foraging of plants is probably independent on AMF presence/absence.

Keywords: root foraging, heterogeneous sources, arbuscular mycorrhizal fungi, root traits

The role of antioxidants in the prediction of honey bee, *Apis mellifera* L., longevity

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Honey bee, *Apis mellifera* L., is a well-known organism with a large ecological and economical importance. Recently, an increase in frequency of colony losses that could be caused by many factors including oxidative stress was observed. Oxidative stress arises during disbalance among the amount of reactive oxygen or nitrogen species and antioxidants and it leads to the cell degradation which can result in senescence of organisms. Therefore, there are many antioxidant mechanisms protecting honey bees against oxidative stress that could also affect their longevity. Antioxidants could be very diverse, and they are divided into three groups: enzymatic, non-enzymatic and hormonal antioxidants. There are two different populations of honey bee workers in our temperate climate – short-living summer populations and long-living winter generation. We used oxygen radical absorbance capacity (ORAC) assay for measurement of the total antioxidant capacity of haemolymph. ORAC assay is a fluorescent method used to measure the amount of antioxidants in various samples, particularly in food. We followed an antioxidant capacity of *Apis mellifera* haemolymph for two years and noticed a higher level of antioxidants in summer populations. This could be caused by the fact that honey bees gain a lot of antioxidants from food and during the summer season they can feed on plant products. However, the same haemolymph samples we also measured by electrophoresis to determine the level of vitellogenin, the yolk protein, which has except others also antioxidant properties. Vitellogenin was found to be increased in winter bee generation. These data suggest that honey bee populations are protected by different antioxidants through the year and their determination could help us with longevity prediction.

This project was funded by NAZV grant number QK1910286.

Keywords: Honey bee, *Apis mellifera*, haemolymph, antioxidant, longevity, oxygen radical absorbance capacity

Lowering *Bd* prevalence as a part of mitigation measures

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Abstract: Due to planned development of nuclear power plant Temelín has the company NaturaServis provided mitigating measures for amphibian and reptiles population. There was a wetland occupied by 12 species of amphibians and 4 species of reptiles on 8 hectare area. During 2014 NaturaServis created 78 new ponds literally on a greenfield site, about 5 km away from original habitat. For reptiles have been created artificial hibernation and aestivation shelter, stonewalls and egg-laying areas. Meanwhile we investigated *Bd* presence in the area of interest. In 2015 initiated the company transfers to new habitats, what we proceeded with till the end of 2017 season. We ended up on number of around 115 000 individuals. Species susceptible to *Bd* were tested before releasing. Positively tested individuals were kept in artificial tanks designed by our company until they got rid of *Bd*. Bottom of these tanks is sloping and covered by black foil. It allowed us to create aquatic habitat, or both aquatic and terrestrial habitats. Success rate of this therapy was almost 100%. Individuals who underwent this cure and were tested negatively for *Bd*, were then released to new ponds. We designed management of these new habitats on the basis of experience with therapy in artificial basins. That means we preserve many of brightened shallows, which should hopefully help to keep the *Bd* prevalence in new habitats as low as possible. Monitoring in 2019 showed only 3% prevalence of *Bd* in the new habitats and all the species transferred have successfully reproduced.

Keywords: Amphibian conservation, chytridiomycosis, mitigation measures, rescue transfer

The effectivity of drift fences within mitigating amphibian road mortality

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Abstract. Various types of mitigation measures to reduce the road-mortality of amphibians are carried out annually in many places across the world. These measures should be effective as for their price and mainly as for efficiency to capture substantial number of crossing amphibians. Based on data from year-round temporary drift fences with pitfall traps, specifically from 109 sites with 72,360 individuals we studied the proportion of captured individuals in each month was found and compared to the financial costs of using fences according their time. The most commonly used temporary drift fences during spring migration will capture merely 15 %, at the time of spring and reverse migration only 30 % of individuals entering the hazardous area during the season. In terms of money spent, these measures are the least cost-effective. The most cost-effective is the permanent fence with installed underpasses, which protect the moving amphibians and other small vertebrates throughout the whole season, without the need for daily control.

Keywords: Amphibian conservation, cost-effectivity, traffic, landscape fragmentation, mitigation measures

Diversity of insects and plants in small-sized gaps of deciduous lowland forests during five years of succession

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A minimal intervention approach applied in most protected forests in Europe has led to loss of vegetation structure and increase in canopy closure in woodlands of low and middle elevations. Protected deciduous forests often lack disturbance regimes that could create early-successional stages and support light-demanding organisms associated with woodlands. For 5 years, we studied communities of butterflies, moths, saproxylic beetles and vascular plants on twelve experimental small-size clearings that were artificially created in dense oak-dominated forests of Podyji National Park. Six of these clearings were directly connected to open habitats, forest edge and meadow, whereas the other six clearings were isolated from open habitats by at least 20 meters of dense forests.We found that species richness of all groups increased through the course of succession and the analysis of species composition revealed a significant turnover of assemblages from one year to another. The connected clearings usually hosted richer communities that were different from those in isolated clearings. Results of the study indicate that conservation management of protected deciduous forests should maintain fine mosaics of different successional stages to support biodiversity of both light-demanding and shade-tolerant species. It also suggests that it is important to ensure a connection of the newly created openings to other open habitats.

Keywords: biodiversity conservation, species composition, succession, connectivity, canopy gaps

The role of eicosanoids and nitric oxide in insect reactions mediated by adipokinetic hormone

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The Greater wax moth (*Galleria mellonella*) is a worldwide distributed parasitic moth. Its development is tied to beehives, where it causes damage to honey combs, death of larvae and loss of honey. The larvae of *G. mellonella* are increasingly being used as a model organism due to its many advantages, such as easy manipulation and no constraints by ethics unlike all vertebrate models. It is also used in this study, where three types of intercellular signals are studied: adipokinetic hormone (AKH), eicosanoids, nitric oxide (NO) and their crosstalk in immunity. AKH is a lipid-mobilising neurohormone in invertebrates; however, its function is pleiotropic as it ensures a complex anti-stress response. Eicosanoids are oxygenated metabolites of polyunsaturated fatty acids with wide range of action. They modulate immune responses in mammals as well as antimicrobial peptide production in insect. Nitric oxide is a small gaseous molecule which has essential role throughout all animal species. It serves as vasodilator, neurotransmitter and it also mediates both humoral and cellular immune reactions in insect. Signaling pathways of NO and eicosanoids were already described in insect; however, it is not known, whether there is a link between an action of AKH and metabolism of eicosanoids and NO. Optimal dilution of AKH in methanol was selected and proved that it does not increase mortality of *G. mellonella* larvae. My results show that concentration of lipids and carbohydrates as well as a level of NO in hemolymph were not affected within several hours after AKH injection or topical application. However, we noticed that injected larvae show decreased mobility which we measured using FIMtrack method. AKH reduces travel distance, velocity and rate of time spent on moving in *G. mellonella*. Reason of this inhibitory effect is not known yet, but future experiments will focus on explanation of this phenomenon.

This study was supported by grant No. 17-03253S from the Czech Science Foundation.

Keywords: Adipokinetic hormone; eicosanoids; FIMtrack; *Galleria mellonella*; insect immune system; nitric oxide

Healtd and ecological risk of recycled rubber for other use

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In 2015, the European Union issued a circular economy package, which accelerates the transition from a linear economy to a circular economy. In the "Plán odpadového hospodářství", the Czech Republic has accepted as one of its targets the take-back of 80% of used tires and 100% of them recycled and then use the rubber recyclate. As tire production continues to grow, it is necessary to look for ways to use recycled rubber. Rubber recyclates contain various toxic chemicals, including polycyclic aromatic hydrocarbons, phthalates, phenols, bezothiazole and others. These chemicals can represents health and environmental risks. Recycled rubbers are used in a variety of ways and are often used to make playground and sports equipment. To date, however, the health safety of playground surfaces and equipment intended for toddlers and school children has not been assessed and safe criteria have not been established. Recycled rubber granulate is used for playing surface surfaces that have very good fall and anti-slip properties. However, children may be exposed to toxic and carcinogenic substances during oral and respiratory or dermal routes when staying in these areas. The age of the child and the time factor associated with exposure also play an important role. However, no assessment of the health and safety of playground surfaces and equipment intended for children from toddlers to school children has been carried out to date. Until now, research into the Netherlands regarding possible health effects has been focused on athletes on artificial turf from recycled rubber. Research on health risks in the use of recycled rubbers in playgrounds is still in start and is the subject of institutional research by the Státní zdravotní ústav and the TAČR grant. The outcome of the research will be to identify possible risks and establish safe health criteria for the use of rubber for a given purpose due to the possible exposure of the child population to toxic and carcinogenic substances.

Keywords: rubber, health risk, environmental risk

Implementing of environmental DNA detection method in the surveillance of amphibian pathogen *Batrachochytrium salamandrivorans*

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The recently discovered pathogen *Batrachochytrium salamandrivorans* (*Bsal*) has severe impact mainly on European salamanders and newts. New presence of *Bsal* has been confirmed for the first time in the wild in Spain by this team. These findings confirm the great area of occurrence of the fungus. There is an urgent need for a better focus on this country, because Spain has a sizable community of exotic pet keepers and the country plays an important role in the amphibian pet trade. Moreover, this part of Europe represents a perfect zone for the spread of *Bsal* with severe potential impact due to the high endemism of newts and salamanders in this area. Environmental DNA (eDNA) allows us to monitor the fungus from earlier stages due to its higher sensitivity, avoiding a direct contact with the disease host and increasing the time frame for the monitoring. We have already tested the methodology in the Czech Republic for *Bd* succesfully and showing same results than swabbing, even in small volumes. Together with that, we implemented eDNA methodology for the detection of *Bsal* in Spain to establish the first approach of this technic against this chytrid fungus in wild. Thus, eDNA and its proved usefulness against non-indigenous species is a powerful tool which may contribute to stop the spreading of the salamander killer fungus and establishing early alarm monitoring system. The knowledge of pathogen's current geographic range is essential to carry on effective measures in affected areas and prevention in *Bsal*-free regions.

Microclimate influences saproxylic beetles within dead wood resource

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Dead wood is a resource for numerous beetle species, so called saproxylic species, which promote decomposition by physical degradation and act as vectors of microorganisms. Microclimate meditated by crown cover, decay stage and tree species should be key factors shaping the saproxylic beetle community living within dead wood. In the year 2011 a field experiment was established, where logs of one broadleaf tree species (European beech *Fagus sylvatica* L.) and one coniferous tree species (silver fir *Abies alba* Mill.) were artificially exposed in forest stands with both closed and open crown cover. Beetle communities within logs were sampled with 81 traps continuously over five years, i.e. at different decay stages. We analysed the effect of microclimate and the interaction of microclimate with stage of decay and tree species on abundance, species richness and community composition of saproxylic beetles with generalized mixed-effect models. Abundance and species richness of saproxylic beetles were higher in logs exposed under closed than under open crown cover and community composition differed. Beetle abundance decreased with decay in both sunny and shady forests and community composition differed, whereas species richness increased, however only in sunny forests. Abundance did not differ between European beech and silver fir and species richness was only higher for silver fir in sunny forests. The results indicate that microclimate and decay stage are key factors for saproxylic beetles within dead wood, whereas tree species itself plays a minor role in my models. For conservation of saproxylic beetle biodiversity, we thus suggest to allow and actively promote dead wood under different microclimatic conditions and preserve it over the entire decay process.

Keywords: Microclimate, Emergence trap, Coleoptera, Conservation biology

Alders under attack of spreading invasive pathogens - threat to riparian stands in the Czech Republic and Europe

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One of the very important groups of invasive organisms that have been neglected in the Czech Republic for a long time are fungi and fungus-like organisms. Especially fungal pathogens of forest tree species can have a significant effect on the functioning of whole ecosystems. Native tree species are far more susceptible to attack due to the lack of coevolution with the introduced pathogen. In recent years, the situation has been affected by a gradual change in climatic conditions that play a key role in the survival and development of pathogens.Typical examples of invasive organisms are species of the genus *Phytophthora*. These fungus-like organisms belong to the group of Oomycetes, which are worldwide known as primary parasites of hundreds of tree and shrub species. Many *Phytophthora* species belong to the most aggressive and most important plant pathogens of the world. The group of oligophagous species includes *Phytophthora* x *alni,* the causal agent of *Phytophthora* disease of alder. This aggressive pathogen spreads through water where it attacks all alder species in Europe and causes their decline. At present, about 50 % of the riparian stands in the Czech Republic are at risk of attack by this pathogen, but with changing climate conditions the situation may deteriorate further. The spread of the pathogen is significantly linked to the temperature and humidity conditions of the environment, but also the more frequent warm winters proves to be a crucial factor for the survival of pathogens.The aim of the research was to evaluate the infestation level of the common and grey alder trees by the pathogen *P.* x *alni* in relation to the selected parameters. The survey was carried out in the area of Beskydy mountains and the Central Bohemia. In 2019, a total of 1100 trees were evaluated in 31 stands. Preliminary results show that the area of Beskydy is less infested than the area of Central Bohemia, when the infestation level decreases with higher altitude. The distance of the tree from the watercourse was also a significant factor influencing the infestation level.

Keywords: invasive species**,** Oomycota, *Phytophthora x alni*, alder tree

Change in the position of the central part of fast-growing settlements

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The influence of suburbanization on the spatial configuration of the street network of small settlements is the topic of the research, which dealt with the analysis of the metropolitan areas of Prague and Brno. The settlements whose population and number of houses have doubled over the past 30 years were examined. The position of the most integrated locations has been identified using the Space syntax integration indicator. It was compared with their location before 1989, and it was subsequently examined whether the potential of these places is being met by the presence of commercial facilities. Due to the development in these settlements, the most integrated places were moved from the original centres. However, most of the new sites do not use their potential, and commercial amenities remain in their original centres. The results can be an inspiration for the solution of spatial planning documentation at the local level in the deployment of commercial facilities, but also in the optimization of the current state of these facilities. The results also show the need to investigate the possible impacts of planned development in territorial studies. The method that was used in this research can be easily replicable, for example, to public areas in suburbs or to optimize the deployment of commercial functions.

Keywords: suburbanization, space syntax, commercial functions, spatial planning, rural areas, spatial segregation

Characteristics and growth of *Photorhabdus luminescens*, the bacteria associated with entomopathogenic nematodes

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Photorhabdus luminescens are gram-negative bacteria of the family Morganellaceae, which live symbiotically in the gut of entomopathogenic nematode *Heterorhabditis bacteriophora*. These bacteria are nonpathogenic to nematodes, but they are lethal pathogen of insect. When the nematodes penetrate into the insect body through the digestive system or by disrupting the cuticule, they begin to consciously release bacteria into the haemocoel and together cause its death by producing toxins and other substances inhibiting host immunity. Bacteria also produce enzymes, which break down the insect host body; subsequently both of them can receive nutrients for their proliferation in the insect cadaver. In order to complete this cycle, the bacteria then enter the nematode juveniles as they develop. Nematodes are not only bound to the host, but can also live in a humid soil. *P. luminescens* forms two phases which are genetically identical, but morphologically different. Cells of Phase I are known as the pathogenic ones which are associated with infective juveniles. They absorb dye from agar media, produce pigments, antibiotic substances, toxins, lipase, protease or lectins and they are also bioluminescent. Phase II cells lose most of these abilities. They could not produce many substances and do not show any light emission. However, they also product pigments but not as strongly as Phase I cells. We can distinguish these phases on special agar medium - MacConkey and NBTA agar. Phase I absorb crystal violet from MacConkey agar and cells are deeply red here. Cells of Phase II are usually very pale or pink here because they could not absorb any dye. Similarly, on NBTA agar Phase I cells could absorb bromothymol blue, thus it appears blue or green and Phase II cells are characterized by red color. To verify the phase we measured the plates in a luminometer. Also growth of these bacteria was measured in a luminometer and the level of emitted light increased with the optical density.

Keywords: *Photorhabdus luminescens*, pathogenic bacteria, *Heterorhabditis bacteriophora*, entomopathogenic nematodes, insect pathogen, bioluminescence, phase variant

Population structure and genetic variability of Daubenton's bat (*Myotis daubentonii*) in the Czech Republic

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Many phylogeographic studies point at frequent presence of interglacial contact zones in the area of Central Europe. They usually originate from interglacial contact between lineages spreading from Mediterranean refugia, specifically from Pyrenean, Apennine and Balkan peninsula. Respective differentiations between sister species can be mirrored in population structures as well as they can correlate with trophic niche of these species. This process have also been observed in model organism for this study, one of the most numerous and distributed species of bat across the whole Europe, Daubenton's bat (*Myotis daubentonii*). Screening of mitochondrial and nuclear variability supports the idea, that in the Central Europe there can be observed a contact zone between populations with east-west vicariance. Due to the higher mobility of bats, the character of contact zone is expected to be mosaic. This contribution shows the preliminary data mapping the variability of Daubenton's bat in the Czech Republic.

Keywords: phylogeography, *Myotis daubentonii*, western Palaearctic, genetic variability, glacial refugia

Development of wet meadow habitats in the southeastern part of the Bohemian-Moravian Highlands in the last 20 years

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During the 20th century, wet meadow habitats were significantly influenced by drainage and transformation for agricultural purposes. In the beginning of 21st century, it was possible to observe increased afforestation, eutrophication and mostly abandonment of traditional use. Today, despite regular management measures at many sites, we can see qualitative deterioration and a gradual area loss of the low-productive wetland habitats. Using local historical vegetation data and current data, it was possible to demonstrate changes in studied natural habitats at 24 localities within southeastern Bohemian-Moravian highlands. Less than two-thirds of habitats (wet *Cirsium* meadows, Acidic moss-rich fens, Transitional mires, Submontane and montane *Nardus* grasslands) remained preserved up today. Significant area changed into mesic meadows, reed beds, willow carrs and young alder forests. Alarming is the change into ruderal vegetation, tree plantations or arable land. The deliberate destruction for agricultural purposes goes hand in hand with the dry seasons, which causes increasing of potential to intensive using. The original habitats were found as same only at three localities, while the rest of localities changed. The results show that the comparison period is long enough for the entire habitat to be transformed into another.

Keywords: degradation, habitats changes, land use, succession, biodiversity

National Park as a model for sustainable nature-based ecotourism in India; example of Keibul Lmajao National Park

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Nature-based tourism has recently been growing into one of the fundamental economic endeavours in the natural landscape throughout India. The Indian tourism industry in recent years has been trying to moderate the impacts caused by the increase of mass-tourists who come exploring in natural areas of the country. The goal is to promote sustainable nature-based tourism that will ultimately result in the transition towards ecotourism. To date, the concept of ecotourism is a relatively new phenomenon within the Indian tourism industry. My research was conducted in a unique national park (NP) in India called Keibul Lamjao National Park, the only floating NP in the world, floating over a lake called Loktak Pat. This NP is also home to one of the most endangered endemic deer species, Sangai. The state tourism department is promoting this NP as an ideal location for nature-based tourism. The goals of the research were multi-fold:1. to find out how many of the tourists visiting the NP were aware of the concept of what denotes an ecotourism destination; 2. to determine how many of these visitors identified themselves as nature-based or eco-tourists; and 3. to conduct strength, weakness, opportunities, and threats (SWOT) analysis of the KLNP to help park management better determine if they are prepared to be identified as an ecotourism destination.Primary data collected 69 visitors survey questionnaires at the NP. This survey was officially sponsored and approved by the University of Wrocław, Poland. The promotion of KLNP as a model for ecotourism in India requires multiorganizational management involving both private and state administrative support. My research determined that even though the concerned authorities are trying their best to endorse KLNP as a nature-based tourism location, there is much work to be done before KLNP can be a model for sustainable ecotourism.

Keywords: Ecotourism, India, Keibul Lamjao National Park, Nature-based tourism, Sustainable tourism

Nesting habitat requirements of saproxylic aculeate Hymenoptera

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Aculeate Hymenoptera are a diverse group of insects providing valuable ecosystem services like pollination or pest control. They utilize various nesting substrates for their progeny. The availability of nesting substrates can often be a limiting factor, therefore affecting local communities of these insects. Relatively few species belonging to this group are saproxylic, i.e. utilising cavities or galleries in deadwood for nesting. Even though most Hymenopterans are generally considered heliophilous, preferring open environments, most deadwood and therefore nesting substrate can be found in forests that are mostly shady. We studied nesting preferences of aculeate Hymenoptera (bees and wasps) in a mosaic of open and shady environments at a site covered with forest and pasture, using trap nests (wood blocks with drilled-in holes). Environmental variables in the vicinity of each trap nest were recorded and all occupied nests were taken to laboratory for rearing. Our results show clear difference between communities nesting in forest environments and in the pasture. The highest number of species and individuals were found in small forest openings and in shady parts (groves) of the pasture. The communities nesting in forest openings consisted of specialist species and their parasites, whereas the pasture was mostly inhabited by generalist species. However, the groves in pastures showed also the highest number of parasitized nests. None of the recorded environmental variables affected the number of species and individuals reared from the nests. Our study suggests that saproxylic aculeates require mosaic of shady and open environments. It shows that they are able to inhabit mostly shady environments, suggesting the ability to utilize very small suitable habitats within larger patches of unsuitable ones. Even large patches of dense forests may be utilized as long as suitable openings are available within.

Snake Fungal Disease: an infectious mycotic dermatitis of snakes

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There has been an alarming increase in the number of fungal diseases affecting wildlife populations over the last decades. Snake Fungal Disease (SFD) is an infectious mycotic dermatitis caused by the fungus *Ophidiomyces ophiodiicola* that affects snakes. Severe skin infections were reported in association with a precipitous decline in timber rattlesnake (*Crotalus horridus*) population in the northern USA in 2006. In 2008, similar infection emerged in Illinois, USA in an imperiled population of massasaugas (*Sistrurus catenatus*). *O. ophiodiicola* has been isolated from over 30 species of wild snakes from six families in North America. Between 2010-2016 were screened 33 carcasses and 303 moulted skins from wild snakes collected in Great Britain and the Czech Republic. The fungus was detected in 26 specimens. Case from the Czech Republic was the first from continental Europe. The second occurrence is from Switzerland. Symptoms of the disease are variable, they include most commonly yellowish/brownish crusts, scale discoloration, increased ecdysis frequency, subcutaneous nodules, desquamation and in severe cases clinical signs include skin ulceration, swelling, and facial nodules. Whereas in some instances the infection ceases and leaves no external signs, in others it leads to the death of the animal. Genetic and culture characterisations indicate that the European *O. ophiodiicola* isolates are distinct from the strains known to infect snakes in eastern USA. We started collecting swab samples and sheds in September 2018. Now we have about 100 samples from Brno Reservoir especially from dice snake (*Natrix tessellata*). Some of them are from snakes with typical clinical symptoms except death. We are starting to analyze samples using quantitative real-time PCR. We would be grateful for any help.

Keywords: SFD, Snake Fungal Disease, *Ophidiomyces ophiodiicola*, mycotic dermatitis, infectious, dice snake, *Chrysosporium* anamorph of *Nannizziopsis vriesii*

The influence of environmental factors on spread of Spruce bark beetle *Ips typographus* (L.)

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The aim of the thesis is to quantify the influence of environmental factors on the spread of spruce bark beetle. The main question to be solved is that the factors threatening the role in the spread of bark beetle? Partial question, does it affect individual factors related to different gradations? The spruce bark beetle dispersion will be monitored in selected forest stands regarding adult migration, selection of the receiving tree in an environment and from the point of view of the spread of infestation. Migration of adults will be measured using passive impact traps, the measured parameters will be the direction and speed of wind, air temperature. Next will be evaluated the geomorphology of the terrain, the presence of resources of the bark beetle population and the predisposition of trees. The selection of the host tree and the propagation of the outbreaks of the attack will be evaluated back based on the tree map entries. To do so, they will have unmanned data, available aerial photographs or terrestrial measurements. Part of the dissertation will also be the determination of the population density of the bark beetle in the redeveloped stands.

Keywords: Ips typographus (L.), Šumava National Park, Norway Spruce

History of atmospheric mercury in Silesia region as reconstructed from tree ring archive: preliminary results

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Tree rings of European Larch (Larix decidua) were identified as a widely available and reliable geochemical archive, which was successfully used for reconstruction of atmospheric mercury levels in Bohemian part of the Czech Republic (Navrátil et al. 2018). This work was focused on understanding and reconstruction of mercury atmospheric levels during the 20th century in Silesian region of the Czech Republic. At 12 sampled sites, 2 cores were taken from each of 3 trees sampled. Prior to analysis, tree ring cores were cut to a 5-years segments weighted and lyophilized. Mercury measurements were done using AMA254 instrument (atomic absorption spectrometer with cold vapor detection). Each tree ring segment was measured individually to observe trends in time for each site. Studied sites were pre-selected with respect to character of the nearest vicinity i.e. former mining sites (Fe-ore or uranium) active limestone or coal mining, cement production, coal combustion and heavy industry. But some sites were also in typical background setting i.e. remote forest areas, atmospheric spa or arboretum. Preliminary time trends did not identify any of the known local Hg emission sources. But overall general trend was typical with elevated Hg concentrations from 1950s to 1970s. Mean of 11 ng/g Hg was typical for segments representing 1950s to 1970s especially at sites located in vicinity of Ostrava city. The highest Hg concentration 20 ng/g in tree ring segment occurred at site near Havířov. At sites in northwest direction from Ostrava, Hg concentrations in 1950s to 1970s tree ring segments decreased to mean of 4,95 ng/g. Based on preliminary results, we assume that elevated Hg in 1950s to 1970s tree ring segments in region of Silesia result from ambient iron ore processing, steel production, black coal mining and combustion in Ostrava (Czech) and Katowice (Polish) region.

Keywords: Larch tree, tree rings, mercury Silesia, pollution

Navrátil T, et al. (2018) Larch Tree Rings as a Tool for Reconstructing 20th Century Central European Atmospheric Mercury Trends. *Environ.Sci.Technol.*,52/19:11060-11068.

Increase of infestation of Norway spruce caused by *Gemmamyces piceae* in Ore mountains between years 2017-18

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Gemmamyces piceae (Borthw.) Casagr. was first found in the Czech Republic in 1918 on blue spruce. Disappeared pathogen from 90´s began to appear significantly in the Ore Mountains at the beginning of the 21st century. Since 2015, *Gemmamyces piceae* has started to appear more on our autochthonous spruce. The fungus, which infects the buds, causes a significant distortion of the buds and the subsequent deformation is encountered practically throughout the growing season. Evaluation of the extent of attack and infestation of Norway spruce stands in the Ore mountains is carried out at GS LČR project. Since 2017, more than 100 permanent plots with at least 50 marked spruce trees (age categories 7 – 30; 31 – 60 and 61 - 140 years) were repeatedly evaluated. Subject of evaluation were defoliation according to IUFRO categorization and extent of infestation caused by pathogen by the following criteria: 0 - healthy tree; 1 - attacked single buds or max. individual branches; 2 - infestation of more branches, max. 1/3 of the crown, 3 - infestation up to a maximum of 2/3 of the crown and 4 - tree attacked from more than 2/3 with visible defoliation. 5 065 trees were evaluated in 2018. The least infested remained stands under 30 years (more than 20 % infested individuals). Most affected was the category 31-60 years, (48 % of individuals). The total proportion of infested trees mostly exceeded 25 %. The greatest deterioration occurred in the western part of the Ore Mountains (Klášterec, Horní Blatná) but the worst situation remains in the eastern part (Litvínov). In 2018, there was an increase in the quantity of infected trees compared to the years 2015, 2016 and 2017 in categories 1 and 2 - trees with a moderate infestation max. to 1/3 of crown. The highest increase of quantity of infested trees was found in the age category 61-140 years in 2018. Preliminary results from the 2019 evaluation show that the extent of pathogen infestation in the Ore Mountains area is increasing.

Keywords: Gemmamyces bud blight, *Picea abies*, evaluation, buds, Ore mountains

Reproductive compatibility of the common bed bug (*Cimex lectularius*) host lineages

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The process of ecological speciation, as an alternative to the natural-selection-induced genetic divergence, has, over the last decade, gained increasing attention for both allopatric and sympatric divergence. The concept of ecological speciation usually works with an assumption that a gene flow barrier results from divergence, raising from adaptations to different species ecology and a consequent selection against hybridization. However, the alternative scenario, in which the reproduction barrier arises directly from a different species ecology (without the preceding accumulation of genetic differences), is rarely considered. As a result, the observed differences in ecology could be caused by a phenotype plasticity. The model organism in our study – the common bed bug (*Cimex lectularius*) – consists of two genetically isolated host lineages, occurring sympatrically on bats and humans. In cooperation with three other universities (MU Brno, Uni Bayreuth, and TU Dresden) we currently test the effect of a specific diet (i.e. human and bat blood) on the sperm phenotype. Thus, an essential part of the project is a study of the genetic influence on the compatibility of the host lineages. In our part of the project, we therefore compare the fertility of the females mated with the males from the same and different host lineage on unified diet, in a full-factorial design using 3 human- and 3 bat-related common bed bug lineages. The preliminary evaluation of the data from 370 crosses shows a positive effect of the female lineage on the oviposition, as well as a positive male effect on the offspring survival (based on the data from 939 offspring individuals). For this suggests a possible heterosis effect in the offspring in the non-specific crosses, it can be, for now, concluded we did not find any indication there is any reproduction barrier between the human- and bat-related host lineages. This furthermore suggests that the different lineage ecologies might be the culprit behind the observed reproduction barrier.

Keywords: ecological speciation, common bed bug, *Cimex lectularius*, sympatric speciation, phenotype plasticity, sperm niche, heterosis effect

Hybrid zone between *Alnus glutinosa* and *A. rohlenae* in southern Serbia: type, origin and maintenance

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Diploid *Alnus glutinosa* and autotetraploid *A. rohlenae* form a narrow hybrid zone in a study area in southern Serbia which results in triploid hybrid formation. The vast majority of studies are focused on the study of maternal plants, but not on the offspring that arise from their crossing. In this research we use the variability of microsatellites and chloroplast DNA between both species and their hybrid to create an overall picture of the development of the hybrid zone and its predicted type. In order to elucidate gene transfer within both species, origin of individual ploidies and especially the role of triploid hybrid, a germination experiment linking with flow cytometry of freshly germinated seedlings was performed. Tension zone model seems to be most adequate due to the observed selection against triploid hybrids and spatial position of the hybrid zone. Despite selection against them, triploid hybrids play an important role in the exchange of genes between both species and therefore serves as a bridge for introgression. The presence of fertile triploids is essential for enriching haplotype diversity between these species and developing new genetic lineages.

Key words: germination, chloroplast DNA, introgression, microsatellites, polyploidy, tension zone

Long-term sustainable use of ecosystems

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Ecology studies the relations of organisms and their environment. Ecosystem is established by mutual concurrence of organisms and environment. Global environmental problems point to our persisting unwillingness or inability to use ecosystems rationally with regard to their long-term functioning. Ecosystems have ability to soften negative effect of anthropogenous factors. Therefore, we can disturb and damage the ecosystems for certain time and cumulate alien substances in them. However, when the threshold value of ecological stability is crossed, degeneration or even devastation occurs. So considerably a small change is enough to make ecosystem functionless at a certain moment. Our problem is that we don´t know these threshold values. Occurrence of main world continental ecosystems called biomes depends on temperature, amount of rainfall and facilities of soil. Then there are ecosystems of world oceans and seas that are created by other effects. Ecosystems provide us with supply, regulation, support and cultural services. Devastated ecosystems are then unable to provide us with ecosystem services. Deep ecology is the way of achieving accord and balance among individuals, communities and the whole nature. Deep ecology means also the work of everyone with themselves. This work means to cultivate ecological consciousness. It is the ability to percept nature fully and to tighten internal persuasion that everything is closely mutually connected. Cultivating the ecological consciousness means learning to percept more holistically, to be more opened and more trusting. Cultivating the ecological consciousness is closely related to conscience development. People feel that cultivation of ecological consciousness is their life need which is in accordance with needs of our planet. Many people feel what the needs of the planet are and how important it is to protect wild nature. According to the supporters of deep ecology, wild nature represents country or ecosystem which was the least disturbed by human activity, mainly by destructing technologies of modern society. Unless we all intuitively feel that the Earth is a living system and realise that it is the part of ourselves, we won´t be able to react automatically in its interest and consequently in our own protection. This planet, which is natural home of all its mutually dependent living beings, cannot belong to any of them, to any population or biological species. It cannot belong to a human as a species, who creates culture. We are the temporary tenants of the Earth.

Key words: ecology, ecosystem, sustainable use, ecological consciousness, wild nature

Proposal of operational – adaptation measures utilizing hydrophilic polymers to reduce the dieback of major tree species due to drought

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Due to climate changes happening in the past years, this research aims on protection of new plantings from drought. Insufficient rainfall in forestry is in particular evident in forest restoration (afforestation). Hydrophilic polymers positively increase yield of plantings. This research has been carried out due to lack of automated devices that could be capable of mechanically restore forest and due to lack of operational knowledge of using hydrogel in afforestation. For purposes of this research, fourteen areas were established to be investigated. On these fourteen areas, major agricultural tree species (oak, beech, pine and spruce tree) were planted in three different ways (with hydrogel, without hydrogel and with soaked root system). Hydrogel had been used in predetermined proportion and mixed with water. Only in the case of soaked method, where plant‘s root system had been soaked, was not possible to specify exact amount of mixture attached to the root system. Methodically specified parameters have been and still are being measured. These parameters are plant‘s height, neck‘s thickness, vitality, photosynthesis, fluorescence, water potential and dehydrins. Measurements repeat in predetermined intervals. Conclusion of the first season’s measurements is that hydrogel’s effect on plants depends on the condition of the plant itself before being planted and on the place of plantation (e.g. fencing, soil, etc.). Great impact on planted trees is also given by protection against animals‘ bites. These days, tree plants are being planted into pots in a greenhouse, plants will be afterwards exposed to stress caused by drought, an automatic irrigation will take place there as well as measurement of the same parameters as are being measured in the case of trees planted in the forest. Measurement and processing of results themselves will still go on.

Keywords: *hydrogel, hydrophilic polymer, drought*

10 years: What happened to Balikpapan's proboscis monkeys?

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Proboscis monkey (*Nasalis larvatus*) is an endangered endemic species to Borneo Island. Its' populations are scattered thorough the whole island in coastal and riverside forests. Population in Balikpapan Bay, described of 1,400 individuals, was predicted to experience steep decline by Population Viability Analysis (PVA). We surveyed two subpopulations within Balikpapan City administrative area, counting proboscis' groups, in three surveys from 2007 to 2017. Contrary to PVA predictions, our findings revealed stable population development in the observed period. Forest fires, supposedly the main cause of habitat loss according to the PVA, did not impact the population on predicted scale. We observed slight increase in overall number of groups, but once sorted on subpopulation level, each one of them followed different development. The groups in the northern subpopulation remained stable in matter of total numbers, but the average group size decreased notably. The southern subpopulation developed in completely opposite manner, in both aspects. Proboscis monkeys were present in each one of the surveyed river systems, but their numbers fluctuated without clear pattern. Those ranging patterns reveals connectivity of both subpopulations, with one exception, which is isolated Somber River. Somber River carries disproportionally larger number of resident groups, which are also extremely large, compared with the rest of the bay, as well with other populations on Borneo. We should therefore consider classifying Somber River as a new subpopulation in Balikpapan Bay.

Keywords: *Nasalis larvatus*, Population Viability Analysis, subpopulation, Somber River

Late phenological aspects and occurrence of dragonfly adults on the Paskov post-industrial secondary hotspots of biodiversity & endangered species migration in the Moravian Gate and Ostrava Basin

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In my presenation I focus mainly on how warming affects life of dragonflies. One of these phenomena is the migration, presence and occasional breeding of thermophilous dragonfly species in lowland areas in Czech Republic. Popular migration routes of these species also lead through the Moravian Gate and the Ostrava Basin. The region known for its black coal mining has a number of post-industrial areals that dragonflies seek. In the next part I deal with an example of such a complex as Paskov sludge ponds. In supplement I deal with valid regulations of the Czech Republic regarding compulsory remediation and reclamation of the mining area. Most of these post-industrial areas undergo remediation and reclamation, which can significantly cause reduction of the species richness of the location. Some recultivated areas, with good management, may have large quantities of species. An example is part of the Ostrava forest in the Ostrava Zoo, which is not so well known as a recultivated heap.

Keywords: post-industrial, black coal, mining, species richness, recultivation, Ostrava zoo, Paskov, Moravian Gate, Ostrava Basin, warming, dragonflies, migration, endangered species.

Cellular immue response of honey bees against *Varroa destructor*

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Despite their lack of adapted immunity, insects are capable of manifesting strong immune response which can be resolved into two broad categories: humoral and cellular immunity. The primary mediators of cellular immunity are haemocytes – specialised immune cells found in haemolymph. There are many types of haemocytes in different insect species, for instance plasmatocytes, granulocytes, lamellocytes, oenocytes and many others. They are specialised in different defense mechanisms including phagocytosis, nodulation and encapsulation. As a model organism for haemocyte analysis we choose the honey bee (*Apis mellifera*). This ecologically and economically important species is currently struggling with significant decline in many parts of the world which is except other factors caused by bee pathogens. Here we compare the haemolymph samples from healthy bees and bees from hives infected with parasite *Varroa destructor*. This mite is well known for its ability to infect both larvae and workers, transmit viruses further amplifying its negative impact; and if not treated bringing the hive to the collapse in just one year. We use flow cytometry with the help of various fluorescent markers to distinguish the elements present in the haemolymph including haemocytes. This method allows us to observe changes in haemocyte counts, their viability and activity. Our analyses were performed through the whole year 2019 to monitor the conditions of the hives and determine its health status. We also use confocal microscopy to compare honey bee haemocytes with characteristics of other species. Our results confirm that in honey bee haemolymph we can distinguish living haemocytes with intact membrane, permeabilised cells and not well-defined cellular debris. It remains to be confirmed if there is a significant difference between healthy and *Varroa*-infected bees.

This study was supported by the Grant Agency of Masaryk university.

Keywords: haemocyte, insect, honey bee, pathogen, *Varroa destructor*, flow cytometry, microscopy, fluorescence

High Latitude Dust sources and impacts on atmosphere and cryosphere

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The Arctic and Antarctic regions include large areas of high latitude dust (HLD) sources, from where dust is transported long distances. HLD 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, 44,000 km^2). Icelandic volcanic dust can be transported distances >2000 km towards the Arctic and deposited on snow, ice and sea ice. Icelandic deserts used to be 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 *in situ* atmospheric concentrations inside dust plumes in Iceland in vertical high altitudes profiles, aeolian transport during extreme wind erosion events of volcanic ash, snow-dust storms, and 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, the most solar radiation absorbing aerosol. Contrarily, volcanic dust/ash insulates the ice below at a thickness of 9-15 mm (called as 'critical thickness'). The maximum melt occurred at thickness of 1mm for the larger particles, and at the thickness of < 1-2 mm for the smaller particles. Long term satellite albedo observations showed a persistent decrease in glacial albedo in South Iceland due to volcanic ash deposition and dust storms during summer season. Impacts of HLD and particularly volcanic dust on climate should be investigated and incorporated into climate prediction scenarios.

Keywords: Volcanic dust, air pollution, cold deserts, aerosol, Arctic, albedo and melt.

Soil-solution partitioning of antimony(III) in Dutch agricultural soils and its dependence on chemical soil properties

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Antimony (Sb) is a widely used toxic semimetal that can enter soil-water systems from natural and/or anthropogenic sources. Adsorption of Sb to soils plays an important role in its fate and transport in the environment. Similarly to arsenic, the predominant oxidation states of Sb in soils are +3 and +5 (antimonite, Sb(III) and antimonate, Sb(V)), the first being much more toxic than the latter. The adsorption behavior of Sb(V) in fourteen Dutch agricultural soils was studied in a previous project, while Sb(III) adsorption to the same soils was investigated in my MSc thesis using laboratory batch experiments and results were compared. The soil-solution partitioning of Sb(III) yielded K_d values between 13 and 555 L kg^{-1}, which are 2 – 12 times higher than that of Sb(V) (2 – 60 L kg^{-1}), indicating stronger adsorption affinity of Sb(III) to these soils than that of Sb(V). Nevertheless, soil properties that had the most effect on Sb(III) adsorption were iron oxide, clay, and DOC contents in the soil, similar to the case of Sb(V). Most adsorption of both Sb(III) and Sb(V) occurred in clay soil. Adsorption data of both Sb species were successfully fitted to Langmuir and Freundlich adsorption models (R^2>0.88). The adsorption of Sb(III) and Sb(V) gradually decreased with increasing soil pH from 3 to 10, with maximum adsorption at pH 3. The pH effect was most visible in clay soils. Since Sb(III) is much more toxic than Sb(V), the observed higher Sb(III) adsorption affinity is encouraging. However, changes in environmental factors can lead to Sb(III) migration and transport, posing a risk to biological systems, urging further research in the factors influencing Sb adsorption.

Keywords: antimony speciation, adsorption, clay, distribution coefficient Kd

What impact can have shorter rotation period on bark-beetle disturbances in temperate forests? - Preliminary results

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The spruce bark beetle *Ips typographus* is the most damaging biotic disturbance agent in European forests. Bark beetles typically attack trees with age above 60 years. Moreover, wind disturbance, which often acts as a trigger of bark beetle outbreaks, also impacts older forest stands more severely. The rotation period of spruce exceeds 100 years in many European countries and this makes forests rather vulnerable to both wind and bark beetles. The reduction of rotation period can be a powerful tool to reduce forest vulnerability. This practice is not typically applied because it might interfere other management objectives such as timber production or nature conservation. Therefore, knowledge of how altered harvesting regimes affect forest disturbances remains incomplete. We used the process-based landscape-scale forest disturbance model iLand to simulate wind and bark beetle disturbances and different forest management practices. The aim of our study is to evaluate effects of shortened rotation period on the amounts of trees killed by bark beetles and windstorms. The study is conducted in a managed temperate forest landscape in Central Europe in the Low Tatras Mountains with stands dominated by Norway spruce. We simulated the impact of six wind storms during the 200-year simulation period, and the subsequent bark beetle outbreaks. The forest development is simulated under the business-as-usual rotation period and under the rotation period reduced by 10, 20 and 30 percent. Finally, we evaluated impact of such reductions on the amounts of killed trees. We found that shorter rotations efficiently reduced the mean age of the forest. Following this reduction, amount of breeding material for bark beetles was reduced as well and the amount of disturbed trees decreased. We revealed complex patterns of changing forest vulnerability under different rotation period, which can inform forest management on how to optimally reduce the impact of forest disturbances.

Keywords: forest management, Ips, typographus, wind, iLand, disturbances

ABSTRAKTY POSTERŮ

Multi-elemental analysis of wood ashes of selected tree species in the tropics

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Although wood ashes are treated as wastes in many countries, they can be used for soil amendments and fertilizers. However, ashes can contain high contents of risk elements. There is no information about the content and releasability of different elements in ashes- their fertilizer values are unknown. We aimed to identify total and plant-available contents of macro, micro- and other elements in ashes of *Theobroma cacao*, *Persea americana*, *Cola nitida*, *Mangifera indica*, *Citrus sinensis*, *Prunus dulcis* and *Senna siamea* trees commonly used as fuelwood in Ghana to suggest their application for soil amendment or as fertilizers. Wood samples from the trees were air-dried and burnt at 500ºC for 4 hours to obtain the ashes. The ashes were digested in *Aqua-regia* and Mehlich 3 extractants, and subsequently inductively coupled plasma-mass spectrometer was employed to determine contents of total and plant-available elements, respectively. The ash yields ranged from 3.1-7.1% and pH (H_2O) of ashes ranged from 7.8-12.9. Branches of *Theobroma cacao* contained highest levels of ash forming matters and pH more suitable to neutralize acidic soils. Mean content of total element ranged from 0.2-4.9% P, 1.9-21.8% Ca, 6.4-32.5% K, 4.8-9.5% Mg, 143-797.7mgkg^{-1} Mn, 53.2-81mgkg^{-1} Cu, 188.1-312.4mgkg^{-1} Zn, 0.04-1.6% Fe and 0.36-2.9% Na in the ashes. Mean content of plant-available elements in the ashes ranged from 21.9-512.3mgkg^{-1} P, 37491-88303mgkg^{-1} K, 2948-19713mgkg^{-1}Ca, 13719-29001mgkg^{-1} Mg, 75.2-141.2mgkg^{-1} Mn, 40.3-74.2mgkg^{-1} Cu, 44.3-91.2mgkg^{-1} Zn, 1.5-383.2mgkg^{-1} Fe and 835.8-6178mgkg^{-1} Na. There were 0.08-92.8% releasable contents of macro- and micro-elements in all the ashes. Total and plant-available contents of studied macro- and micro-elements were high and releasable enough to make the ashes applicable in fertilizing agricultural soils. Total and plant-available Ni, Cr, Pb, Co, As, Cd and Al contents were below permissible limits thus, the ashes can be applied to soils without contamination. Multi-elemental analysis of wood ashes can offer relevant information about ash utilization as soil improvers.

Keywords: Fertilizer; Fuelwood; Macro-element; Micro-element; Soil amendment; *Theobroma cacao*; Total and plant-available element

3-D/complEx/mysTeRic/high dIversiTy microUniverSeat the river bottom: MATTER ALL-IN-ONE

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Lotic freshwater ecosystem can be investigated at different scales; e. g. river bed. It is generally composed of inorganic and organic matter. The first one consists of mineral grains of variable size (sand, gravel … and rolling stones). Biota (rheobenthos) and dead matter represent the second one. You can find also anthropogenic material (e. g. tires, plastic wraps … or Chinese ski) there. Composition of natural river bed seems to be simple, but we should distinguish also forms of matter. Not yet explored system is deposited **detritus** which can be called "MATTER ALL-IN-ONE". And why? It´s made up of microbial flakes, plant tissue residues, faecal pellets produced by invertebrates, fine mineral particles, biofilm, algal cells and single-celled organisms. All matter comes from springs, rhizosphere or aquatic macrophytes. This study is focused on deposited detritus composition and its spatial heterogeneity in the Malše River (South Bohemia, CZ). Freshwater pearl mussel population with unique natural reproduction live there; detritus is a food source for these critically endangered filter-feeders. We chose 21 sites in the longitudinal river profile (length up to 50 km). At these sites, sampling of detritus was realized during August 2018. We used syringes Janette, coarse filters (mesh 100 μm) and sedimentation boxes. In the lab, field samples were filtered through fine filters (mesh 40 μm), dried and transformed to powder by milling. Then, we made out organic matter percentage (loss-on-ignition method) and amount of metals (ICP-OES) in detritus. Relation of detritus parameters and river kilometer was assessed using linear regression method. Content of organic matter (AFDM) significantly decreased downstream ($p < 0.001$) whereas phosphorus levels in dry mass increased ($p = 0.002$). Calcium levels along the river remained more or less unchanged. All analyses haven´t been realized so far. But just now, you have unique opportunity to meet detritus using your senses!

Keywords: Detritus, filter-feeder, AFDM, phosphorus, longitudinal profile, Malše River

Usage of Sentinel-1 radar data for soil moisture mapping

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The Remote sensing laboratory at CENIA is currently focusing on soil moisture mapping using the means of remote sensing as a part of CENIA's ongoing research plan on energy flows in landscape. The soil moisture research also investigates the connection of three related parameters – soil moisture, vegetation index and surface temperature. Soil moisture is a significant factor linked primarily with hydrological and climatic conditions, but also with many other processes in the environment. In the current climate trend, it is necessary to develop and explore new methods that would provide early and regular information on the current state and changes in the environment in order to respond to the situation in a timely and adequate manner by taking appropriate measures. Radar images from Sentinel-1A and Sentinel-1B satellites are a key source of the soil moisture research using Sentinel data from the European Copernicus program. The resulting soil moisture values are compared and interpreted together with the vegetation index (NDVI) derived from Sentinel-2A a Sentinel-2B satellites and surface temperature thermal data from the Landsat 8 satellite. Sentinel-1 satellite images have undergone a pre-processing process and the Remote sensing laboratory is now investigating suitable methods for soil moisture derivation from backscatter values. The values of the vegetation index (NDVI) and surface temperature are obtained from the Remote sensing laboratory archive, which contains already processed data. So far, the best method for soil moisture retrieval seems to be the Change detection method, where changes of backscatter values are examined within a certain time period. However, these changes can be influenced for instance by change in the shape of surface or roughness. The resulting maps from Sentinel-1 radar data are showing the current state and changes in soil moisture at different time scales. These maps are compared with vegetation index (NDVI) and surface temperature values to determine the coherence of these parameters. The resulting method can be applied locally or throughout the Czech Republic for regular monitoring of soil moisture and its changes in individual time periods and years.

Keywords: radar data, multispectral data, soil moisture, remote sensing, NDVI, surface temperature

Finding a suitable coat: Invasive ectoparasite, Deer ked, and its ecology on large mammals

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Research on the *Lipoptena cervi* (Linnaeus, 1758) (Diptera: Hippoboscidae) and environmental interactions. Observation in progress since 2015 on hunted game in several areas in the Czech Republic. Research of the red deer (Lipoptena cervi) began in northern Moravia - Lesser Moravia and spread to another locality of Libavá, Chlumec nad Cidlinou - Kinský dal Borgo. The spread of red deer has become increasingly difficult due to its density and ability to survive winter conditions in Europe. The problem is for the forest visitors during the summer months, for the game, which is the main host of this species. In recent years, this species occurs in domestic animals (dogs, cats, cattle, horses, sheep, goats). Such parasites can cause several health problems to humans. Some species of parasites are transmissible to humans, in most cases by contact with animals or their environment. The main parameters of the research were the variable species of game, place of collection, sex of game and day of the year. The aim of the work was to find the influence of various factors on the occurrence of deer ked (Lipoptena cervi) on game at three localities in the Czech Republic.

Key words: Deer ked (*Lipoptena cervi*), Roe deer (*Capreolus capreolus*), Red deer (*Cervus elaphus*), Fallow deer (*Dama dama*)

Comparison of vegetative and reproductive fitness of *Orchis purpurea* in natural habitats

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Most *Orchideace* family species are threatened with extinction as a consequence of the loss of suitable habitats caused by inconvenient management or advancing habitat deterioration. Recent orchid protection research is mainly focused on the conservation and distribution of existing populations to prevent the loss of diversity natural habitats. Due to the significant loss of natural habitats in the Czech Republic as well as abroad, the lack of plants flexibility, their specific traits and complicated distribution to new suitable habitats, it is assisted translocation that appears to be a new challenge in *ex situ* sphere (Swarts and Dixon 2009). Our research of *in vitro* germination is focused on *Orchis purpurea* in five monitored populations in Czech Republic. Populations of these sites are of different abundance. The aim is to investigate if populations with small abundance are endangered with lower germination and might be limited by this factor in the future. There is also a hypothesis based on the possible correlation between vegetative and reproductive fitness (smaller plants mean a smaller reproductive ability). We suppose that this kind of research can contribute to better understanding the important biological aspect of *Orchis purpurea* – an endangered taxa of Czech flora (C2b – Grulich and Chobot 2017) and help to explain the factors inevitable for successful germination not only *in vitro* but also in monitored habitats.

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Keywords: *Orchis purpurea*, *Orchideace*, germination, *in vitro*, reproductive fitness

Sorpce amonných a dusičnanových solí v biocharu v závislosti na pH

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Ne všechny státy mají kvalitní a vydatné zdroje surové vody vhodné k úpravě na vodu pitnou. Snížená kvalita a vydatnost těchto zdrojů vede k řešení dodávky vody prostřednictvím použití alternativních zdrojů. Takovým alternativním zdrojem může být například mírně znečištěná odpadní voda, která je vícestupňově přečištěna. U každého z čisticích stupňů je vhodné hledat takové nastavení parametrů, které zajistí maximální efektivitu procesu. Jedním ze stále častěji se objevujících prvků systému je využití fyzikálně chemických vlastností biocharu. Biochar, používaný jako sorbent v širokém spektru aplikací, se jeví být velice efektivním při čisticích procesech odstraňující NH4+ a NO3- z vodných roztoků. Popisovaný experiment ukazuje závislost sorpce těchto iontů z laboratorně připravených roztoků na pH v rozsahu 4-8,5. Testovaný biochar (Olešnice, max.pyrolytická teplota 650°C) byl propírán 0,05M HCl, poté 1M CaCl2 a nakonec deionisovanou vodou, aby se rozpustily a odstranily přítomné soli a alkálie a zajistila se homogenní iontová saturace. Kromě laboratorně připraveného roztoku byla ještě sorpce NO3- ověřena na vodě z reálného prostředí s přirozeným obsahem těchto iontů, konkrétně z vybudovaného mokřadu upravujícího zemědělskou drenáž ve Velkém Rybníce. Obě měření prokázala, že pH roztoku je velice podstatným parametrem při nastavování podmínek pro čisticí procesy, kdy je jako médium použit biochar.

Biotope natural swimming pool and new method of mechanical cleaning

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Natural biotope pools are a new trend in water recreation and are becoming increasingly popular. Water in biotope swimming pools is not chemically treated and is suitable for all-day bathing especially for children and individuals with respiratory and skin problems. Biotope pools also have low purchase and operating costs compared to chemically treated pools. Water purification takes place in a cleaning lake with the participation of plants, algae, bacteria and other aquatic organisms. However, every biotope swimming pool has a limited capacity of natural cleaning. How to guarantee water quality and biological cleaning functionality despite the large number of visitors, even during tropical summer days? Water technologist Ing. Pavel Rada created a unique method in the Prague biotopes Lhotka and Radotín. This method removes excess nutrients from the water and guarantees its excellent aesthetic and hygienic quality. It is a regular mechanical cleaning, during which sediments are removed from the bottom of the cleaning lake. Depending on the blowdown intensity, it can remove several hundred kilograms of sludge from the bottom of the cleaning lake each week. The sludge water then passes through a system of sedimentation tanks where the sludge settles. The purified water is then returned to the beginning of the cleaning lake for cleaning. My diploma thesis dealt with the effectiveness of this method. Systematic sampling took place throughout 2018 and their subsequent analysis in the laboratory of the Faculty of the Environment proved not only the functionality of biological treatment, but also the positive effect of mechanical treatment on water purity. At the end of the purification lake the concentrations of phosphorus, nitrogen and carbon were always lower than at the beginning. All knowledge can be applied in the design of future natural swimming pools or, based on them, to increase the efficiency of maintenance in existing swimming pools with natural bathing water purification.

Keywords: natural biotope swimming pool, natural water purification, maintenance of natural swimming pool

Environmental impact of human burial

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The dissertation thesis is focused on territorial demands, for burial and mapping of individual rituals with respect to cultural differences. Personal experiences from travel and research are also processed. The main world religions and their burial cultures are mapped. A catalog of visited cemeteries is made from the findings. This catalog inspired the creation of the Manual for the design of cemeteries with regard to religious practices, which is also part of the work. Each sheet of the catalog maps the individual cemetery, its location in the village. We can also find a few pictures taken at the burial ground, more information on the history and what legislation is applied to the burial ground. The last part of the thesis is the Design of a Multicultural Cemetery in Prague. This is a simplified architectural design on a plot on the banks of the Vltava River in Karlin. The proposal takes into account the needs of individual religious cultures and aspects of the land.

Keywords: Burial, death, world religions, manual, design, urbanism of cemeteries.

Estimation of effective precipitation and recharge of “El Culebrón” aquifer

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The aim of this study is the estimation of effective precipitation and recharge of “El Culebrón” aquifer. “El Culebrón” watershed is in an area with climatic transition between the Atacama hyper-arid desert and the Mediterranean climate of Central Chile. The rain on the semi-arid coast of Northern Chile is concentrated during winter and southern spring. The estimation and study of recharge were analyzed by ESPERE (Estimation of effective precipitation and recharge according to different methods), a spreadsheet for assessing the recharge of an aquifer. This spreadsheet compares different hydrological methods: Thornthwaite, Dingman-Penman, Dingman-Hamon, Turc and recharge using the variability of Water Table Fluctuation (WTF). In the rough calculation, the different methods integrate daily precipitation, temperature, evapotranspiration, porosity, surface of the watershed, latitude, the minimum and maximum volume of soil storage, flow, in this case, the flow of “Bella Vista” artificial canal. The results of the annual recharge (mm/year) of the aquifer through the methods of Thornthwaite, Dingman-Penman, Dingman-Hamon, and Turc are negligible. These methods are negligible because in this extremely arid zone precipitation is so low, that it can be completely neglected. On the contrary, by the method of "Water Table Fluctuation", recharges are estimated between 280mm for the years 2007 and 2008, and a recharge of 300mm between the years 2010 and 2011. From 2012 water table of aquifer “El Culebrón” is declined. According to INGEOREC, 2010 the waters of the “Bellavista” canal, from irrigation spills, represent the main source of recharge of the aquifer in 80 or 90%, and between 10 and 20% from rainfall or lateral contributions from the “Lagunillas” aquifer, located south of the “El Culebrón” aquifer.

Evaluation of regeneration effect from hydrodynamic test on wells

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Work deals with evaluation of regeneration effect from hydrodynamic tests on wells. Practical part of this work has wells on locations (Velký Hubenov - region of Ústí nad Labem and Machnín - region of Liberec), regeneration was made by pumping test. Followed by the evaluation of the measured data. The all results of the individual measurements before and after regeneration by pumping test are discussed.

Keywords: hydrodynamic test, borehole, additional resistances, regeneration

Development of a microsatellite marker set for population genetic structure estimation of *Peucedanum cervaria* (Apiaceae)

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Phylogeography of dry grassland species remains a largely unexplored area of study. Yet these postglacial migration patterns are imperative to understanding the distribution of these highly valuable and under protected areas. The study species, *Peucedanum cervaria* (Apiaceae), is a characteristic species of Central European dry grassland ecosystems. In order to determine population genetic variability and the history of *P. cervaria* in Central and Eastern Europe, six microsatellite markers specific to this species were developed. It has been determined that there are several independent genetic lineages present in Central and Eastern Europe. On one side, there is a lineage specific to northern Central Europe that has a relationship to populations occurring in the Bohemian Massif. On the other side, there are lineages occurring exclusively in Carpathians, unique from all delimited lineages, including Czech ones. Finally, lineages occurring in the Pannonian Lowland are also present in the Czech Republic. All analyzed Czech populations are derived from populations occurring in Pannonia. While German and Poland populations represent separate lineage.

Keywords: microsatellites, Peucedanum cervaria, population genetic structure

The interspecific variability of ladybird immunity and its response to stress conditions

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Ladybirds (Coccinellidae) are the family of more than 6,000 species of beetles living worldwide. They differ in size, colour, territory, but also by type of nutriment. The best known are species that prey on aphids and scale insects. But some coccinellid species prey also on other arthropods or consume plant food. We compared immune reactions of 24 selected species of this large family, especially European species. The determined concentration of circulating haemocytes, antimicrobial activity against Gram-negative (*Escherichia coli*) and Gram-positive (*Micrococcus luteus*) bacteria were compared with fundamental physiological parameter, the total concentration of proteins in haemolymph. The comparison of basic immune parameters focused mainly on differences between species varying in ecology and invasiveness. Since harlequin ladybird (*Harmonia axyridis*) is an important invasive species, we further test its response to overwintering by measuring above mentioned immune parameters in individuals which were bred in different overwintering conditions. We have found that species from genera *Harmonia*, *Ceratomegilla* and *Hippodamia* have strong antimicrobial activity. Some other species, like seven-spot ladybird (*Coccinella septempunctata*) or two-spot ladybird (*Adalia bipunctata*), showed intermediate level of activity, but in many species we did not detected any antimicrobial activity against tested bacteria. Interestingly, three genera of ladybirds with strong immune activity had also the lowest concentration of proteins (50-80 mg/ml), whereas most of other species had concentration among 100-250 mg/ml.

Keywords: innate immunity; ladybird; antimicrobial activity; haemocyte concentration; total protein concentration; *Harmonia axyridis*; harlequin ladybird; antimicrobial peptides

Identification of infested trees using unmanned aerial vehicles

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Jehličnaté lesy mírného pásu se stávají ohroženými ekosystémy díky rostoucí nákaze lýkožroutem smrkovým. Cílem řady vědeckých studií je proto z různých úhlů pohledu najít jakýkoli vhodný nástroj, který by šíření lýkožrouta smrkového eliminoval nebo alespoň zpomalil. Této problematice je v posledních letech věnována zvýšená pozornost, přesto zatím neexistuje komplexní a zároveň efektivní řešení. Přitom detekce napadení porostů (na úrovni jednotlivých stromů) je důležitá nejen z ekonomických, ale i z výše zmíněných ekologických důvodů. Jedním z možných podpůrných nástrojů pro detekci napadených stromů je využití bezpilotních leteckých systémů. Této problematice se věnuje metodika, která podrobně popisuje kroky zpracování dat pořízených dronem až k vlastní identifikaci napadených stromů.

Keywords: bark beetle, outbreaks detectability, photogrammetry, object-based classification

River phenomenon is reflected by higher species saturation of recent forests in river valley

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Higher plant species richness in river valleys compare to surrounding flat landscape is the main assumption of the river phenomenon. However, we lack the studies which would estimate how plant colonization contributes to such a great accumulation of species in relatively small areas of river valleys. We supposed higher colonization rate of plant species in recent forests of river valleys compare to surrounding landscape. Data was collected along the large transect starting in the Elbe valley and ending outside the valley using 40 phytosociological plots distinguished to recent and ancient forests. Simultaneously, forest species were distinguished due to their strong affinity to forest environment and they were chosen for creating a separate group to analyse. Distance from the river bank was correlated to plant richness using a generalized linear model (GLM) with Poisson distribution. The results were similar for both patterns of all and forests species. In opposite to our expectation, higher species richness was associated with sites outside of the valley. Nevertheless, the results indicate that plant species colonization rate was a higher in river valleys than in surrounding landscape and confirmed the main hypothesis. Plant species colonized recent forests in the river valley more successfully. The study reveals that plant species richness in river valleys is affected by higher colonization rate which result into higher species saturation of recent forests.

Keywords: river phenomenon, plant colonization, forest age, plant species richness

Safety mapping of the vegetation along the transport infrastructure

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Tree detection in forested and non-forested areas is currently possible thanks to the fine resolution of imagery obtained using Unmanned Aerial Vehicle (UAV). UAV can significantly improve the yield of the necessary information at the individual tree level. At the present time, this information is acquired by a ground measurement method, which is very ineffective and often not a sufficiently accurate way of data acquisition in terms of time, personnel and economics. Furthermore, information about the state of the trees is a necessary basis for the selection of tenders aimed at their maintenance. To identify potentially dangerous trees photogrammetric method Structure from Motion was used - to process images to generate point clouds and subsequently Digital Elevation Models. Digital Terrain Model represents the elevation of the ground, which can be detected in open canopy forests, while Digital Surface Model, comprising all objects on Earth's surface, can be detected even in close canopy forests. Based on these two models Canopy Height Model can be derived and individual tree height estimated. Trees whose height is bigger than their distance to roads or railways are considered dangerous to the passengers or the transport infrastructure itself. They are shown in point layer including information about their height, location and distance from the infrastructure section. Potential users to whom the project responds directly are Railway Infrastructure Administration and Road and Motorway Directorate of the Czech Republic.

Keywords: Canopy Height Model, Structure from Motion, Unmanned Aerial Vehicle

Local climatic characteristics and their inclusion in process of seed orchards layout development

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Seed orchards (SO) are one of the most important sources of seed crop. Seed crop orriginated form SO is used for afforestation and reforestation and characteristics of seed crop affect properties of future forests. Functioning of SO is determined by many factors. The first factor is the type of the SO (clonal/seedling). Second factor is the genetic quality of selected individuals and their representation (genetic gain/diversity ratio) in SO. Third is the placement of individuals in SO area. The way, how the individuals are placed is called design. Using a particular design a specific layout is created (Zobel and Talbert 1984). It is known that the distance of two trees affects the probability of their crossing. For this reason SO design influences properties of the seed crop (White et al. 2008). However, there are other circumstances effecting the crossing scheme: wind blowing direction and the location of beehives. These ecological factors, are not taken into account by any currently known SO design. For this reason, the new approach has been created, which involves the direction of the prevailing winds in SO layout generation process. The orriginal Optimum neighborhood algoritm (ONA) design (Chaloupková et al. 2016) R code was used and extended and resulting sheme is presented here. In this scheme, the prevailing wind blowing direction in CZ is involved. The isue was solved by adapting the potential range of pollen distribution of each individual. The original range of the optimized area (8 positions) was expanded to suit defined clima. This approach is particularly beneficial for operational forestry and forest managers.

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White, T., Adams, T., Neale B. Forest genetics. USA and CK: CABI publishing, 2007.

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Keywords: Reforestation, Climatic Conditions, Seed Orchard design, Optimum Neighborhood Algorithm

GEO-BI – Geoinformation portal for invasive species

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Invasive alien species (IAS) monitoring and their appropriate management planning are key problems of nature conservation. Once non-native species exist in an area, predictions of future spread are important for management approach selection and evaluation of the practical feasibility of possible further actions. The main purpose of the geoportal is to help land managers to stop or reduce the spread of IAS across the country, to create a useful tool for planning regional IAS management strategy and thus protect the environment and economy from IAS impacts. **What does GEO-BI include? 1. Maps of species' current distribution** – using both published and yet unpublished data to illustrate the selected IAS current distribution based on net-mapping. **2. Prediction models of maximal potential distribution** – using species distribution modelling tools built on presence or presence/absence data shows the particular species area of suitability and environmental limits of further spread under contemporary conditions. **3. Mechanistic models of local spreading** – using a combination of spread probability based on spreading vectors, species ecology, habitat characteristics, and species distribution shows the possible local species spread modelled in a GIS environment. The input data for all three above named sections of the geoportal are gained from the Digital Register of the Nature Conservation Agency of the Czech Republic.

What are the GEO-BI goals? IAS distribution and predictive maps show where the species are present and most likely to be able to spread. The predictive GEO-BI maps may affect decision-making of management at a landscape level and coordinate regional strategic

mapping, planning, and implementation of IAS control projects. The GEO-BI maps can also serve as support to secure funding for strategic IAS control projects and policies.

Keywords: control, eradication, geoportal, GIS models, invasive alien species

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Two shades of grey: xerophytes from garden beds as invaders of native vegetation?

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Public parks and private gardens are sources of new potentially invasive plants, escaping from ornamental garden beds, lawns, and hedges. The majority of studies are focused on invasions from plantings to mesic habitats via traditional spreading vectors (transport, watercourses, railways, etc.). Invasions to dry semi-natural and natural habitats are largely overlooked, even though semi-natural dry grasslands are often directly connected with gardens and plantings in warmer areas of Central Europe. Identification of potentially invasive xerophytes and description of their ecology can help prevent their further spread. The objective of our project is a comprehensive study of the potentially invasive alien species Stachys byzantina and Lychnis coronaria. Both species are escaping from cultivations and form stands that reduce the diversity in the herb layer of ornamental plantations and, after escaping, also in their close surroundings. It is possible, therefore, that these species with high invasive potential (escape from cultivation was recorded throughout the Czech Republic) can continually reach natural biotopes and create viable naturalised populations with high impact on the environment. The study is aimed at identification of (i) reproduction traits rate and mode of spread, germination of seeds (generative reproduction) (ii) cytological variability of the plants using flow cytometry (ploidy levels and genome size). Generative reproduction of both species is significantly influenced by temperature: the germination rate was high for L. coronaria at 15 - 22°C

(99%) and for S. byzantina in a range from 3.3% (15°C) to 63% (22°C) in contrast to temperatures under 10°C (L. coronaria 2.7%, S. byzantina 0%). All studied populations of both species reach approximately the same genome size.

Keywords: alien plants, generative reproduction, germination, ornamental plants, spreading

Predicting the toxicity of ionic liquids toward acetylcholinesterase enzymes using novel QSAR models

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Limited information on the potential toxicity of ionic liquids (ILs) becomes the bottleneck that creates a barrier in their large-scale application. In this work, two quantitative structure-activity relationships (QSAR) models were used to evaluate the toxicity of ILs toward the acetylcholinesterase enzyme using multiple linear regression (MLR) and extreme learning machine (ELM) algorithms. The structures of 57 cations and 21 anions were optimized using quantum chemistry calculations. The electrostatic potential surface area (S_{EP}) and the screening charge density distribution area (S_{σ}) descriptors were calculated and used for prediction of IL toxicity. Performance and predictive aptitude between MLR and ELM models were analyzed. Highest squared correlation coefficient (R^2), and also lowest average absolute relative deviation (AARD%) and root-mean-square error (RMSE) were observed for training set, test set, and total set for the ELM model. These findings validated the superior performance of ELM over the MLR toxicity prediction model.

Key words: Toxicity, Ionic liquids, Acetylcholinesterase enzyme, Extreme learning machine, Multiple linear regression

Genetic lineages of brown bear (*Ursus arctos*) in the Slovak Carpathians

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Brown bear (*Ursus arctos*) as a large omnivorous mammal was substantially affected by Pleistocene oscillations of the climate. Although today it is the most widespread species of the bear family, there is currently only occasional occurrence in the Czech Republic and it was almost extinct in Slovakia 100 years ago. The genetic structure of this largest European carnivore in Slovakia is given both by demography during the last glacial period and it was also affected by anthropogenic factors in recent. Two mitochondrial lineages have been detected in the Slovak Carpathians – first (clade 1) is found in eastern Slovakia (on the border with Ukraine and Poland). The second lineage (clade 3a1) occurs in the whole Slovakia and also at the Slovak-Czech border in the Javorníky area. We are now working on a project in cooperation with the State Nature Conservancy of Slovak Republic to get more detailed data about distribution, genetic structure and ecology of the western Carpathian population. We also cooperate with Nature Conservation Agency of the Czech Republic and Friends of the Earth Czech Republic to get the information about individuals occurring at the Czech side. All information from invasive and non-invasive genetics integrated with geographic approaches will be also used in conservation management of this species.

Keywords: phylogeography, mtDNA, Carpathians

Differences in photosynthetic pigments content of *Fagus sylvatica* L. from various provenances

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European beech is one of the most important trees in Europe. Its geographic distributional range spans from south to north of Europe, from lowlands to montane regions. It refers that european beech has substantial genetic diversity. We investigeted seedlings of european beech from 3 provenances and from various altitudes. Samples were collected in Denmark from 2-years-old seedlings in September. We compared content of chlorophylle a, chlorophylle b and carotenoids. Statistically significant differences among beech provenances were found.

Keywords: chlorophyll, European beech, provenances

Perennial ornamental plantations as a source of plant invasion: long-term trends in species compositions

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Ornamental plantations are typical for a broad range of human-made habitats such as gardens, parks or urban spaces. Nowadays, so-called low-maintenance perennial beds are becoming popular in horticulture and urban planning. Due to a low level of management

and a good record of the time of establishment and planting, they provide a suitable study system for analysis of individual species' survival and how it depends on their traits. Monitoring of the population processes (survival, reproduction, spread) thus can provide detailed information about the naturalization and community assembly processes within the scope of one of the most important source of alien plants, horticulture. We studied perennial flowerbeds in the Czech Republic with a known initial composition at the time of establishment in 2006–2010 and compared them with the state in 2016. The flowerbeds were initially planted in publicly accessible part of the garden for ornamental purposes and harboured diverse species compositions. We tested the effect of biological traits of species (height, vegetative and generative reproduction, SLA) on their survival and spread, and analysed the change over time in species composition, richness and diversity. We found that the height of plants and generative reproduction had a positive effect on the survival of individual taxa. Taxa taller than 1 m with massive and regular generative reproduction survived best. *Aquilegia* sp., *Aster dumosus, Knautia macedonica* and *Silene coronaria* spread most easily into neighbouring areas. In terms of flowerbed compositions and their 10 years dynamics, highly diverse prairie assemblages were most stable, and the most successful group of taxa were those of North American and Mediterranean origin.

Keywords: flower beds, long-term monitoring, community, species origin, diversity, survival

Kutlvašr J, Pergl J, Baroš A, Pyšek P (2018): Survival, dynamics of spread and invasive potential of species in perennial plantations. Biological Invasions, 21(2), 561–573. https://doi.org/10.1007/s10530-018-1847-4

Vodní ptáci v světle měnících se klimatických a environmentálních podmínek

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Zájem lidí o vodní ptáky sahá ještě před počátky lidské civilizace. Shromaždiště a tahové zastávky znali určitě již pravěcí lovci. Po druhé světové válce se většina populací vodních ptáků v Západní Palearktidě i v jiných částech naší planety nacházela v žalostném stavu. Mnohým z nich dokonce hrozilo vyhubení. Snahy po jejich ochraně i potřeba získání věrohodných údajů o jejich početnosti vedly až k mezinárodně koordinovanému monitoringu populací vodních ptáků, jehož výsledky jsou dodnes využívány k ochraně druhů a jejich stanovišť. Současné studie prokazují výrazné změny početnosti zimujících vodních ptáků na úrovni jednotlivých států či areálů tahových populací příslušných druhů. Převažujícím trendem je nárůst populací a posun jejich zimovišť z jihozápadní do severovýchodní Evropy. K nárůstu početnosti většiny druhů ale dochází i na středoevropských zimovištích, a tedy i v České republice. Na našem území se dlouhodobě zvyšují například počty zimujících volavek, kormoránů, hus, většiny druhů kachen a racků. V mnoha případech se jedná o druhy, které mohou mít nebo mají silný dopad na zemědělství (herbivorní druhy jako jsou např. husy) či rybářství (rybožravé druhy jako jsou např. volavky a kormoráni).Ačkoliv v posledních přibližně 10 letech vznikla řada publikací analyzující změny početnosti a distribuce zimujících populací, víme stále jen málo o změnách struktury populací, které by nám mohly naznačit, jakým směrem se ubírá jejich natalita či mortalita, které právě mohou být hybateli rozsáhlých populačních změn. Ukazuje se tedy, že ačkoliv více než 50 let intenzivního mezinárodně koordinovaného monitoringu vodních ptáků přineslo mnoho cenných výsledků, včetně významných publikačních výstupů, stále toho spíš více nevíme. Na druhou stranu i po dlouhých desetiletích se objevují nové a zajímavé poznatky. Současně může být monitoring vodních ptáků i inspirací pro projekty začínající v současnosti, které je třeba zakládat tak, aby mohly přinášet výsledky i po 50 letech.

The Litavka River floodplain: Unwanted legacy sediment

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Floodplain sediments are often used for reconstruction of the historical impact of human activities on river ecosystems. The Litavka River flows through the "Příbram Ore district" which is very well known for its long history of polymetallic ore mining (Pb, Zn, Ag, Sb, and U) since medieval times with peak in the 19th century. Collapses of tailing dam during floods in 1932 and 1952 resulted in release of mining waste to the Litavka River and deposition of approximately 1.7 m thick layer of polluted sediment downstream in the floodplain near Trhové Dušníky. Due to the continuous erosion, this area became the main source of pollution for the downstream river system. The aim of this work was an estimation of the amount of material and concentrations of toxic elements released during annual flooding cycles and assessment of recently deposited sediment contamination along the Litavka River after flooding in June 2018. We sampled erosion banks from two sites - Trhové Dušníky (TD) and Valcha (VAL). Concentrations of Pb, Zn, Cu and Cr were measured using X-ray fluorescence spectroscopy and Hg concentrations were measured using cold vapour atomic absorption spectroscopy. Concentrations of all evaluated toxic elements exceeded legislative limits for Czech soils. We assessed the lateral channel shift (using ArcGIS) between years 2011 – 2013 and we also estimated the quantity of eroded material (227 t in TD and 83 t in VAL, respectively), and the level of associated toxic element release. Recent sediments deposited after the flooding in June 2018 exhibited decreasing concentrations of toxic elements with increasing distance from the Trhové Dušníky area. Over a distance of 37 km mean values of Pb and Zn near Trhové Dušníky decreased from 2039 mg/kg Pb and 2584 mg/kg Zn to 99 mg/kg Pb and 394 mg/kg Zn in Beroun. The floodplain near Trhové Dušníky still remains an environmental threat which will require enforcement of measures to prevent further erosion of polluted sediments.

Keywords: geochemical archives, the Litavka River, floods, erosion, sediment pollution, floodplain sediments

State of territorial systems of ecological stability in Hodonín municipality with extended power

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This paper deals with the state of territorial systems of ecological stability in the territory of the municipality with extended competence, Hodonín, which manages 18 municipalities, each of which has one cadastral area. Specifically, this looks at five municipalities: Čejč, Čejkovice, Mutěnice, Starý Poddvorov, Nový Poddvorov. It analyses the situation at the time of planning and today, considering the state of implementation of the planned network. Orthophoto images and field survey were used for verification. The results were then displayed using ArcGIS. The results show that 76.7% of the proposed areas for TSES already exist, 6.9%, partly exist and 16.4% do not exist at all. In further analyses it is necessary to broaden the analysis to the verification of target communities and the correct proportions of individual elements according to the approved methodology.

Keywords: Territorial system of ecological stability, Hodonín

Projection of Changes in Future Precipitation over Rajasthan Using LARS-WG

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In the recent years, climate change and management of water resource has become a serious concern in many parts of the world including India. Although, the Global Climate Models (GCM) are the primary source of future projection used for various climate related research, the coarser spatial resolution hampers its direct use in regional scale studies. In this study, the climate projections from two global circulation models (HadCM3 and GFCM21) are used with the statistical downscaling tool LARS-WG5 (Long Ashton Research Station Weather Generator) to generate future precipitation over Rajasthan, India. The Indian Meteorological Department (IMD) grided precipitation data from 1976-2005 are used as reference period. Three future periods are used for the analysis, i.e., early century period 2011–2040 (2025s), a mid-century period of 2041–2070 (2055s) and a late-century period of 2071–2100 (2085s). Based on results, it is observed that there is a possible decrease in monsoon precipitation at many grid points for all the three future periods. The maximum decrease in rainfall (−142 mm) is observed in Banswara (southern region) for the period 2041–2070, while the maximum increase (37 mm) is found in Alwar, along with Churu 1 and Ganganagar (northern region) during the period 2071–2100. The results of this study will serve as reference for future studies and can be beneficial for decision makers and water resources planners to understand the probable changes in future precipitation in water scarce state of India.

Key words: Precipitation, Global Circulation Models, Monsoon projections

Water regime of the soil when mulching cotton crops

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In the arid zone, the water availability of plants is the main factor determining the amount of yield and product quality. The plant uses moisture to synthesize organic matter, and it increases the formation of saline and colloidal solutions in the plant. Basically, moisture is used by the plant for transpiration. Soil moisture affects soil formation processes and the development of microorganisms in the soil. Determination of soil moisture reserves under agricultural crops is necessary to calculate the irrigation rate, the choice of crops that would use the maximum amount of moisture for the formation of organic matter. The article presents the results of a study of the water regime of soils in the serozem-oasis soils of Uzbekistan with irrigation using mulching in cotton fields. The studies were conducted on three field sites: the control variant (without mulching) and using two types of mulch materials (polyethylene film and manure). The studies were conducted to identify the distribution of moisture in the soil column under irrigation with mulch during the vegetation period and its effect on the formation of water regime in the soil. As a result of the study, it was noted that mulching with plastic wrap and manure ensures the maintenance of a moister soil condition. It has been established that a transparent polyethylene film has a greater effect on the soil water regime than in the variant with manure.

Keywords: mulching, polyethylene film, manure, serozem soil, water regime, cotton.

Distribution of Organic Pollutants in Hunhe River and Removal Efficiency of Microcystins by Nanofiltration

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According to the characteristics of industrial and agricultural production in the Hunhe River Basin, the surface water of Hunhe River was selected as the research object and eight samples sites were selected. Treated by SPE, the water samples were analyzed by HPLC, Gas chromatography (GC) and enzyme-linked immunosorbent assay (Elisa) for the pollutants of bisphenol A (BPA), polycyclic aromatic hydrocarbons (PAHs) and microcystins (MCs). The results show that the detection concentration of BPA in Hunhe River is between 0μg/L and 0.23 μg/L, downstream of Dahuofang Reservoir, Dongzhou District, Hunhe Bridge, BPA is detected in Fushun Xiaxian and Changqing Bridge three times, but only in July and October in Shenfu Irrigation canal and Hunhe sluice. The content of BPA in Hunhe River is higher in summer, and the detection concentration is between 0.02μg/L and 0.23μg/L, and the detection concentration is around 0.010μg/L in autumn. For sixteen kinds of PAHs, the content is between 0μg/L and 0.55μg/L. As a result, the changes of climate in different seasons influence the contaminants concentration. MCs are not detected in other sampling sites except the samples in Dongzhou in May with the detected concentration of 0.18μg/L, which indicates the trend of eutrophication is moving northward. Desal 5 DL and Desal 5 HL nanofiltration membranes were used to investigate the retention performance of MCs. When the filtration volume increased, the retention rates of DL and HL increased, respectively, because with the increase of operation time, more MCs were adsorbed on nanofiltration membranes, resulting in more and more substances being intercepted. And both membranes adsorption of capacity decreased with the increase of solution filtration volume. Therefore, in the process of nanofiltration, the chemical materials that make up the membrane have a certain adsorption effect on MCs and will cause a certain extent contamination of the nanofiltration membrane.

Keywords: Solid phase extraction, Polycyclic Aromatic Hydrocarbons, Bisphenol A, Nanofiltration, Microcystins

Evaluation of vulnerability indicators in urban areas

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CENIA (Czech Environmental Information Agency) was tasked with the evaluation of so-called vulnerability indicators, which are part of the National Action Plan on Adaptation to Climate Change. Demarcation of urban 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, land surface temperature of the city and the proportion of urban greenery with water. Conditions for defining the boundary of the urban 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. Using of this analysis in the future to evaluate other indicators is dependent on size of the scale. The identification of the urban 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 (Maximum Likelihood) of Sentinel satellite imagery and the subsequent use of grid. The chosen procedure was applied to several selected cities, which varied in both the size and variety of landscape coverage. The identified urban area was discussed and subsequently approved by experts from the Ministry of the Environment. This 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) for further analyses.

Keywords: cities, landscape coverage, Maximum Likelihood, remote sensing data, urban greenery, water areas

Assessment of heavy precipitation event using satellite data: a case study in the Uttarakhand, India

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As a consequence of global warming, the global hydrological cycle has been influenced. Heavy precipitation is an uncertain and catastrophic natural event that results in devastation, and socio-economic losses worldwide. In this study, we aim to recognize the variability in hydro-meteorological variables during heavy precipitation over the Uttarakhand, India. Moderate Resolution Imaging Spectroradiometer (MODIS), Tropical Rainfall Measuring Mission (TRMM), Decision Support System for Agrotechnology Transfer (DSSAT) were used to retrieve meteorological data. The meteorological parameters such as atmospheric temperature, precipitation, and relative humidity were analysed, before and after the heavy precipitation event. The results show that during the two days of heavy precipitation (16th and 17th June 2013), the relative humidity was higher (95%), the rainfall was higher (102.28 mm on 16 June 119.23 mm on 17 June 2013) and the temperature was low (14.33°C and 13.38 °C on 16th June and 17th June respectively). It is anticipated that because of variation in temperature and relative humidity, a maximum amount of cloud got condensed at a very rapid rate and resulted in heavy rainfall over the Uttarakhand, India.

Keywords: Heavy Precipitation, Global Warming, Relative Humidity, Tropical Rainfall Measuring Mission (TRMM)

Climate change Impact mean annual runoff of 501 years across European continental using Budyko hydrological balance model

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This study is focused to assess the climate change impact on runoff during 501 years (mean-annual runoff) over the European continental using Budyko Hydrological balance model. The model uses the temperature based Hamon potential evaporation. The primary result shows that the runoff has declined over south Europe. The correlation among the precipitation, runoff and the potential evaporation has also found similar to runoff. This relation is useful to the projection of global hydrological modeling with impact of climate change. The significance of Budyko equation is to simulate the large-scale runoff with impact of climate change specially for data limited area. The limitations of Budyko model is to estimating the mean annual change runoff using the change mean annual potential evaporation and precipitation.

Keywords: runoff, precipitation, potential evaporation Budyko model

A new species of Oiceoptoma Leach, 1815 (Coleoptera: Silphidae) from eastern China

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A new species of *Oiceoptoma* Leach, 1815 from Zhejiang Province, China, is diagnosed and illustrated. The new species is closely related to *O. subrufum* (Lewis, 1888), distributed in central and north-eastern China, Korea, Eastern Russia and Japan, and *O. nigropunctatum* (Lewis, 1888), endemic for Japan. Distribution maps of all three species are presented.

Key words: Coleoptera, Silphidae, Silphinae, *Oiceoptoma*, taxonomy, new species, description, China, Palaearctic Region

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Occurrence of the family Ochodaeidae (Coleoptera: Scarabaeoidea) in the Arabian peninsula

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First country records of *Ochodaeus carinatus* Benderitter, 1913 from Oman and Yemen are presented. These data represent the first report of occurrence of the family Ochodaeidae in the Arabian peninsula. Currently *O. carinatus* is known from all of Horn of Africa (Djibouti, Eritrea, Ethiopia and Somalia (both Somalia and Somaliland)), Kenya, Oman and Yemen. Known distribution in the Arabian peninsula is mapped.

Key words. *Ochodaeus carinatus*, Ochodaeidae, Coleoptera, distribution, first record, Afrotropical region, Palearctic region, Arabian peninsula, Oman, Yemen

Acute toxicity effects of neonicotinoid pesticide on aquatic organisms

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During the past two decades, neonicotinoids are the most widely used insecticides in the world and their agricultural use is increasing worldwide, posing a risk to nontarget organisms. These substances are characterized by low toxicity to vertebrates and high toxic effect on invertebrate organisms. Thiacloprid is one of them most frequently used active ingredients in agriculture crops to control of a variety of sucking and chewing insects. The present study investigated the basics information about acute toxicity of widely used insecticide Calypso 480 SC (containing 48% thiacloprid) to nontarget organisms living in different surface waters. A 48-h effective concentration associated with 50% reduction in mobility (48hLC50) or lethal concentration associated with 50% mortality (96hLC50) were evaluated on model organisms. Calypso 480 SC had the lowest acute toxicity dose 96hLC50 on freshwater species red swamp crayfish (*Procambarus clarkii*), 1.55 mg L^{-1}, followed by fish guppy (*Poecilia reticulata*), 83.30 mg L^{-1} and Mediterranean mussel (*Mytilus galloprovincialis*), 7.77 g L^{-1}, inhabiting brackish waters. The 48hEC50 for freshwater *Daphnia magna* correspond to 32.70 mg L^{-1}. These results contribute to ongoing and future evaluations of neonicotinoid insecticide use, and provide data on the relative acute toxicity of one of these compounds to a sensitive and ecologically relevant nontarget aquatic species as little is known regarding adverse effects.

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Keywords: insecticide, acute toxicity, non-target organisms.

Analysis of spring beaver diet composition in Telemark, Norway

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Determining diet is essential for understanding ecology of species and their management. Eurasian beaver diet consists of three basic components: trees, terrestrial plants and aquatic plants. Most of previous research were primarily concerned with composition of different tree species in beaver diet, neglecting terrestrial and aquatic plants. For this work we used macroscopic scat analysis to determine presence of woody and herbaceous fractions (plants, grasses, water plants, moss) in beaver scat, as other available methods to study scat were ill-suited. In case of beavers, this method is not commonly used (mostly for *cervidae*). The proportional occurrence of each plant type was contrasted between different age groups, sex, reproduction status and social dominance using Wilcoxon test. For analysis we used 95 samples, collected from 2002 to 2018 in three different study areas in Telemark, South Norway, which included 16 beaver families. In almost every sample, wood and bark reached much higher numbers, sometimes outright outnumbered other food types. Yet the total numbers between years remained mostly similar and no significant change between groups of interest were found. In some cases, it could be explained by insufficient number of samples, in others by outside force, as in age (young kits depend on food provided by older animals) or different digestibility of food types (grasses). We found this method appropriate to study diet composition of beavers, which makes this work a great stepping stone for further research. Also, we suggest adding more samples and using advanced statistical methods in future.

Key words: *Castor fiber*, beaver, diet, composition, scat analysis, Norway, Telemark, Wilcoxon test

What is a suitable management for Typha latifolia control in wet meadow?

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Typha latifolia cause serious problems in wet meadows by overgrowing and suppressing other plants, especially short species. To find suitable management for *T. latifolia* control, the long-term experiment in Malá Strana nature reserve in Jizera Mountains was established in the year 2005. Experiment was arranged in randomised block design with three replications. The treatments were: unmanaged control (**U**); cutting yearly in June without biomass removal (**1O**) and with biomass removal (**1R**); cutting twice per year in June and August without biomass removal (**2O**) and with biomass removal (**2R**). Percentage cover of vascular plant species was visually estimated in experimental plots in June every year from 2005 to 2011 and in individual years 2013 and 2017. The results of RDA analysis showed that interactions year×cutting once per year and year×cutting twice per year significantly affected plant species composition. The effect of biomass removal was not significant for both cutting frequencies. Plant species composition of control treatment (U) and 1O was significantly different in comparison with two cuts treatments. *Typha latifolia* had the highest cover in the U treatment throughout all study period whereas the lowest cover was revealed in treatments cut twice per year (2O, 2R). Number of all vascular plant species increased in all treatments during the study period, but was lower in U than in all cut treatments at the end of the experiment. This long-term experiment showed the positive effect of cutting twice per year on plant species composition and richness of wet meadow. However, biomass removal had any effect. Regular cutting twice a year could be a sustainable management type in wet meadows with *T. latifolia* dominance especially in the sites with high conservation value.

Keywords: biomass removal, cutting, plant species composition, richness

On the correlation between aerosol optical depth and precipitation over hyperarid regions: A case study from the Arabian Peninsula

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Atmospheric turbidity plays a crucial and controversial role in the hydroclimatology of arid regions, with atmospheric aerosols both acting as rainfall inhibitors and enhancers. Aircraft observations and model simulations show that cloud development is strongly modulated by aerosols-cloud interactions at the microscales, during the drop formation process. However, the influence of aerosols on precipitation remains poorly understood due to our limited knowledge of the dynamical processes which drive cloud formation and trigger precipitation over a wide range of spatiotemporal scales. The effects of aerosols on precipitation mostly depend on the concentration of particles acting as cloud condensation nuclei, their chemical composition, size, and morphology. In recent years, the application of satellite data to characterize aerosol distribution has advanced dramatically through the systematic acquisition of aerosol optical depth (AOD). Although AOD is not a direct measure of the aerosol concentration in the atmosphere, but rather an estimate of the atmospheric optical depth, it poses as a proxy of aerosol concentration in the atmospheric column. Many studies have analyzed the coupling between aerosol abundance and precipitation. They mainly focus on the long-term influence (monthly/annual scales) of aerosols on precipitation onset, and the influence of transport processes. In this study, we investigate daily scales over the Arabian Peninsula, where precipitation events are highly sporadic and scattered in space. We use AOD data from MODIS and precipitation fields from TRMM, to determine the diverse correlation patterns between aerosols and rain occurrence across the region. Our findings establish a link between dust abundance and precipitation. This link is stronger, positive, and localized with convective and intense rainfall events, such as the ones that take place over the Peninsula during the spring.

Bioindication of Road Salting Impact on Norway Spruce (*Picea abies*)

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Winter chemical road maintenance has a significant negative influence on the environment. The application of chemical de-icing salts affects the trees growing near the road. Sodium and chlorine ions which are washed out into the environment are absorbed by the ambient vegetation; the increased concentration of these ions has a negative influence on the vegetation health. The determination of sodium and chlorine ions content in assimilative organs of conifers is used as a bioindicator of the impacts of winter chemical maintenance. The presented research paper evaluates the influence of the contamination potential on these ions content in needles of the Norway spruce (Picea abies). This species of spruce was chosen because of its abundant occurrence and heightened sensitivity towards salinization. The study was conducted in the north of the Czech Republic in the Liberec Region. To assess the damage potential of the winter chemical road maintenance, samples of the Norway spruce first- and second-year needles were collected and the sodium and chlorine ions concentrations were determined. At the same time, the research assessed the contamination potential of the region and the health condition of the analysed spruce trees. The results of ions concentrations (Na, Cl) were evaluated depending on four factors: the contamination potential, the health of the tree, the distance from the road and the age of the needles. Based on the evaluation of the results, a scale with framework concentration values was designed. This scale can be used for practical assessment of the degree of contamination.

Keywords: winter road maintenance, road salts effects, needles, sodium and chlorine ions

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