II. Natural Hazards and Climate Change Conference

Session 5 Plant Communities in Transition

Community changes caused by an invasive alien C4 grass, and a promising biocontrol tool to suppress it – *Alida Anna Hábenczyus, Csaba Tölgyesi, Róbert Pál, András Kelemen, Zoltán Bátori, Judit Sonkoly, Fanni Molnár, Kata Anna Bán, Kata Frei, Ádám Lőrincz, László Erdős, Zalán Czékus, Attila Ördög, Klára Terézia Kovács, Edina Tóth, Péter Török, Péter Poór*

Climate change-related decline of Robinia Pseudoacacia forests in Hungary: a microbiome analysis – *Boris Indic, Nóra Tünde Lange-Enyedi, Simang Champramary, Omar Languar, Attila Szűcs, Orsolya Kedves, Csaba Vágvölgyi, László Kredics, György Sipos*

Mapping the occurrence of Asclepias syriaca using AI methods based on geotagged landscape photographs – *Georgina Veronika Visztra, Péter Balázs, Ádám Makai, Ádám Katona, Márton Bence Balogh, Zalán Tobak, Péter Szilassi*

Stable carbon and oxygen isotope ratios in Norway spruce (Picea abies (L.) Karst.) tree rings along an elevation gradient in the Rarău Mts (Romania) – *Daniela Maria Llanos-Campana, Zoltan Kern, Ionel Popa, Aurel Perșoiu*

Sown wildflower strips in urban areas–a strategy to enhance biodiversity of arthropods – *Botond Magyar, Anna Viola Nagy, Helga Simon, Attila Torma*

Community changes caused by an invasive alien C4 grass, and a promising biocontrol tool to suppress it

Alida Anna Hábenczyus[1], Csaba Tölgyesi[1], Róbert Pál[2], András Kelemen[3], Zoltán Bátori[3], Judit Sonkoly[4], Fanni Molnár[3], Kata Anna Bán[3], Kata Frei[3], Ádám Lőrincz[3], László Erdős[4], Zalán Czékus[5], Attila Ördög [5], Klára Terézia Kovács[5], Edina Tóth[4], Péter Török[4], Péter Poór[5]

[1]MTA-SZTE 'Momentum' Applied Ecology Research Group, University of Szeged, Szeged, Hungary
[2]Department of Biological Sciences, Montana Technological University, Butte, Montana, USA
[3]Department of Ecology, University of Szeged, Szeged, Hungary
[4]HUN-REN-UD Functional and Restoration Ecology Research Group, Debrecen, Hungary
[5]Department of Plant Biology, University of Szeged, Szeged, Hungary

Invasive alien species pose a dreadful threat to natural ecosystems and their ecological functions. In particular, invasions of C4 perennial grasses promoted by global warming are of outstanding hazard. Here we evaluated stands of Sporobolus cryptandrus in its native North American range and its non-native European range, where it is a recent invader. Our aim was to reveal how the species' increasing abundance affects functional diversity and the ecosystem service-provisioning capacities of plant communities in each range. We also tested the effects of Odontites luteus, a native European hemiparasite, on Sporobolus, as a potential biocontrol agent. We found that increasing Sporobolus cover resulted in a lower functional diversity and species richness, reduced average specific leaf area and increased the average height of the plant communities in both ranges but these effects were significantly stronger in the non-native stands. Sporobolus also negatively affected the cover of insect-pollinated plant species and the proportion of native perennials, switching the rest of the community from perennial-dominated to annual-dominated. Thus, the spread of Sporobolus, away from its native range, leads to the impoverishment of host communities and compromises the biomass and floral resource-provisioning capacity of the vegetation to pollinator communities. Our results also showed that Odontites considers Sporobolus a suitable host and reduces its biomass production (and potentially its competitive ability) by approx. 50%, equalling the effect on Festuca vaginata, i.e. the major native host of Odontites. However, Festuca showed severe metabolic impairment under hemiparasite pressure. So, the application of hemiparasites is a promising biocontrol tool against Sporobolus, but we cannot expect a full eradication of it. Rather, thinning monodominant Sporobolus stands to allow certain populations of native species to come back is a more realistic goal, leading to a partial recovery of the former species composition and an improvement of ecosystem functions.

Climate change-related decline of Robinia Pseudoacacia forests in Hungary: a microbiome analysis

Boris Indic[1], Nóra Tünde Lange-Enyedi[1], Simang Champramary[1], Omar Languar[1,2], Attila Szűcs[3], Orsolya Kedves[2], Csaba Vágvölgyi[2], László Kredics[2], György Sipos[1]

[1]*University of Sopron, Functional Genomics and Bioinformatics Group, Sopron, Hungary;*

[2]*University of Szeged, Department of Biotechnology and Microbiology, Szeged, Hungary*

[3]*Institute of Zoology, University of Innsbruck, Innsbruck, Austria*

Robinia pseudoacacia trees are a significant part of the forestry landscape in Europe, specifically in Hungary, where they cover some 23% of the forest area. They have significant economic and ecological roles, as they are important timber and fuelwood sources, crucial for honey production, while also aiding in nitrogen fixation and erosion control. However, a significant decline in tree health and productivity, possibly associated with climate changes, has been exhibited in recent years. This study investigates the potential biotic factors that could be contributing to this trend, focusing on the application of microbiome analysis in order to identify pathogenic agents. While the trees do not exhibit any external manifestations of disease, deeper investigations revealed internal trunk rot, thus suggesting a hidden pathology. To understand the full scope of fungal and bacterial communities within affected trees, high-throughput sequencing of the microbiome was employed. Specifically, samples were collected from both healthy and infected areas of Robinia pseudoacacia tree trunks, the center of the trunk and the underbark. DNA was extracted, and the 16S rRNA gene region was amplified and sequenced using Oxford Nanopore MinIon. The results showed generally low abundance of microbial communities in all samples except for the one coming from the center of the infected trunk. However, the primarily soil-dwelling bacteria, Alloacidobacterium, Bradyrhizobium, Paraburkholderia, were present across multiple samples regardless of infection status. In addition to these, several genera known to include potential plant pathogens were identified, such as Streptomyces, and Curtobacterium, primarily within the infected trunk center. These findings suggest a complex microbial community, with potential roles for both opportunistic and pathogenic bacteria in the observed decline. This approach, in conjunction with targeted sampling of healthy and infected trunk locations, aims to characterize the microbial communities associated with the observed decline and identify potential pathogenic agents.

Mapping the occurrence of Asclepias syriaca using AI methods based on geotagged landscape photographs

Georgina Veronika Visztra[1], Péter Balázs[2], Ádám Makai[2], Ádám Katona[2], Márton Bence Balogh[1], Zalán Tobak[1], Péter Szilassi[1]

[1]*Department of Physical and Environmental Geography, University of Szeged, Szeged, Hungary*

[2]*Department of Image Processing and Computer Graphics, University of Szeged, Hungary*

Invasive plant species are becoming increasingly widespread worldwide, making the mapping of their occurrence ever more important. However, collecting high-quality occurrence data presents a significant challenge, primarily due to the considerable time and financial resources required. Therefore, artificial intelligence- based image recognition models are gaining popularity for species identification from photographs. Nevertheless, it is essential to consider the diverse features of the images being analyzed and to select and train the image recognition model accordingly. The accuracy of photo recognition depends on various factors, including the dataset used for training, the quantity of available data, and its characteristics (e.g., a close-up photograph of the target species versus a landscape image).

In this study, we evaluated the efficiency of two AI-based image recognition models in identifying the invasive plant species Asclepias syriaca using the EUROSTAT Land Use and Coverage Area Frame Survey (LUCAS) image database. We developed a YOLO-based image recognition model, trained specifically on landscape photographs from the LUCAS database that had been pre-tagged with the target species. This model was compared to the Pl@ntNet image recognition model, which was trained on specifically targeted close-up photographs.

The results indicate that while the YOLO model recognizes Asclepias syriaca in landscape photographs with high efficiency, it also generates a high number of false positives. In contrast, the Pl@ntNet model shows lower efficiency, recognizes less instances of the target species but produces significantly fewer false detections. These findings suggest that while neither image recognition model can completely substitute human validation in landscape image selection, specialized models can significantly accelerate the process.

Stable carbon and oxygen isotope ratios in Norway spruce (Picea abies (L.) Karst.) tree rings along an elevation gradient in the Rarău Mts (Romania)

Daniela Maria Llanos-Campana[1], Zoltán Kern[2], Ionel Popa[3,4], Aurel Perșoiu[5,6]
[1]*Doctoral School of Environmental Sciences, Eötvös Loránd University, Budapest, Hungary*
[2] *Institute for Geological and Geochemical Research, HUN-REN Research Centre for Astronomy and Earth Sciences, Budapest, Hungary*
[3] *National Institute for Research and Development in Forestry Marin Dracea, Campulung Moldovenesc, Romania*
[4] *Center of Mountain Economy -INCE - CE-MONT Vatra Dornei, Romania*
[5]*Emil Racoviţă Institute of Speleology, Romanian Academy, Cluj-Napoca, Romania*
[6]*Stable Isotope Laboratory, Ştefan cel Mare University, Suceava, Romania*

The application of stable isotopes such as δ13C and δ18O has opened new opportunities to expand our knowledge across various fields, including geochemistry, environmental sciences, paleoclimatology, ecology, and others. In paleoclimatology, these isotopes help to reveal climate data stored in proxies like tree rings.
Based on this, samples of Norway spruce (Picea abies (L.) Karst.) were collected along an altitudinal gradient in Rarău Mts in Romania to correlate the δ13C and δ18O signal in α-cellulose with Tmax, Tmin and precipitation amount. The aim of this study is to assess whether the plant physiological information documented in the isotopic composition of cellulose can provide insights into the environmental sensitivity of spruce populations, considering the local conditions at different altitudes.
After extracting α-cellulose from tree rings and measuring the isotopic composition, these data were correlated with environmental variables. The results from the individual series indicate a decrease trend in the mean δ18O value with increasing altitude, suggesting influences from factors such as source water composition, precipitation, and evaporative enrichment. However, mean δ13C values did not follow this trend, implying the impact of local factors like water stress and light exposure. Correlation analysis shows a negative relationship between δ18O value and summer precipitation which decreased with altitude, while the positive influence of growing season temperature increases at higher elevations, inferring that water availability becomes less important, and temperature plays a larger role near the timberline. A positive correction of δ13C and temperature during the growing season suggests stomatal conductance during dry conditions, while the negative correlation with temperature at higher altitudes may reflect relative humidity effects.
In conclusion, the findings emphasize the role of temperature and water availability in shaping the physiological responses of plants in response to climate variability, making it important to know how this could affects them.
Acknowledgments: This work was supported by the UEFISCDI Romania [grant number PN-III-P2-2.1-PED-2019- 4102]; and the FORCLIMSOC Programme [PN23090101].

Sown wildflower strips in urban areas–a strategy to enhance biodiversity of arthropods

Botond Magyar[1], Anna Viola Nagy[1], Helga Simon[1], Attila Torma[1,2]
[1]Department of Ecology, University of Szeged, Szeged, Hungary
[2]Lendület' Landscape and Conservation Ecology, Institute of Ecology and Botany, HUN-REN Centre for Ecological Research, Vácrátót, Hungary

Urbanization is a global phenomenon which, through its many processes, can negatively alter urban ecosystems, with potential adverse effects on arthropod assemblages. Such effects include the fragmentation and degradation of natural and semi-natural habitats, the presence of various pollutants, the urban heat island effect (UHI). In addition, the high degree of built-up areas limits the arthropods movement between the remaining habitat patches, thus affecting many biotic interactions. A potential attempt to mitigate these negative effects is the establishment of sown flower strips, which through their diverse set of plant species, may help the survival of arthropods in these urban habitats. They can provide food base, shelter and overwintering sites to several arthropod groups, they also provide favorable microclimatic conditions through their shading activity, increasing connectivity between habitat patches.

In our current research, we investigated the extent to which these small habitats can support urban arthropod communities in twenty flower strips planted with a commercial seed mixture throughout the city of Szeged. Based on our preliminary results, we found significant differences in the number of species and individuals of pollinators and phytophagous insects between the flower strips and control sites, which clearly shows that these flower strips are indeed capable of maintaining a diverse arthropod community in urban environment.