27th Congress of the European Vegetation Survey
23-26 May, 2018
Wrocław, Poland

Vegetation survey 90 years after the publication of Braun-Blanquet's textbook – new challenges and concepts

Book of Abstracts

Uniwersytet Wrocławski

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Regionalna Dyrekcja Lasów Państwowych we Wrocławiu

IAVS

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90 years on, how does phytosociology inform habitat conservation and assessment?

Rodwell J.

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Ninety years after the publication of Braun-Blanquet's textbook, what more can we claim to know about habitat conservation and assessment, and how phytosociology can assist? Nature conservation as we understand it is considerably younger than phytosociology and it is an aspiration/goal/outcome that needs to be informed by more than science, and which is sometimes complicated by the policy frames which increasingly implement it. Also, for some people and institutions, phytosociology's claim to be a science has been recognised only slowly and with reluctance. Increasing numbers of high quality data are accumulating across wider tracts of Europe; analytical methods grow every more powerful and sophisticated; an overall authoritative conspectus of higher-level syntaxa is now available; and the pragmatic power of phytosociology to interpret and resolve conservation problems is persuasively demonstrated – yet some basic questions and chalenges remain for us. The syntaxa that phytosociology defines are not the same as the habitats or biotopes that are the focus of nature conservation; and phytosociological descriptions do not exhaust the meaning of 'biodiversity', whatever that term does mean. Authoritative accounts of vegetation can also exert a tyranny of typology, when they are interpreted as not simply descriptive of fields of variation but as providing rigid standards of quality or condition that must be monitored and maintained by management. Phytosociology can provide high quality field data but such recording is not always readily repeatable and may not provide a good surrogate measure of the condition and sustainability of whole habitats. A more comprehensive parameterisation of those environmental features which characterise plant communities lags behind the detail and scale of our floristic knowledge. The notion of ecosystem services presents a more recent frame within which we can see whether phytosociology can inform the evaluation of biodiversity and its conservation. Where do we stand now and, over the next 90 years, how can we ensure fuller responses to these challenges?

New challenges in the vegetation classification in the recent data-rich era of phytosociology

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For long time numerical classification of large trans-national vegetation datasets has been limited by availability of digitalized data and capacity of computers. Development in of large phytosociological databases and increasing capacity of PCs practically eliminated these limitations. Nowadays, numerical classification of thousands of relevés is common in papers published in the leading journals of phytosociology.

Are we really arrived the Golden Age of numerical syntaxonomy where all technical problems has already solved? In my opinion, the development of algorithms does not follow the amazing development in data availability and computing capacity. In my lecture would call the attention some critical points of our recent classification toolkit. My aim is not showing the solutions, rather pointing out the problems and provoking a common thinking on how they could be overcome.

The first problem is the interpretation of classification results by the experts. Until only 50-100 relevés (or even less) were classified, we could print the whole dendrogram and its details (sometimes position of each relevés) could be interpreted. Obviously, we cannot do it, when thousands of relevés were classified. Rather we should calculate summary statistics (e.g. constancy, mean cover, fidelity) for characterizing the groups.

Even the best numerical classification algorithm may classify some relevés wrongly. Our summary statistics should be robust against presence of these wrongly classified plots, but this robustness has not been tested yet. Alternatively, we could develop algorithms for detecting and removing these outlier plots.

One possible reason of misclassification is that a plot is poor in character species. Such relevés may be excluded from the analysis or classified only at higher hierarchy level. Again, the question is how could we detect such plots.

Finally, we have to remember that our aim is not simply doing numerical classification exercises, but the better understanding vegetation pattern and often creating/modifying a syntaxonomical system. Stability is an expected property of any syntaxonomic system. Therefore, we should not change the existing system too often. Using traditional, unconstrained classification of plot data always results in a new classification that slightly departs from the existing syntaxonomic system. The recent practice is that experts decide when the system has to be modified and when the departing new results can be neglected. Subjective decision of experts could be formalized using semi-supervised classification or classifying lower-level syntaxa instead of plots.

This research was supported by GINOP - 2.3.2 - 15 - 2016 - 00019 project.

Plant invasions in Europe: general overview across natural and semi-natural habitats

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Invasions by alien plants are considered one of the major threats for natural ecosystems as they may produce loss of biodiversity and changes on community structure and functioning. However, there is considerable controversy regarding the consideration of invasive species as drivers or as mere passengers of ecosystem degradation. In the latter case, plant invasions would be the consequence of previous habitat degradation. Disentangling this controversy is a challenging task, which requires the compilation of huge amounts of data on plant invasion effect on plant community diversity and functioning and the design of experimental studies.

Plant invasion is basically driven by three factors: propagule pressure, species invasiveness and habitat invasibility. The combination of varying degrees of such three factors will produce strongly differing levels of invasion across habitats and regions, as already reported in previous studies. The most vulnerable habitats, i.e., those with intrinsic susceptibility to invasion (open disturbed habitats) will show higher invasion levels if subjected to high propagule pressure and even higher if those alien species arriving at the community are adapted to the environmental conditions prevailing there.

In this talk, I will try to provide a general overview on plant invasion in European natural and semi-natural vegetation. Given the difficulty of separating habitat invasibility from propagule pressure, I will focus on the real invasion level across habitats, which can be directly inferred from the information contained in vegetation plots. I will also provide the most frequent alien species in the different European habitats, highlighting those that are generally present with high cover values and are thus especially harmful for habitat conservation.

After this general overview, I will provide a more detailed insight on plant invasion in the Basque Country, a southwestern European region with contrasting climatic features characterized by high habitat diversity. The Basque Country hosts around 500 alien species of vascular plants, approx. 15% of the total flora, and has been intensively studied regarding several features of plant invasion. Several coastal and riparian habitats show high invasion levels, and some of the neophytes occurring there are transformer species that alter community structure and functioning, such as *Baccharis halimifolia* in salt marshes, *Oenothera x fallax* in coastal dunes, *Fallopia japonica* in riverbanks and *Paspalum distichum* in riverbeds.

Oral Presentations

Long-term development of soil chemical properties and vegetation dynamics after wildfires and clearcutting in Central European pine forests

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Disturbances are an important part of natural forest dynamics. In temperate forests of Central Europe, they are represented, apart of forest management, mainly by windthrow and insect outbreaks. Although wildfires occur in such forests too, their ecological role has lagely been neglected even though the high frequency of wildfires in naturally fire-prone forests is well documented. Deeper knowledge of the influence of fire on the dynamics and development of Central European forest vegetation is therefore desirable but still missing.

In this study we focused on the comparison of spontaneous post-disturbance development of vegetation and soil chemical properties of fire-affected forests with the development of forest clearings. We hypothesized that wildfires can support the occurrence of certain plant species in the landscape and that, in the long-term, they can alter the species composition of forest stand.

We focused on semi-natural forests dominated by Pinus sylvestris in Central European sandstone regions resembling boreo-continental pine forests, which are claimed to be fire-adapted. We collected a set of vegetation and soil samples in various post-disturbance phases after wildfires and clearcutting using a space-for-time substitution design. We thus reconstructed the development of forest vegetation and soil chemical properties, covering a period of 200 years after the disturbance events. We analysed more than 400 vegetation samples using multivariate and univariate statistical methods; soil samples were analysed in a specialized pedological laboratory.

Our results indicate that early post-disturbance stages of succession following wildfires and clearcutting differ significantly in understorey species composition. The two types of disturbance exhibit their specific species composition, but the species diversity of post-fire plots is significantly greater. Fire also elicits a significant positive effect on the abundance of ground lichens and on natural tree regeneration. This is probably connected with significantly increased soil pH and content of available P and SO_4^{2-} during the first roughly 15 years after a fire event. The species composition of the understorey differed significantly until about 50 years after the disturbances, but older stands (> 60 years) developed into communities with a similar species composition. However, the species diversity of post-fire stands remained significantly greater than that of former clearcuts. This could also be a consequence of spontaneous development of post-fire plots, which leads to more heterogeneous stands, in contrast to continuously managed post-clearcut stands.

These results confirm the resilience of Central European pine forests to fire and their ability to recover spontaneously and with a similar end result as artificially restored stands, but with greater species diversity. Our results demonstrate that controlled fires seem to be a suitable management practice for the ecological restoration of Central European pine forests, as has previously been established for boreal forests of Fenno-Scandinavia.

The *Castanea sativa* woods of the Cévennes: habitat of Community interest or not?

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The habitats Directive is one of the main tool for biodiversity conservation in the European Union. It has regulatory implications at the European level and in the French legislation. These requirements and the French choice to implement this Directive on a contractual basis have consequences on the management of natural areas and their resources. Any doubt on the occurrence of a habitat could be detrimental to all the stakeholders.

The status, of Community interest or not, of the chestnut groves in the Cévennes area (southern France) is a recurring question. The definition provided by the Interpretation Manual is "Supra-Mediterranean and sub-Mediterranean *Castanea sativa*-dominated forests and old established plantations with semi-natural undergrowth". This definition is short and rather open to interpretations. We had to clarify this definition in a way that fits the local situation.

The two following questions summarize our problematic:
– How many different types of chestnut-dominated vegetations are there in the area?
– Where do they fit on a mediterraneity gradient?

We random sampled about 400 plots already mapped as chestnut-dominated forest in four Natura 2000 sites: Vallée du Galeizon, Vallée du Gardon de Saint-Jean, Vallée du Gardon de Mialet and Hautes vallées de la Cèze et du Luech. We analyzed these new field relevés along with another set of data made of already published relevés. These reference relevés do not focus on chestnut dominated vegetation but are representative of the different types of forests occuring in the area. They embody a gradient going from the Mediterranean belt to a montane belt devoid of Mediterranean influence.

The joint analysis of our field chestnut relevés with the reference relevés enabled us to identify the chestnut dominated communities and to see if they belong to the 9260 habitat: *Castanea sativa* woods. These results will provide good foundations for a serene management of the four studied Natura 2000 sites.

Valday highland as a fragment of the Great Eurasian Nature Massive: priority habitats conservation and renovation

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The Great Eurasian Nature Massive (GEANM) is a complex of low disturbed and not disturbed nature areas in the limits of Russia (north Eurasia). It lies from the Pacific Ocean in the East to Fennoscandia in the West. The Valday highland is one of the fragments of GEANM in the North-West of the European Russia. Due to geologic, geomorphologic, pedologic, climatic, historic and anthropogenic factors and its location on the north-eastern border of hemi-boreal zone, the region is characterized by high diversity of plant and animal species and types of habitats. The majority of them are mentioned in the Resolution 4th and 6th of Bern Convention and preserved in the National park "Valdaisky". That's why the territory of the national park could be considered as the European Area of Special Conservation Interest for the Emerald Network.

So the main aim of the research is the survey of priority habitats of the national park. As a result of geobotanic investigations and space images remote sensing (Landsat 5) the diversity of habitats was revealed and the map of their spatial distribution was made.

Various types of forests and shrub cover more than 75% of the national park territory. *Picea* and *Pinus* taiga woodland dominate on the came complexes and morainic plains. Often *Pinus* and *Picea* forests with mosses change each other as fire-induced succession. Eurasian boreal *Betula*, *Alnus* and *Populus tremula* woods usually occupy territory after coniferous cutting. The areas of former broadleaved-coniferous and deciduous forests dominated by *Quercus robur* are occupied by after forest grasslands. Nowadays without any anthropogenic impact these meadows are overgrown with brush. Riverine *Salix* woodland is usually met along riversides.

In inter-hill depressions in the condition of humid moderately warm climate various types of bogs and moist or wet grasslands are developed: Raised bog complexes, Boreal bog conifer *Sphagnum-Pinus* woodlands, *Sphagnum-Betula* woods, Transition mires and quaking bogs, Rich fens, Moist or wet grasslands, Meadows, including those at different stages of overgrowing by forest (nearly 15% of the area).

257 lakes occupy 9,2 % of the Park territory. They are the most attractive for the visitors. All of them are differed by high diversity of hydro-chemical regimes, macrophytes composition, vegetation, priority habitats.

Unlike other parts of GEANM, Valdai is located in an area with high population density and recreational impact. Therefore, monitoring of biodiversity takes on special significance here.

Understory functional response to different management strategies in subMediterranean beech forests

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Silvicultural management represents a type of disturbance affecting forest ecosystems by altering ecological parameters, and can greatly influence species in the understory. The ground flora is a key element in forest ecosystems, accounting for large part of their diversity. Therefore, understanding how silvicultural practices affect conservation and functioning is fundamental to assess their sustainability. In the Italian Apennines, the progressive abandonment of mountainous areas has led to the conversion of coppice-with-standards (CWS) to high-forests (HF), a different management type involving longer rotation periods which maintains canopy cover. This management change is expected to have impacts in the understory layer with unknown effects on species assemblage and ecosystem functioning. We used a trait-based approach to characterize old CWS and HF stands, analyzing their differences and evaluating the status of old CWS by considering their conversion towards HF stands. The study area is located in the Montagne della Duchessa, Central Apennines. We placed sixty six plots (20x20 m each) where species abundance and structural parameters were recorded for old CWS and HF stands. We collected data traits on reproductive strategies, dispersal ability, resource acquisition and response to disturbance, consulting both European databases and relevant literature. We performed redundancy analysis to assess relations between trait states and silvicultural practices, and forward selection identify the structural parameters with significant effects on trait variability. We run Wilcoxon test to compare trait states in the two management types. We found that tree height and number of individuals are the major structural parameters shaping trait composition. HF proved to be more related to trait states typical of mature forest conditions (e.g. spring green leaves, early flowering species and short flowering duration), while old coppices did not show clear associations with specific traits, except for the relation with sunny and open habitats (scleromorphic leaves), and showed the same "mature forest" trait composition (according bibliographic data), even if with lower abundances. This indicates that despite the higher initial disturbance pressure, once abandoned, old coppices tend over time to evolve naturally towards mature forest functional conditions, revealing a good recovery ability to disturbance.

Vegetation description and scale or can parts of the vegetation be excluded from formal description?

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The checklist of the vegetation of Europe comprises vegetation on all scales. However it has been challenged recently, that units of small organisms, those of micro-algae, and the small-scaled vegetation on special habitats should be permitted a formal description.

It will be shown here, that the Braun-Blanquet approach is all-encompassing, permitting, even requesting the description of vegetation types on all scales. Same as in taxonomy and with the Linné-approach no types of vegetation may be excluded. While a researcher may limit a study to distinct vegetation types, the limits of the Braun-Blanquet approach are given by nature.

The small-scaled epiphytes, epixyles, epiliths and the epigeic gap communities are often but not always cryptogamic communities. It has been acknowledged that those units inhabit deviating habitat conditions in two ways: They are traditionally excluded from the large-scaled relevés as growing on special habitats and they have been described as separate entities for almost a century now.

A crucial point is the varied application of the term 'synusia'. Therefore it will be explained how the term is used by Gams, by Braun-Blanquet, by bryologists and in recent vegetation studies on different scales. Illustrated with many examples, hopefully future misunderstandings can be avoided, which originated from disregarding scale and it will be shown that vegetation description on different scales is not a problem but on the contrary, very useful.

Diversity of *Molinio-Arrhenatheretea* communities in climatic gradient along the southern edge of the Pannionian plain

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Mesic grasslands of the class have been intensively studied on the southern edge of the Pannonian plain in NW Balkan Peninsula. There were many similar communities described differently in various countries, so elaboration of their floristic composition, ecological condition, geographical separation and classification on regional scale is needed.

Our research took place in the northern part of the NW Balkan (NE Slovenia, N Croatia and N Serbia), where are mountains gradually passes to the Pannonian plain. In this area, we can find a strong macroclimatic gradient from wet (sub)Atlanic climate in the west to dry (continental) climate in the east.

A database of 2565 vegetation plots originally assigned to *Molinio-Arrhenatheretea* communities was compiled. Semi-supervised classification based on the K-means algorithm was applied to assign plots into 12 a priori alliances and to search for new alliances within the subset of non-assigned plots. We found two well recognisable new groups.

Generally, analysed communities show a typical Central European feature in the western part, but changes their floristic composition and ecological conditions towards the eastern part of research area. Among 14 groups, 12 groups can be recognised in EVC (Euro Veg Checklist), but there two well recongisable new groups appeared.

In the eastern part of the research area, many ruderal species appear in mesic mown meadows on mineral rich soil appear. We could merge these communities within a new alliance *Salvio nemorosae-Arrhenatherion*. Sporadically such vegetation can also be found on dry and nutrient rich sites (e.g. road banks) in the western part of the area, but in the east this vegetation forms regularly mown grasslands and substitute the alliance Arrhentherion.

The other novelty is group that can be recognized in the western part and can be termed as *Alopecurion*. It appears in the transitional conditions between mesic (*Arrhenatherion*) and temporarily wet meadows (*Deschampsion*). It appears in the western part of the area and is substituted by wet meadows of the *Trifolion pallidi* in the east.

The Red List of ecosystems in France, progress and improvements

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In order to evaluate the probability of biodiversity loss at the ecosystem level, IUCN has built a standardized methodology that introduces the concept of ecosystem collapse, equivalent to species extinction. This methodology is based on five easily understandable and scientifically rigorous criteria, using quantitative thresholds and applied over four periods of time including past and future.

IUCN Red List of Ecosystems enhances the overall capacity for monitoring and assessing the state of biodiversity. This IUCN knowledge product represents a decision-making tool for both decision-makers and ecosystem managers, in order to define priorities for nature conservation and to assess the impacts of management choices. IUCN red lists are also a major information source in order to raise public awareness about biodiversity trends and its threats.

IUCN French Committee is declining this tool in France with the objective of assessing all French metropolitan and overseas ecosystems. Here, we show the results of the French National Red list of Ecosystems for the metropolitan Mediterranean sandy coastal ecosystems. This first evaluation underlines the highly threatened status of most of these ecosystems because of dune destruction and urbanisation, generalized disturbance of the sedimentary dynamics of sandy coasts and tourist overcrowding. Thus, out of nine assessed ecosystems, one appears Endangered (EN) and six Vulnerable (VU).

Based on the most exhaustive bibliographic synthesis available for each ecosystem, these assessments now included a conceptual model, explaining in a simple and comprehensible way the functioning of these ecosystems and the impacts of the major identified threats. However, we have noticed that both bibliographic sources and expertise used for these evaluations are mostly based on vegetation survey and little on other datasets, such as interactions with the fauna or long-term ecological processes modelling.

In order to evaluate criteria linked to the oncoming evolution of ecosystems (projection in the future), in particular criterion C "Modification of abiotic variables" and criterion D "Disruption of biotic interactions", we aim at including predictive data resulting from remote sensing or ecological systems modelling, for example. It would also be interesting for some ecosystems to explore the use of criterion E "Multiparametric numerical modelling estimating the risk of collapse at 50 or 100 years".

Class *Mulgedio-Aconitetea* in Khamar-Daban Ridge, East Siberia

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Tall-forb, tall-grass, and fern communities phytosociologically treated within the Eurosiberian class *Mulgedio-Aconitetea* Hadač & Klika in Klika & Hadač 1944, which eastern distribution limit located in Baikal rift zone (Southern Siberia). The Khamar-Daban is one of the ridges that form the rift zone around Lake Baikal. Thanks to its sublatitudinal orientation, northern slope of the ridge intercepts the greatest amount of precipitation in the region. High air humidity during summer and thick snow cover during winter, provide favorable conditions for tall-herb communities, despite the mean annual temperature -3.4°C. On the base of 500 relevés collected in 2014-2017, we have conducted the first classification of the tall-herb vegetation on the Khamar-Daban Ridge.

Despite the fact that more than 50 associations of *Mulgedio-Aconitetea* described from South Siberia, this biome in Khamar-Daban Ridge consists of highly original community types. Main reason for this originality is a presence and high abundance of endemic as well as East-Asian species (*Allium chamarense, Anemone baicalensis, Eranthis sibirica, Poa ircutica, Swertia baicalensis*) absent or rare in other regions of South Siberia. Furthermore, the low forest boundary (950-1200 m a.s.l.) promotes active penetration of forest species into subalpine meadows that leads to a stronger role (in comparison with those from western part of South Siberia) of such species in composition of the Khamar-Daban subalpine plant communities. Based on significant floristic differences, the new alliance *Poo ircuticae-Geranion krylovii* (prov.) is proposed. The new alliance comprises typical subalpine tall-forb meadows at different altitudes between 900 and 1500 m a.s.l.

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Research based on the European Vegetation Archive: the progress made so far

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The European Vegetation Archive (EVA, http://euroveg.org/eva-database) is a centralized data repository of vegetation-plot records from Europe and adjacent areas, which is maintained by the IAVS Working Group European Vegetation Survey. Its aim is to facilitate the use of these data for non-commercial purposes, mainly academic research and applications in nature conservation. By 1 March it included 1.5 million vegetation-plot records from 73 databases. Founded in 2012, it started to provide data to various projects in May 2014. Since then it provided data to 64 projects of basic and applied research, some of which have already resulted in published papers.

In this presentation, we summarize the main results achieved during the three years since the opening of EVA as a data source to the international research teams. Of the projects that received data from EVA, almost 40% are dealing with macroecological questions related to taxonomic, functional or phylogenetic diversity, and community assembly across Europe. More than 30% deal with syntaxonomy of European vegetation types, especially forests and grasslands. About 10% of projects are focused on nature conservation, dealing mainly with the assessment of natural habitats. The remaining projects used species distribution data from EVA for various purposes of species distribution mapping, distribution modelling and autecological studies of individual species. As EVA is a part of the global vegetation database sPlot, it is also used for sPlot projects, most of them focusing on global relationships between plant traits and the environment.

EVA-supported research already resulted into several synthetic publications. An example of macroecological studies is the assessment of plant invasions in European forests (Wagner et al. 2017) or diversity patterns across European beech forests (Jiménez-Alfaro et al. 2018), while examples of syntaxonomic studies are pan-European classifications of fen vegetation (Peterka et al. 2017) and beech-forest vegetation (Willner et al. 2017). An example of nature conservation applications is the Red List of European habitats (Janssen et al. 2016).

Although many topics are already covered by the currently running EVA projects, there are still plenty of vacant research niches in the potential use of EVA data.

Ecological features of three forest spring geophytes

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Forest spring ephemerals are widely common in temperate deciduous forests. They usually appear in large numbers and create carpet-like, often homogeneous patches in ground cover vegetation from snowmelt and senesce shortly after the overstory canopy has closed. Our goal was to investigate the ecological and ecophysiological characteristics of three spring forest geophytes widespread in Europe, namely *Anemone ranunculoides* L., *Corydalis sativa* (L.) Clairv. and *Ficaria verna* Huds. The stands of the selected species are important parts of the Central European spring pattern in deciduous forest communities. Examination was carried out in the natural oak forest stand of the Gödöllő Botanical Garden of Szent István University and covered the whole vegetation period of forest spring geophytes.

In order to achieve the aims stand level Net Ecosystem CO_2 Exchange (NEE) and evapotranspiration (ET) fluxes, as well as leaf area index (LAI) of forest geophytes were measured on a weekly basis, and the dependence of NEE on air temperature (Tair), leaf area index and light intensity (PPFD) were examined. In addition, percentage cover of each taxa was estimated, the actual phenological stage of selected geophytes was recorded, as well as their above and below ground biomass and its carbon and nitrogen content were measured. Parallel with the episodic measurements meteorological data were continuously recorded.

All three of the geophytes appeared shortly after snow melt and completed their aboveground growth, including fruit production, within 2 months. Despite their relatively short ephemeral lifecycle the stand of each taxa showed a considerable high carbon sequestration from the beginning of the vegetation period until the end of it or until the last phase of fruit formation. Positive linear correlation was measured between NEE and PPFD as well as NEE and LAI while negative linear correlation stood between NEE and Tair. During the investigation of biomass allocations such processes were recognized, which are essential to understand the survival strategy of forest geophytes.

Assessment of the conservation value, impact of threats and risks of loss of the habitats of Ukraine

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For development of measures for habitat maintenance and conservation, it is important to assess their threats, the conservation value, and the risks of their loss (Didukh 2014). At the same time, this is the basis for the formation of the Habitat Red List as a document which regulates conservation of biotic and landscape diversity at the ecosystem level. We aimed to evaluate not only the impact of various factors on habitats, degree of their stability and renewability, but also the value of habitats, which is important for the calculation of environmental services. Based on this, we assess the impact of threats by four criteria: resulting effect of threats, degree of habitat loss, (AL analogue), scale of impact (AG), intensity of threats (QU) and renewability degree (RE). Each of them was estimated in four-point scale. The second component is conservation value of habitats, which was evaluated by 10 criteria: position in succession series, regional representativity, distribution peculiarities, ecological amplitude, position in main eco-factors system and relation to their limiting effect, presence of invasive species, hemeroby degree, the ratio of the strategy types (K/R strategies), dominance or presence species listed in the Red Data Book, IUCN Red List, Annexes II and IV of the Habitat Directive, Resolution 6 of the Bern Convention as well as the habitat conservation status (habitat types listed in the Habitat Directive Annex I, the Bern Convention Resolution 4 or the Green Book of Ukraine). These characteristics are also evaluated on a 4-point scale. According to the calculation of the amount of points, the degree of stability and value were estimated and the corresponding classes are allocated: I > 81%, II 61-80, III 41-60, IV 21-40, V <20%. Thus, among the 186 evaluated natural habitat types the majority belongs to the III class, much less (26.9-38.7%) – to the II class. The most valuable I class includes 9.7-15.6% of habitats, violated and less valuable habitats of IV class includes 4.3-19.4%. Habitats of V class, formed under the direct influence of anthropogenic factors, not evaluated. The habitats of I and II classes (more than half of the evaluated list – 52.7%) are of high value, limited distribution, poor renewability, sensitive to the anthropogenic influence, at high risk of loss and require certain targeted protective measures.

Structure of moss layer as the environmental predictor for vascular plant vegetation in sub-alkaline fens

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Fens are a unique ecosystem in having a ground layer of bryophytes, frequently covering 80-100% of the fen surface, which to some extend structures the ecosystem. Two contrasting stages occur within fen ecosystems. One is dominated by *Sphagnum* species and one by the so-called brown (non-sphagnaceous) mosses. Brown-moss rich fens (referred as sub-alkaline fens in this study) are usually one of the earliest successional stages and may turn into *Sphagnum* fens rather rapidly. Sphagna, considered as ecosystem engineers, speed up the succession from sub-alkaline fens to acidic poor fens, i.e. from species-rich to species-poor habitats. The shift results in a rapid loss of fen-specialized species which are mostly rare, endangered or relic. The understanding of the intraspecific interactions is one of the crucial tasks for current conservation ecology and is especially important in sub-alkaline fens which act as biodiversity hot-spots. While many studies in conservation ecology focused on intraspecific interactions (such as competition) among vascular plants, few studies were focused on moss-vascular plant interactions at a large spatial scale, especially in fens.

We have tested the impact of mosses on vascular plant communities within two temperate-European compositional datasets using variation partitioning and structural equation modelling. We found a significant impact of the structure of moss layer (relative cover of brown mosses and sphagna) on species composition of vascular plants specialized to fens, independent of water table and pH, which are the major determinants of compositional variation in fens. We identified individual vascular-plant specialists which respond positively or negatively to the proportion of brown mosses relative to sphagna and analysed variation in their functional traits using pheatmaps to test the hypothesis that the traits associated with clonality determine the species response to the structure of the moss layer. Rather short-living species relying more on generative reproduction, most of them being red-listed, were generally more associated with the dominance of weft-forming brown mosses, which usually grow slowly and laterally, while more clonal species were generally more associated with the dominance of sphagna, which grow upwards faster and hence compete intensively with vascular plant seedlings. Our findings showed the important role of moss layer in mire ecosystems and confirm its structuring effect on the composition of vascular plants communities.

Conservation implications of habitat heterogeneity in forest-grassland mosaics

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Forest-grassland mosaics such as savannas, wood pastures and forest-steppes possess outstanding ecological and conservation values. However, the importance of spatial habitat heterogeneity is as yet not fully appreciated in forest-steppes, and the contribution of individual forest versus non-forest habitats to the overall conservation value of the entire mosaic is not fully understood.

We analyzed six main habitat types in the forest-steppes of the Danube-Tisza Interfluve (Hungary) and compared them according to their species composition, species richness, Shannon diversity, the number of protected, endemic, threatened and specialist species, naturalness, structural characteristics, and environmental variables.

All habitat types had their own typical species composition with at least some species that were rare or totally lacking elsewhere. Grasslands proved to be the most important from a conservation perspective (the highest number of protected, endemic, threatened and specialist species). North-facing forest edges had significantly higher species richness values than any of the other habitats under study. South-facing edges contained the highest number of native tree seedlings and saplings, mostly white and grey poplar and pedunculate oak. Small forests were the most valuable among the differently sized forest patches, whereas large and medium forest patches had lower conservation importance.

We conclude that the current research and conservation focus on the grassland habitat is not adequate. An integrated view of the entire mosaic would be necessary. Habitat management actions and interventions should promote habitat heterogeneity, i.e. the existence of both forest and non-forest habitats.

Revising the EUNIS habitats classification – where are we?

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The EUNIS habitats classification is a hierarchical classification covering all European habitats, marine, terrestrial and freshwater, natural, semi-natural and anthropogenic which has been developed by the European Topic Centre on Biological Diversity (ETC/BD) for the European Environment Agency (EEA). The classification was produced by a series of working groups, involving several members of the EVS, from 1995 onwards and the first stage of development ended with the publication of a report by Davies, Moss & Hill (EUNIS habitat classification revised 2004. Report to: European Environment Agency-European Topic Centre on Nature Protection and Biodiversity, 2004).

By 2010 there were demands to improve and revise the classification and a series of contracts between the EEA and a consortium led by Alterra (now Wageningen Environmental Research) but involving John Rodwell, Milan Chytry and others used the EuroVegChecklist to propose revisions for forests, heaths and grasslands at level 3 of the classification. This work also included using EVA to produce lists of indicator species and distribution maps. The forest and heath sections are now published on the EUNIS website (http://eunis.eea.europa.eu/habitats-code-browser-2017.jsp). The grassland section is close to publication but work by the ETC/BD to help the implementation of the Emerald network in Eastern Europe showed that the treatment of semi-deserts and steppes required further work.

Work has started on a revision of the freshwater section and this aims to make EUNIS compatible with typologies developed for reporting under the EU's Water Framework Directive. A proposed revision for the remaining sections has been produced based on the typology used for the European Red List of Habitats, slightly modified following suggestions from the team responsible. This will be the subject of an EIONET consultation this summer and all members of EVS are invited to participate. European Red List of Habitats reports are accessible from http://ec.europa.eu/environment/nature/knowledge/redlist_en.htm.

Floristic and phytosociological features of the *Brachypodium rupestre* communities in Italy

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The pale green dense Tor-grass (*Brachypodium rupestre*) tufts are a quite distinctive aspect of the Italian grassland pattern of the colline and submontane belts. *B. rupestre* is used to be found in secondary grasslands both in natural environments and in some aspects of the post-coltural environments such as forest clearances, abandoned terraced and extensive pastures. In northern Italy (Alps, Prealps and northern Apennines) *B. rupestre* has only sporadically been considered in the grasslands syntaxonomic frameworks. On the contrary it occurs in those regarding the central Italy where several semi-natural and post-coltural grassland associations (e.g. *Polygalo flavescentis-Brachypodietum, Galio lucidi-B. Dorycnio-B.* etc.) were described. As far as the southern Italy is concerned only the *Polygalo mediterraneae-Brachypodietum* is known whereas two new associations were recently proposed for Sicily (Gianguzzi et al. 2018 submitted). As regards the syntaxonomical ranks higher than association, the majority of the *B. rupestre* communities were classified in the *Festuco-Brometea* and a minor part to the *Trifolio-Geranietea*. In particular Di Pietro *et al.,* (2015) proposed the classification of the Italian *Brachypodium rupestre* grasslands in the following three alliances: *Coronillo-Astragalion* Ubaldi 2003 (flyschoid eroded substrates); *Cytiso-Bromion erecti* Bonin 1978 (xerophilous mixed *Brachypodium rupestre* and *Bromus erectus* on limestone) and *Polygalo mediterraneae-Bromion erecti* (Biondi, Allegrezza et Zuccarello 2005) Di Pietro in Di Pietro et al. 2015 (post-coltural or natural environments on pelithic-arenaceous or marly-clayey colluvial soils). On the other hand Allegrezza *et al.* (2016) considered *Brachypodium rupestre* as a guide-species for the sub-Mediterranean heliophilous forest edges and proposed a new suborder *Dorycnio herbacei-Brachypodienalia* (*Asphodeletalia macrocarpi, Trifolio-Geranietea*) a new alliance, *Dorycnio herbacei-Brachypodion*, and three new associations (*Galio erecti-Brachypodietum, Laserpitio siculi-B.* and *Bituminario-B.*). In this presentation a synoptic table including all the *B. rupestre* communities described for the Italian Peninsula has been statistically analysed and discussed from a floristic and coenological point of view. From this analysis emerged that the *B. rupestre* communities described so far for the Italian peninsula are all characterized by the prevalence of the *Festuco-Brometea* species regardless of their original classification at the class rank.

Spatial scales of alpine plant communities in Navarino island (Chile)

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The survival of flora and plant communities of the top mountains is threatened by diverse factors, all of them of anthropogenic origin and grouped in the so called global change. It is a flora with a high degree of endemicity and/or, in some cases, rarity. The study of any of some biotic and abiotic characteristics has not been realized or it is not enough accurate, with regard to the degree of existing threat. The present work is a part of results obtained of a study done in the alpine vegetation in Navarino island (Chile). These plant communities are natural pastures, rich in hemicryptophytic herbaceous and chamaephytic plants, which, in some cases, might act as "nursery species" and in others as competitors. In general, they are organized forming mosaics (patches) that leave zones of bare soil among them.

The spatial pattern of a plant community is determined by a combination of processes including the soil heterogeneity, biotic interactions, growing pattern, seed dispersal, availability for seed rooting and other random processes. Not always is possible to determine all of those factors but the spatial analysis can give us information to understand how plant communities are formed and what its particular floristic composition is. To know that we have applied a standardized protocol to analyse the spatial structure. Such sampling have also served to study the direct interactions among the species forming these communities, in so unfavourable environment (feldmark) that they are able to colonize. In this respect, with regard to the characterization of the microhabitat, we have also studied some microclimatic and microedaphic features, obtaining information about temperature, relative dampness and solar radiation of the studied plots, as well as the characteristics of soils. The results that we have obtained would lead us to knowing more precisely the spatial patterns of plant species which colonize such environments.

Contrasting patterns in environmental drivers of taxonomic and phylogenetic diversity in temperate forests

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Variation in biodiversity and compositional patterns of temperate forest vegetation is fairly well known. However, understanding the combinations of environmental drivers responsible for these patterns is a difficult task. Such difficulties can be attributed to the interrelations between the environmental drivers and complex processes forming the plant communities. Our aim is to disentangle which combinations of environmental variables best explain the variability in biodiversity of temperate forest herbaceous communities in central Europe.

We focused on two essential measures of plant community diversity: species richness and mean phylogenetic diversity. We used data from a monitoring system comprising 450 plots. They were established in six sites with species-rich thermophilous forests in the lowlands of Czechia. Data on vegetation and environmental variables were analyzed by linear mixed models with the study sites as a random variable. Using the backward elimination of non-significant effects we got the best combination of explanatory variables.

The results showed that out of 15 environmental variables, only seven played significant roles in shaping diversity of forest herbaceous vegetation. Three were linked to topography (heat-load index, topographic position and relief concavity), two were derived from tree species-specific properties (litter quality and shade-casting) and two were related to soil properties (soil acidity and nitrogen content). Taxonomic richness was positively correlated with heat-load and topographic position and negatively with litter quality and shade-casting. On the contrary, the mean phylogenetic diversity was positively correlated with litter quality and shade-casting and also with the nitrogen content. In addition, soil acidity and relief concavity showed unimodal pattern when related to taxonomic richness.

We concluded that the drivers of phylogenetic and taxonomic diversity showed partly opposing patterns, and that partly different drivers significantly influenced the two measures of diversity. Our results suggested that multiple aspects should be considered in order to better understand the patterns in vegetation diversity.

Transplantation of *Anacamptis morio* in coastal grasslands of the Netherlands

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About half of the territory of the Netherlands is situated below sea level. For safety reasons, strict criteria on height and width are applied to the dikes and dune systems protecting the hinterland. One of the dikes that didn't meet the nowadays criteria is situated at the Noorderstrand coast on the former island of Schouwen, province of Zeeland. The dike had to be strengthened, and after many debates it was decided to broaden it towards the inland. Here, the nature reserve "Zoute Haard" is located, which contains the largest population of *Anacamptis morio* in the Southwest of the Netherlands. *Anacamptis morio* is an endangered species in the Netherlands and most of the countries of north-western Europe. In the Netherlands it nowadays is mainly restricted to coastal grasslands and heathlands.

The nature manager (State Forestry Department) agreed on broadening the dike into the nature reserve, under the condition that the endangered part of the population would be dug out and replaced towards another nature reserve (transplantation) and that the effects of this transplantation and of the dike enlargement would be monitored. For the transplantation, three other nature reserves in the province were chosen, in which *Anacamptis morio* either had grown in the past or at present still exists with a very small population. The aim was to establish a sustainable population of the orchid species in the region, following a genetic study of the population.

In autumn 2013, in total 20 square meters with vegetation in which *Anacamptis morio* grows (communities of the endemic association *Rhinantho-Orchidietum morionis*, alliance *Calthion palustris*) were dug out by hand and transplanted towards the nature reserves Zoete Haard, Braakman and Schotsman. In the winter of 3013/2014, the dike was broadened. We monitored population characteristics (number of orchids, size of plants, number of flowers, number of seed pods) and species composition before the dike enlargement and since then in the transplanted plots and in reference plots. After five years, the transplantation seems successful in two of the three new sites, where the orchid is gradually forming a large population. We will demonstrate some of the results, which provide insight in the population ecology of *Anacamptis morio.* Besides, we will discuss two dilemmas when dealing with this type of "nature management": (1) can we except transplantation as a mitigation measure, when populations of endangered plant species are threatened by destruction? And (2) when can we conclude that we meet the aim of establishing a sustainable population of *Anacamptis morio*?

Data gap analysis for European alpine vegetation

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The analysis of large vegetation datasets requires a previous filtering of data sources into target vegetation types. Ideally, this filtering process should combine different selection procedures with gap analysis. Although data gap analysis is a general analytical process for checking the quality of data in many disciplines, it is not routinely implemented in vegetation science. Here, I use several descriptors that may be applied for data gap analysis in projects dealing with European vegetation data. The main aim was to optimize the quality of data provided by the European Vegetation Archive (EVA) for biodiversity analyses on alpine vegetation. I used the expert system procedure recently applied for classifying EVA plots in EUNIS types as the first selection criteria. Gap analysis consisted of the evaluation of the header data provided by EVA for (i) assessing the coverage of vegetation typologies when compared with the phytosociological alliances assigned to the plots and with the EuroVegChecklist, (ii) assessing the spatial coverage of georeferenced plots in pre-defined regions, (iii) combining (i) and (ii) to detect spatial gaps for specific vegetation types. The analysis provided a comprehensive evaluation of the individual databases contributing to the target vegetation and a discussion forum with the database custodians for improving the selection procedure and for establishing a preliminary list of contributing authors. The new selection criteria was then used to conduct another query to EVA, which can be eventually subjected to a new gap analysis.

Formalized classification of the European montane and alpine river gravel bar vegetation

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Gravel bars are features of gravel-bed rivers developed at sites with a specific combination of floodplain morphology, water discharge pattern, and sediment transport regime. Gravel bars with typical vegetation have a wide distribution across the mountainous areas in Europe, but human interventions have made this habitat extremely endangered in many countries. Although they are of considerable conservation importance, they remain insufficiently explored in many areas. Also, the classification of gravel bar vegetation is highly inconsistent among countries.

We compiled a dataset of about 5 000 relevés from existing national or private databases, digitalized additional relevés from literature and sampled the gravel-bar vegetation in the countries where it has not been previously studied or is less explored, especially in south-eastern and northern Europe and the Caucasus. We were able to cover the main areas of the occurrence of this habitat, and vegetation types occurring in the dynamic mosaic that includes several successional stages, ranging from the initial herbaceous stands of the order *Epilobietalia fleischeri* (class *Thlaspietea rotundifolii*) and scrub of the class *Salicetea purpureae*. Here we present a consistent vegetation classification system with formal definitions of vegetation types occurring on river gravel bars down to the level of associations.

Insight from the interaction of a monodominant with species pool

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There have been several documented cases which emphasizes on the effect and impact of strong competitor species in altering the vegetation composition. Though, this reduction in biodiversity can be done by native or alien species as well. The current study deals the interaction between a monodominant species *Allium ursinum* and diverse species assemblages in the deciduous oak-hornbeam forest's herb layer. The investigations were carried out at fine scale in facies of *Asperulo taurinae-Carpinetum* vegetation type in the Mecsek hills SW of Hungary in 2016-17. To avoid strong abiotic gradients and strong biotic interactions were few among several sites selection criteria. The presence/absence and cover data samples were collected from six study sites along the transect. Sites were having two different types of under-storey vegetation: the *Carex pilosa* and the *Melica uniflora* as dominant and opponent plant species to *Allium ursinum.*

To understand how the background species of this vegetation are excluded by the growing density of *A. ursinum* from the edge towards the monodominant situation a 20m long transect was laid down. It has 25cm x 25cm (micro quadrat) eight parallel lanes touching each other up to 20m for each site. By first meter it spans from rich species diversity but missing *Allium ursinum* to monodominance of *Allium ursinum* around its last few meters.

To understand the micro structure of herb layer along the eight parallel lanes of the transects cluster analysis was performed. Clustering has shown three overlapping zones charactering dominant opponent species zone followed by a transition zone and lastly a monodominant zone. The border of these zones is wavy not straight line in transect indicating differential species compositions per lane per site. However, the area of transition zone reflects the varied scope and scenarios of competition potential of opponent species pool and *Allium ursinum*.

To characterize the omitting order of competitor species at fine scale density profiles of species were made. The species numbers of examined transects were between 22 and 31. Based on density profiles the species can be characterized into different types along transects. There are few species such as *Stellaria holostea* or *Asperula odorata* and *Veronica hederifolia* mainly occur and cover the front of the transects. *Dentaria enneaphyllos* and *Galeobdolon luteum* occur at the other end while few has occurrence only around transition zone such as *Galeobdolon luteum*. Majority of species show different presence-absence density profiles in each transects may be due to abiotic and biotic factors.

Initial response of understory vegetation to different forest management intensities in Illyrian beech forests in Slovenia

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Understory vegetation is an important component of European temperate forests. Understanding its response to disturbances and changes in management is essential in studies of biodiversity conservation and ecosystem functioning. In this experimental study, we investigated short-term effects of different felling intensities on understory communities in Illyrian beech forests (Natura 2000) in the Dinaric Mountains, Slovenia. Specific questions we addressed: (1) are there any plant indicator species significantly associated with different felling intensities? (2) what are the differences in abundances of plant functional types along the disturbance gradient? (3) how do typical forest plant species respond to silvicultural treatments?

In managed Illyrian beech forests, 27 karst sinkholes were selected. Sampling plot of 0.4 ha was established in the centre of each sinkhole. Three different felling intensities were implemented, with one third of the plots assigned to each treatment: control (no felling), 50% of the growing stock removed, and 100% of the growing stock removed. Vegetation surveys of vascular plants were made before (in 2012) and two years after (in 2014) the felling. Indicator species were identified by employing the Indicator Value Method. Functional classification was used to group species into functional types with respect to their life-history traits (growth form, N-fixing ability, life span, plant stature).

47 species (out of 251) were significantly associated with the 100% felling intensity. This relatively high number of indicator species was due to the post-disturbance recruitment of colonizing species (newcomers), coupled with the expansion of most pre-treatment resident species. One species was a strong indicator for 50% felled plots, while three species showed preference for unfelled plots. Understory species composition differed significantly between treatments. Graminoids, tall perennial forbs, annual/biennial forbs and legumes exhibited the most prominent increase in cover in the disturbed plots. In general, most of typical forest species responded with increased frequency and/or abundance to the felling operations.

The taxonomic and functional composition of forest plant community exhibited different degree of change for different felling intensities. An increase of many early-successional, non-forest and shade-intolerant species in the felled plots can be attributed to altered environmental conditions (increased light availability) and their greater dispersal capacity. Our results suggest that in the initial stage after disturbance, ecological conditions in the canopy gaps were not modified to such extent to act detrimentally to the persistence of forest species.

Abiotic and biotic factors that shape the diversity of ruderal vegetation (Silesian Uplands Poland)

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The classification of data set using the floristic criterion enabled 26 "patterns" of vegetation units of the ruderal habitats to be delimited.

Direct ordination methods (RDA) with physico-chemical soil parameters showed two independent gradients: one marked by the calcium content in the soils, available nutrients (P, Mg, K), Ntot and the amount of organic carbon (negatively) and a second gradient connected with the granulometric composition and soil reaction (pH). The results of CCA analyses with selected soil variables enabled only a part of the variability in the data set (35%) to be explained. The most important factor for species composition was clay particle content, followed by CaO concentration, the amount of sand particles, pH (KCl), P_2O_5, Ntot and MgO concentrations.

A detailed partition of variance in species data into the species traits connected with dispersal (1), competition or stress (2) and soil variables (3) revealed that species composition was primarily shaped by differences in competitive traits, dispersal traits and to a lesser extent by soil variables. The unique variance explained were slightly smaller but statistically significant, for competition (R^2_{adj}= 0.063, p = 0.001), dispersal (R^2_{adj}= 0.058, p = 0.005) and soil parameters (R^2_{adj}= 0.021, p = 0.005), respectively.

A large portion of residual variation (80%) may be related to historical events (land use e.g. former arable fields), stochastic processes (the frequency and intensity of disturbances, long-distance seed dispersal, etc.), linear dependence between variables (assumption of linearity and excluding intraspecific variation), the rather complex species responses to environmental gradients, as well as, variables not included into the model (e.g. heavy metal concentration, other mineral salts, anthropogenic changes in soil processes, landscape elements, etc.).

Five responsive groups of species were distinguished in relation to fertility and disturbance gradients. The first group comprised monocarpic and biennials, with high seed weight and terminal velocity that differed in relation to seed bank type and lateral spread. The second and third groups comprised polycarpic species, with high leaf area, canopy height, high seed number, long-term seed bank, mainly nitrophilous ruderal and meadow species, which differ in relation to lateral spread, seed weight and terminal velocity. The fourth and fifth groups were mainly made up of species that possessed traits that enabled them to adapt to disturbances or other forms of stress that differ in relation to life span.

Morphological types of below-ground organs of herbs as indicators of features of primary volcanic habitats

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Below-ground organs of plants, especially roots, play an important functional role and represent one more independent trait dimension as well as above-ground traits. To improve our understanding of trait-based community assembly, particularly in disturbed or water deficient habitats, below-ground traits along with traits of other plant parts are worth considering. However, many root traits are hard to measure, and thus they are rarely used in extensive trait-based studies. The question is: whether there are some easily recognizable traits of below-ground organs? We assumed that such nominal functional trait as a morphological type of below-ground organ could be relevant to the species tolerance to disturbed habitats. We also supposed that this trait reflects some functions of the plant (e.g. anchoring, storage, nutrient acquisition and others) and of an ecosystem (e.g. soil structural stability). In addition, this trait could be easily measured in the field as well as in herbarium specimen or obtained from the literature.

The study area was located in a volcanic region – the Tolbachinskii Dol Plateau, Kamchatka, Russia. Vegetation cover has formed after 1975 eruption in primary habitats on tephra deposits. To minimize the biotic interactions among plants, 40 relevés of primary succession vegetation with sparse plant cover were selected. 53 species of herbs were divided into 5 groups based on the root system type (taproot or fibrous) and the underground stem type (long- or short-rhizome). Sums of the percentage cover per plot of these groups were used to conduct the canonical analysis (RDA) of vegetation in disturbed volcanic habitats. R-sq (adjusted) of the RDA model was 0.515. The distribution of the distinguished herb groups was dependent on the presence of lava remnants and woody debris and the depth of tephra layer. Then to specify the explanatory power of this trait the inverted version of RDA was conducted where predictors and responses change places. 11 environmental characteristics were included in the response matrix. Cumulative R-sq (adjusted) of the inverted RDA model was 0.303. Hence, the morphological type of below-ground organs is an informative functional trait for the initial stages of primary succession in disturbed habitats. It explained at least 30% of the total variance of the environmental characteristics.

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Floristic and ecological characteristics of pedunculate oak (*Quercus robur* L.) forests in Europe

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Pedunculate oak (*Quercus robur* L.) is economically one of the most valuable hardwood tree species, which due to its wide ecological niche forms different types of forests widespread in Europe. The aim of this study was to investigate the floristic and ecological characteristics of the pedunculate oak forests in Europe.

For this purpose, a data set of 14745 phytosociological relevés with pedunculate oak was used, obtained from the European phytosociological database (EVA – http://euroveg.org/eva-database) and the literature (for areas that were not included in the European database). After the stratification, the analysis was conducted on 3594 phytosociological relevés.

Based on the hierarchical cluster analysis, we defined five basic groups of relevés, i.e., types of pedunculate oak forests in Europe, which differ in their floristic, ecological and geographical characteristics. On fine-scale division, they could be further divided into 17 different subtypes, so the data was observed and analyzed on two levels. For each of these five forests types, the area of distribution and diagnostic plant species were determined, a DCA ordination analysis of relevés based on floristic composition was performed with passive projection of syntaxonomic affiliation of species. The results show clear differences in floristical and ecological features among the groups obtained from the cluster analysis. The atlantic and subatlantic groups of relevés could be clearly separated from the continental group. Within the latter thermophilous and mesic forests, as well as extrazonal forests in alluvial river areas could be distinguished. At finer scale of 17 different forest subtypes, the differentiation is based on ecological differentiation of site conditions evaluated by Ellenberg indicator values and distribution reflected in change of chorological spectrum.

WetVegEurope, not only a classification exercise…

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The WetVegEurope project started five years ago as one of the first classification exercises at the European scale. The main aim was to develop a consistent formalized classification of European and aquatic vegetation at the level of association to be used as a tool for nature conservation. The initial idea was to use the Cocktail method in a similar way that was used to formally classify the vegetation of the Czech Republic. Despite the general scope has remained almost the same, during these five years the project has undergone substantial methodological development. New studies were published (e.g. the European Vegetation Checklist by Mucina et al. 2016), new tools have been released (TURBOVEG 3, improvements of the JUICE 7.0 program) and new methods have been introduced, allowing us to produce a complete consistent classification protocol for the classification of marsh vegetation across all hierarchical levels (from association to class).

This study presents the complete classification protocol realized for the *Phragmito-Magnocaricetea* class. The main results up to the level of association are also presented and a revision of the European Vegetation Checklist is proposed. According to our results the associations included in *Phragmito-Magnocaricetea* are 94, divided in 6 orders and 11 alliances. One order (*Saccharetalia ravennae*) and four alliances (*Typhion laxmannii*, *Imperato cylindricae-Saccharion ravennae*, *Phalaridion arundinaceae, Deschampsion argenteae*) included in the European Vegetation checklist were rejected.

The classification protocol was built to create a consistent classification section sensu the "Comparative framework for broad-scale plot-based vegetation classification" (De Cáceres et al. 2015). We offer this classification protocol as a model that could be used for developing a unified vegetation classification system in Europe and beyond.

Petrophytic steppes of the Urals: diversity and ecological drivers

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The steppe communities in the Urals remained only in habitats unsuitable for plowing, including stony habitats with coarse soils. Stony habitats hold a variety of steppe flora and vegetation in the region. Diversity and main compositional patterns of petrophytic steppes of the Urals were studied. Two questions were considered in details: (i) how rich the phytocoenotic diversity of petrophytic steppes?; (ii) what ecological drivers determine its differentiation? The dataset of 1025 relevés was compiled, representing communities of different climatic and geological conditions. Using formalized classification (TWINSPAN algorithm) eight vegetation types among petrophytic steppes were defined.

Petrophytic steppes of the Urals have shared species group, typical for all defined types. The species of this group are vast-distributed in the steppe of studied region: *Festuca valesiaca* s.l., *Stipa pennata, Campanula sibirica, Veronica spicata, Filipendula vulgaris, Thalictrum minus, Seseli libanotis* etc. Obligate and facultative petrophytes are mentioned as common: *Centaurea sibirica, Echinops ritro* s.l., *Allium rubens, Artemisia commutata, Euphorbia seguierana* etc.

The distribution of first four communities types is connected with a steppe and southern part of a forest-steppe zone. They are characterized by the presence of obligate petrophytes (*Astragalus helmii*, *Orostachys spinosa, Hedysarum argirophyllum* etc.), xerophytes and mesoxerophytes (*Poa crispa, Ephedra distachya, Potentilla glaucescens* etc.). Communities of types 5-8 are more mesic. They are indicated by high activities of mesophytes (*Achillea millefolium, Pimpinella saxifraga, Vicia craca* etc.) and xeromesophytes (*Amoria montana, Fragaria viridis, Inula hirta* etc.)

DCA-ordination was used to determine main ecological drivers (both climatic and edaphic) of plant communities' diversity. Among them are mean annual temperature and precipitation, aridity, rockiness, local habitat moisture. Interaction of different ecological factors lead to high floristic and coenotic diversity of vegetation on dry rocky habitats.

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Trait-based numerical classification of *Molinio-Arrhenatheretea* grasslands in Poland

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Descriptive vegetation science has witnessed a rapid progress in the last decades due to the improvement of broad-scale electronic databases. Most synthetic works aimed at delimiting vegetation types on the basis of numerical analysis of species composition of sample plots. Such classifications are often supposed to serve as a multi-purpose reference of habitat types, since the diversity and composition of natural communities are known to determine general ecosystem properties. However, it has been recognised that focusing on species composition may fail to reveal certain patterns of vegetation that are strongly linked with the functioning of ecosystems. Instead of the taxonomic identities of species, their functional traits could offer more relevant information. Functional classifications are expected to have more general validity than species-based classifications because often the same traits respond to the same environmental gradients in very different places of the world due to convergent evolution. In contrast, species are dispersal-limited, thus their local abundances are informative only within their respective distributional limits. Our aim was to classify managed herbaceous vegetation on deep soils and temperate climate of *Molinio-Arrhenatheretea* syntaxonomical class in Poland on the basis of phytosociological relevés, plant trait data, and using numerical methods.

19995 vegetation plots representing all major grassland types of Poland were retrieved from the Polish Vegetation Database, from which a narrower subset of cca. 6000 *Molinio-Arrhenatheretea* relevés were resampled. Records of specific leaf area, canopy height, seed mass, clonality and bud bank were obtained from the LEDA and CLO-PLA databases. Between-plot dissimilarities were expressed by Rao functional dissimilarity index. The dissimilarity matrix was passed to principal coordinates ordination, and its most important axes were classified by Ward's method.

Although, this classification did not reproduce the hierarchy of the syntaxonomical categories at a coarse scale, at finer resolutions the main subtypes of *Molinio-Arrhenatheretea* were differentiated: mesic and wet hay meadows and pastures, marshes and wet grasslands rich in sedges, tall-forb vegetation, and trampled grasslands. After the first promising results, more subtle differences between types in individual traits are subject to further research.

Edge effects and vegetation dynamics in back alder swamp woods in Latvia

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Swamp woods in Europe have experienced major changes through rapid decrease during last centuries. In Latvia, many black alder swamp woods have been affected by forest drainage activities during the last century. Black alder swamp woods represents an important habitat type and it is protected under Habitat Directive (Council Directive 92/43/EEC). Forest fragmentation increases the number of anthropogenic edges which affect and decrease the quality of these protected habitats. The main objective was to analyze the changes of edge influence on stand structure adjacent to young, middle-aged and mature stands. In total 30 study sites were established and surveyed. The area of a sample plot was 20x50m. In the south or south-west side of study sites adjacent stands corresponded to the three different age groups: young forest stands, middle – aged forest stands and mature forest stands. In all study plots living trees and dead wood was measured and vegetation was described by layers and the presence of rare epiphytic lichens was recorded.

Edge effects influence the vegetation for more than 40 years after the clear-cut and the best indicators for this influence are vascular plants. In black alder swamp woods the edge influence of trees remain for up to 10 years after the disturbance – the volume of living trees, diameter of black alders, total projective coverage and number of species decreases. The occurrence of rare epiphytic lichens are influenced by management actions in adjacent stand for up to 20 years after the disturbance – significantly fewer of these species occur at the distance up to 10m from the edge. The influence of the distance from edge on these species was found up to 41 years after the disturbance in adjacent stand. The rare occurrences of these species at edges are explained by the lack of substrate due to increased death of black alder trees at edges as well as the interaction of ecological factors. Relatively small black alder forest parcels in production forests contain valuable habitats but these habitats are influenced by edges created by forest management actions in adjacent stands. To decrease the influence of forestry on these stands and retain the characteristic vegetation in a long term further research at the level of landscapes is needed.

Diversity of aquatic macrophytes in overgrowing lakes

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Human pressure on lakes is evident as increasing share of emergent macrophytes and suppression of submerged, particularly sensitive charophytes. The most serious problem in European temperate zone is intensification of eutrophication, which causes lake disappearance as a result of their gradual shallowing and overgrowing. The most threatened with this process are shallow lakes, characterised by low resistance to degradation. In the last two decades great effort has been made to improve water quality in European Union, as demanded in the Water Framework Directive, however the activity has been concentrated on lakes bigger than 50 ha and on the ecological status of lakes. Lake overgrowth has not been considered as a one of the effects of lake degradation, whereas large proportion of macrophytes in the lake reflect better ecological status of the lake.

The aim of the study was to analyse the species composition of overgrown , shallow lakes, taking into account various macrophyte forms of growth in relation to lake morphometry, water's chemistry and bottom sediments. Changes in the range of emergent vegetation were analyzed in the period 1911-2014 on the basis of historical cartographic materials and current orthophotomaps and field studies. The research involved 33 lakes characterized by a varied degree of vegetation development, located in Wielkopolska region, central-western part of Poland.

Our study demonstrates that in lowland temperate lakes the process of lake overgrowth is linked with intensive growth of emergent vegetation, particularly *Phragmites australis* (Cav.) Trin. ex Steud. and *Typha angustifolia* L. This group of macrophytes can serve as an indicator of lakes disappearances due to overgrowth because a large proportion of emergent macrophytes in a lake observed over a long-term scale can reflect the degree of advancement of lake overgrowing or at least can support the interpretation of the direction of their changes. In lakes with the currently highest degree of overgrowth, intensive development of the littoral zone was found over many years (1910-2010), which confirms the bioindicator properties of helophytes in assessing the extent of lake overgrowth.

Our research also showed the greatest diversity of forms of vegetation growth in strongly overgrown lakes, in which the share of hydrophytes and floating plants was also significant. This was reflected in better water quality, associated with greater transparency with limited phytoplankton development. However, these differences between the analyzed groups of lakes with different levels of overgrowth were not as significantly different as in the case of nitrogen and potassium in sediments.

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Classifying European heathlands of the class *Calluno-Ulicetea*: data set selection and procedures for a broad-scale classification

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The class *Calluno-Ulicetea* is spread across temperate and mediterranean climatic regions of Europe, on acidic nutrient-poor soils. It is formed mostly of woody Ericaceae (*Erica* spp., *Calluna vulgaris*, *Daboecia* spp.) and Fabaceae (*Ulex* spp., *Genista* spp.). Heathlands are listed in Annex I of the Habitats Directive (4010, 4020*, 4030 and 4040*) because they are in retreat across Europe mainly due to land use changes. According to EuroVegChecklist, this class comprises two orders: *Ulicetalia nani* and *Vaccinio myrtilli-Genistetalia pilosae*. The first order includes seven alliances distributed in Western Europe, including the hyperhumid communities of the Azores, as well as the Mediterranean communites of northern Morocco. The second order with seven alliances includes the communities of cold-Atlantic, subcontinental suboreal and boreal regions of Western, Central, and northeastern Europe and Scandinavia. In general, heathlands are best developed in temperate lowlands of the Atlantic Region, where they reach the highest floristic diversity and contain most specialist species. Elevation, latitude and continentality affect the composition of these communities. In some cases, they are floristically impoverished, such as in the continental zone where *Calluna vulgaris* is the only dwarf shrub in the heathland communities. In other cases there is noticeable enrichment of communities with characteristic species of other syntaxa, such as *Oxycocco-Sphagnetea* on peaty soils, *Cisto-Lavanduletea* in the Mediterranean Region and *Vaccinio-Piceetea* in the boreal zone and high mountains of the nemoral zone. In the latter cases, it becomes necessary to establish the criteria for assignment of the communities to this class or the others; for this reason a survey at continental scale is needed. For this purpose, we requested data from the European Vegetation Archive and received a total of 50 000 plots across Europe. Here we present this project and discuss data selection and methodological issues to reach a sound classification.

Vegetation classification in Bosnia and Herzegovina – current state and future prospects

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Owing to its geographical position, geological, geomorphological and climate diversity, Bosnia and Herzegovina possess great diversity of vegetation types. Although study of the Bosnia and Herzegovina's vegetation according to the Braun-Blanquet's methodology dates back to 1930s, the overall level of knowledge remained relatively poor. Extensive research began only in 1960s, just to be halted by the civil war 1992-1995. Twenty years after the war B&H vegetation science hasn't still achieved the prewar level.

However, there are differences in exploration level depending on the vegetation type, so we can say that some vegetation types are reasonably well investigated while the others were not studied at all. According to Lakušić's overview of vegetation of Bosnia and Herzegovina (the only systematic survey published so far) the phanerogamic vegetation numbers 33 classis only, what can be attributed to different concept from 1970s. Recent research shows that this number is between 54 and 60, considering that some of the classes are still doubtfully present.

The aim of this study was to examine the level of exploration of the main vegetation types of the country providing the gap analysis of vegetation science in Bosnia and Herzegovina and as such can be used for defining the future goals of its development.

There is about 4150 published and ca. 3050 unpublished relevés from B&H. The preliminary results, based on literature relevés only, show that forest vegetation (ca. 2000 relevés) is under best study, following by vegetation of subalpine and alpine pastures (ca. 800), while pioneer, ephemeral, and aquatic vegetation pure investigated. The best investigated classes are: *Carpino-Fagetea sylvaticae* Jakucs ex Passarge 1968 (ca. 1200 releves), *Molinio-Arrhenatheretea* Tx. 1937 (ca. 390), *Quercetea pubescentis* Doing-Kraft ex Scamoni et Passarge 1959 (ca. 350), *Vaccinio-Piceetea* Br.-Bl. in Br.-Bl. et al. 1939 (ca. 280), *Festuco-Brometea* Br.-Bl. et Tx. ex Soó 1947 (ca. 235), *Elyno-Seslerietea* Br.-Bl. 1948 (ca. 220) etc. Some classes are not investigated at all (*Brachypodio pinnati-Betuletea pendulae* Ermakov et al. 1991, Robinietea Jurko ex Hadač et Sofron 1980, *Franguletea* Doing ex Westhoff in Westhoff et Den Held 1969, *Poetea bulbosae* Rivas Goday et Rivas-Mart. in Rivas-Mart. 1978, *Halodulo wrightii-Thalassietea testudinum* Rivas-Mart. et al. 1999, *Adiantetea* Br.-Bl. et al. 1952, *Polypodietea* Jurko et Peciar ex Boscaiu, Gergely et Codoreanu in Ratiu et al. 1966), while some of them contain only a few releves (*Quercetea ilicis* Br.-Bl. ex A. Bolòs et O. de Bolòs in A. Bolòs y Vayreda 1950, *Ononido-Rosmarinetea* Br.-Bl. in A. Bolòs y Vayreda 1950, *Lygeo sparti-Stipetea tenacissimae* Rivas-Mart. 1978, *Salicetea purpureae* Moor 1958, *Crithmo-Staticetea* Br.-Bl. in Br.-Bl. et al. 1952, *Lemnetea* O. de Bolòs et Masclans 1955, *Montio-Cardaminetea* Br.-Bl. et Tx. ex Klika et Hadač 1944 etc.).

Are we looking sufficiently at vegetation structure in our vegetation analyses?

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Vegetation ecology has, since its beginnings, regarded structure as an important trait of the vegetation stand. In fact, Braun-Blanquet's cover-abundance scale merges abundance, cover and dominance elegantly, being an unquestionable standard. Frequently, vegetation analysis focus directly on the floristic composition of the relevés, but the selection criteria of these relevés can be quite different, as: relevés availability in databases; minimum cover of a certain species or a group of species; relevés considered a priori to belong to some syntaxa, etc.

We argue that some of these criteria can produce very heterogeneous datasets and that a first systematic look at the structure of each relevé, as well as at the structure patterns in the entire dataset can be a relevant first analysis. Yet, this task can be time consuming for large datasets. We devised some functions for R software to explore relevés' structure/physiognomy, highlighting dominancy patterns in the dataset, based on some given ordered classification of dominant types. Such patterns can be analysed using graph theory. Eventually, some pre-classification of our dataset can be obtained. We illustrate the application of these functions with real-world data.

Syntaxonomy of oak-hornbeam forests of Central Europe: new insights into old problems

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Oak-hornbeam forests represent widespread mesophilous deciduous forest vegetation within Central Europe. There are many associations of the alliance *Carpinion betuli* described. Additionally, several associations of the alliance *Erythronio-Carpinion*, limited to the southernmost part of Central Europe, were recognized. However, approach to delimitation of associations often differs amongst countries of the region. Contrary to relative commonness of this vegetation, analysis of variability on a broad geographical scale, which could provide crucial insight into its variability, has not been carried out yet. Therefore the main goals of the project are as follows. 1) To analyse variability of Central European oak-hornbeam forests by various analyses of species composition of phytosociological relevés obtained mainly from EVA. 2) To create formal definitions of selected associations using formal logic and based on results of the analyses. 3) To prepare a revised syntaxonomical system of the studied vegetation. The analysed dataset contained approximately 6000 relevés of oak-hornbeam forests from all Central European countries.

Unweighted means of Ellenberg´s indicator values and climatic variables obtained from CHELSA were appended to all relevés in order to provide better insight into environmental factors driving their variability. Executed analyses revealed that the main gradient in species composition follows changes in soil moisture and nutrient amount. However, geographical position is also important due to occurrence of many forest mesophytes with distinctive distribution ranges. Afterwards, cocktail formulas for selected associations based on results of numerical analyses were proposed. In this way, 15 association has been defined so far, 11 of the alliance *Carpinion betuli* and the rest of the alliance *Erythronio-Carpinion*. Approximately 40% of relevés of the dataset were classified on the association level. Mesophilous oak-hornbeam forest association *Galio sylvatici-Carpinetum* is the most common unit and it occupies central position among distinguished associations. *Stellario holosteae-Carpinetum* involving slightly wet types and *Primulo veris-Carpinetum* involving thermophilous Central European types are other relatively common associations. Final results will be presented during the meeting.

Identification of potential Natura 2000 habitats in local scale based on remote sensing data and habitat modeling

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The habitat mapping through the field surveys requires expert knowledge and is time-consuming. The development of habitat modeling methods and the availability of high resolution remote sensing data makes it possible to predict the distribution of habitats with high accuracy on a local scale. The aim of this study is to compare the importance of two sources of high resolution remote sensing predictors: topographic and hyperspectral to identify selected Natura 2000 habitats, as well as, to assess the transferability of developed models between different areas.

The research was carried out for three types of Natura 2000 habitats: xerothermic grasslands (6210), Molinia meadows (6410) and mountain yellow Trisetum hay meadows (6520) in five Natura 2000 protected areas. Biological data were obtained during field surveys at the optimal time of the growing seasons in 2016 and 2017. For each of the habitats a representative number of samples in at least two areas was collected. For all three habitat types, a total of 5794 presence/absence samples with precise GNSS coordinates were gathered. The digital elevation model derived from the ALS laser scanning and airborne hyperspectral imagery recorded with HySpex sensors were used to calculate the predictors. A total of 522 predictors with 1 meter spatial resolution were tested: 41 topographic variables and 481 spectral variables, including 430 original spectral bands, 26 vegetation indices, 5 PCA bands and 20 MNF bands. The analyzes were divided into three phases: 1 – initial selection of predictors, 2 – development of models for each area using selected predictors and 3 – projecting the models into another area and validation of biological data from this area. Each phase was repeated for each habitat, area and a set of predictors.

The majority of models based on only one set of predictors had a tendency to overestimate. Models based on topographic predictors mostly identified potential abiotic conditions while ignoring actual vegetation, contrary to models based on hyperspectral data. The models developed on the combined set of topographic and spectral variables obtained significantly higher accuracy. The main factor limiting the transferability of models is the variability of spectral predictors between areas, therefore these predictors should be selected with caution.

The study is part of project "The innovative approach supporting monitoring of no-forest Natura 2000 habitats, using remote sensing methods" co-financed by the funds of The National Centre for Research and Development.

Central European forest-steppe: the concept, its testing and a preliminary synthesis

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Forest-steppe is a biogeographical region with temperate climate and a mosaic of dry grassland and woodland vegetation. It is situated between the steppe and temperate forest biomes in ecological space and also in the real world it often forms a transition between the two. Outside Eurasia, analogous ecosystems are usually termed differently.

European forest-steppe has a substantial extent in Eastern Europe, where it forms a belt stretching between the Carpathians and Ural Mts. While climate is clearly the decisive factor shaping the relationship of forest and steppe on a broad scale, local factors such as fire and grazing were shown to play an important role too. These may be particularly important in the forest-steppe (i.e. northern steppe) zone, where climate is generally favourable for tree growth.

Central European regions with analogous ecosystems are treated ambiguously. Pannonian forest-steppe is largely accepted, other regions largely not. Whether we consider the forest-steppe concept useful or not, following criteria should be considered during any modern study of vegetation history in the regions concerned: climate (both present and past); soils (mollic horizons and other indications of non-forest past), floristic composition of vegetation (presence of dry steppe to steppe meadows; *Festuco-Brometea*, *Geranion sanguinei* and *Quercetea pubescentis* vegetation being part of the mosaic; share of species with Siberian-Pontic-Pannonian distribution); presence of habitats characteristic of steppe biome (e.g. dry steppe grasslands, salt marshes, continental floodplain meadows); historical link to steppe biome (palaeoecological, archaeological, phylogeographical or biogeographical indication). A case study from White Carpathians will be presented.

Temporal patterns in dry dune grasslands on a regional scale are driven by sea-climate interactions

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Dune grassland ecosystems are driven by wind and sand dynamics. Whereas the Aeolian processes were perceived as a threat in history, the current absence of these rejuvenating processes are nowadays seen as a challenge for restoring natural dune dynamics. Large-scale human interference (e.g. marram planting), the impact of epidemic rabbit diseases and nitrogen eutrophication, leading to grass and shrub encroachment, have immobilised dune systems over time. As such they are a threat for ecosystem properties essential for maintaining species-rich dune grassland, a priority habitat type within Natura 2000. Sand mobility, natural succession, nutrient availability and grazing activity are referred to as the main driving forces for sustaining dry dune grassland ecosystems. The effects of these factors can be relatively well predicted at a local scale but have proven to be hard to predict on a regional scale. At this scale, other environmental factors may play a vital role in the formation of vegetation patterns over time, factors that are poorly understood and are therefore often not considered in the practice of dune management.

In this study, we explore the correlation between large-scale environmental factors and vegetation dynamics in dry dune grassland ecosystems in the calcareous coastal dunes of the Netherlands. Long-term data on large-scale environmental factors, including climate, weather and marine conditions, were correlated with long-term data on vegetation composition and cover, using time-series of field observations and remote sensing images. We show that the repeating interactions between sea level dynamics and variation in wind direction largely explain the variation in dry dune grassland vegetation cover and sand availability over multiple decades. This supports the theory of autonomous processes responsible for dune grassland rejuvenation, posing new insights for the management of coastal dunes, to be considered where local measures to promote sand mobilisation have often proven ineffective.

On European fruticose halophytic vegetation: new insights and proposals

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Updated data had clarified the correct distribution of the European species of *Sarcocornia* (*Salicornia*) species: *Sarcocornia perennis* and *S. pruinosa* from Atlantic littoral salt marshes; *S. alpini* from western Atlantic and eastern and western Mediterranean estuarine coastal salt marshes; *S. lagascae* found in Mediterranean coastal areas on the Iberian Peninsula and Balearic Islands; *S. hispanica* from Mediterranean semi-arid inland and coastal salt pans; and *S. carinata*, endemic in continental inland salt pans on the Iberian Peninsula. *Sarcocornia fruticosa* has been found to be absent from Iberian territories; our last data suggest it is distributed along Mediterranean coasts of France, Italy and Greece.

We recently published a review of the current syntaxonomy of the *Sarcocornia* plant communities for both coastal and inland saline territories in West Europe. Now, new insights and proposals are compiled trying to build an updated and coherent syntaxonomy of these fragile European vegetation-types.

Alnus glutinosa woodlands in Sicily: an example of paleo-temperate vegetation at the southernmost limit of its distribution range

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In the frame of phytosociological investigations focused on the riparian woody vegetation of Sicily, the meso-hygrophilous plant communities belonging to the alliance *Osmundo-Alnion glutinosae* are surveyed. In Sicily, this vegetation represents an outstanding example of paleo-temperate vegetation, mainly circumscribed to the mountain riparian environments featured by a very humid and fresh micro-climate, and floristically characterized by a pool of hygrophilous-calcifuge ferns, e.g. *Polystichum setiferum*, *Dryopteris affinis*, *Anthyrium filix-foemina*, *Osmunda regalis*, etc.

This vegetation, exclusively found on the Peloritani Mts., occurs along the rivers of more or less recessed deep valleys, but also along less steep watercourses where the bed widens into large pebble beds (locally called "fiumara"). The paleo-temperate floristic elements reached the southernmost Mediterranean territories during the last glacial maximum (LGM), thus getting in contact with the already established Mediterranean flora. As a consequence of the penetration of these species, the riparian vegetation of Sicily is also characterized by plant communities belonging to the *Osmundo-Alnion glutinosae* alliance and currently found on the metamorphic substrates of north-eastern Sicily.

These tree plant communities are included (as priority habitat) in the Annex I of the European Habitat Directive 92/43/ECC. Their relevance is linked both to their ecological features representing the climacic vegetation of the riparian environments with running oligotrophic waters and to the intrinsic vulnerability of the peripheral *Alnus glutinosa* populations being at the southern limit of their distribution range.

Our study is aiming at (1) delimiting the *Alnus glutinosa* populations in Sicily, (2) analysing structure and composition of the surveyed plant communities, (3) evaluating demographic trends of the *Alnus glutinosa*-dominated woodlands, (4) assessing the *Alnus glutinosa*-dominated plant communities at national level, and (5) finally, to provide more insights on the ecology of *Alnus glutinosa* woodlands in order to improve protection and management policies.

Clonal plant response to disturbance: A case study from montane Norway spruce forests in the Tatras

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We examined clonal plant response to disturbance in the Tatra Mountains, Slovakia, at both the community and population levels. We hypothesized that communities in canopy gaps had greater dominance and foraging of clonal species than those in large wind throws and greater diversity, due to the greater heterogeneity of the canopy gap communities (such environmental heterogeneity should favor clonal plants over non-clonal plants). We collected 10 plots (10x10 m) of data from four disturbance site types (DR = wind throw and not salvaged; DS = wind throw salvaged; NF = Forest without gap; NG = forest with canopy gap) in 2 localities of the Tatras (totally 80 plots). Data included cover of all species, heterogeneity data and clonal connectedness data (through dye experiments on three species: *Calamagrostis villosa*, *Rubus idaeus*, *Vaccinium myrtillus*). Based on the variance to mean ratio as a measure of heterogeneity, wind throw sites that were not salvaged had the greatest heterogeneity, and all other sites had similar heterogeneity. Further, heterogeneity was driven by litter and woody debris as live grass and herbaceous vegetation heterogeneity were similar among sites; however, both herbaceous and grass heterogeneity were noticeably less in forests without gaps, suggesting that treatment had the lowest heterogeneity. Additionally, conductivity was lowest and pH highest in salvaged sites. Forests sites had the greatest richness while forest gaps and regenerating wind throw sites had the greatest diversity. Nearly all species had some aspect of clonality, but only those species with roots with adventitious buds had significantly more cover in wind throw sites; rhizome species also tended toward more cover in gap and salvaged sites.

Robinia pseudoacacia as the driver of homogenization of broadleaved temperate forests

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Species composition of forest vegetation is changing in past decades due to changes in land use, fragmentation, and synanthrophisation of forest communities. All these processes cause extinction of some typical (including rare) forest species and invasion of aliens and lead to the homogenization of forest vegetation. Planting of alien trees and intensive forest management play a key role in the homogenisation process. Alien forests are often the hotspots of non-native species diversity supporting spreading of non-native species to the surrounding environment. In the Carpathian Region one of the most commonly planted alien trees is *Robinia pseudoacacia*. Many types of native forests (hardwood floodplain forests, oak forests, *Carpinion* forests) were replaced by *Robinia* plantations. The diversity of broadleaved deciduous forests is huge in the Carpathian and Pannonian regions, with many local differences, geographical variability and endangered (according to IUCN) species occurrence. We hypothesize that (1) areas where these native forests were replaced by *Robinia* forests show lower diversity than native communities do, especially the diversity of diagnostic species from native forests species pool and endangered species (2) total species pool of native broadleaved deciduous forests is higher than the species pool of alternative *Robinia* forests, (3) plantations of *Robinia pseudoacacia* are a factor that unifies species composition of forests, unifies variability of different geoelements and thus restraining local differences in forest diversity and (4) *Robinia pseudoacacia* plantations can unify also microenvironmental characteristic of localities. We used more than 264 paired relevés of *Robinia* forests and native forests sampled during 2014-2017 vegetation seasons in the area of Slovakia, Czech Republic, Hungary, Poland, Ukraine and Romania. Relevés were sampled following standard methodology of Zurich-Montpelier school using the new Braun-Blanquet cover-abundance scale on the area 400m^2. Each pair of relevés was sampled in native and adjacent *Robinia* forest patches with less than 250 meters distance among them and in the same environmental conditions (slope, orientation, soil type) to avoid the influence of local environmental conditions' variability on the forest undergrowth. Thus, the difference in species composition can be interpreted as an effect of alien trees. The dataset of native forest relevés and dataset of corresponding *Robinia* relevés were analysed using SYN-TAX and Canoco software and the differences in beta-diversity, site conditions presented via Ellenberg indicator values, endangered species and different geoelements occurence within native and *Robinia* forests were compared using Wilcoxon paired tests (R-software). We found total species pool of Robinia forests is 372 species, native stands have larger species pool – 422 species. Total dissimilarity in the dataset of native forest relevés is markedly higher (similarity ratio>3) than inside the homogenous

group of relevés dominated by *Robinia pseudoacacia* (<2). This result shows native stands tend to be more variable than stands replaced by *Robinia pseudoacacia*. Even if abiotic conditions (altitude, slope, orientation, soil, water regime) of sites are the same, environmental condition measured via indicator values of present plant species differ significantly. The variance of moisture is higher in native forests. Amount of nutrients varies from nutrient poor to nutrient rich localities in native stands, however in *Robinia* stands amount of nutrients is significantly higher and less variable.

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Biomass biodiversity relation in vegetation on post-mining heaps

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Relationship between biomass biodiversity and different environment factors are of interest biological for a long time. In natural systems biomass is negatively correlated with biodiversity. On man-made habitats such as e.g. post-mining waste dumps, there is no data on the relationship between plant biomass and biodiversity parameters within spatial patches of spontaneously growing vegetation. Biomass is understood as an organic substance that is produced as a result of the process of photosynthesis. The purpose of the research is to find out: which of the selected biotic and abiotic habitat factors and biodiversity parameters influence the amount of biomass produced by selected species of vascular plants in spontaneously developed patches of vegetation on post-mining heaps?

Biomass of plants collected from research plots of surface 0.25m^2. Biomass of the individuals collected from the plots was divided into the dominant species* and other species (subdominants and transient species together). The following dominant species were sampled: *Calamagrostis epigejos, Daucus carota, Phragmites australis, Poa compressa, Tussilago farfara*. In next step biomass samples were dried in 105^{o}C and thr weight of each sample was rcorded. In the next stage of the study, the relationships between plant biomass and the number of species, percentage cover, enzymatic activity, humidity, water capacity, value of biodiversity indicators (Evennes, Shannon-Wiener (H'), Simpson (D) were analyzed. Biodiversity indicators were calculated using the CANOCO 4.5. *The dominant species was the species that occupied the largest area compared to the rest of the species within the plot.

It was found that dry biomass of dominant species is different in patches of the most frequent vegetation types. The highest biomass was found in patches dominated by *Phragmites australis*, and lowest in patches dominated by *Poa compressa*. Similar results have been obtained with respect to dry biomass. The Spearman rank correlation showed that the dry biomass of the dominant species is negatively correlated with the values of the tested diversity indices: D, E, H and with soil moisture. The highest value for the species homogeneity index (E) was recorded in patches dominated by *Daucus carota* and *Poa compressa*, and lowest in patches dominated by: *Calamagrostis epigeios* and *Tussilago farfara* respectively.

The highest value for the Shannon-Wiener (H) index was recorded in patches of *Poa compressa* and *Daucus carota*, significantly less in *Calamagrostis epigejos*, and lowest in patches of *Tussilago farfara*. On average the highest number of accompanying species occurred in patches dominated by *Poa compressa* and *Daucus carota Calamagrostis epigejos* and lowest in patches with *Tussilago farfara*. The analyzes performed showed that the amount of dry biomass have negative relationships beetween values biodiversity.

Preliminary analyzes revealed that in transformed habitats and on man-made sites such as post-mining waste biomass production of the dominant species is negatively correlated with biodiversity. The results also show that biomass is higher when the habitat is dry.

Forest and scrub vegetation dominated by *Carpinus orientalis* in Balkan Peninsula

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Carpinus orientalis is SE European tree species occurring in the understory of many thermophilous deciduous oak dominated forest communities. However, this vegetation is structurally degraded and often appears as *Carpinus orientalis* dominated coppice forests and scrub. Such *Carpinus orientalis* dominated scrub communities appear also as a stage of secondary succession. Such degraded stands can be mono- or polydominant communities composed of different species, having closed, semi open or open canopy. Being mainly coppice, all of them share common prominent synmorphological characteristics, such as bushy appearance, which was one of reasons why, up-to-date, there were only a few *C. orientalis* dominated associations recognized and described in Balkan Peninsula. However, recent research suggests that there is a much higher diversity among these communities, since they appear in different regions, reflect ecological conditions and originate from different types of oak forests.

This study aimed at, based on more than 800 relevés from all around Balkans, resolving the syntaxonomy, ecology, nomenclature and distribution of these communities in Balkan Peninsula. Data were analyzed using numerical methods of classification and ordination in TURBOVEG, Juice, PC-Ord and R.

Our preliminary results show that there appear considerable number of new associations, which for the main part belong to thermophilous alliances of *Carpinion orientalis*, *Fraxino orni-Ostryion, Syringo-Carpinion orientalis* and *Quercion confertae,* but also to much more mesophilous *Ostryo carpinifoliae-Tilion platyphylli*, *Fraxino excelsioris-Acerion pseudoplatani* and *Erythronio-Carpinion*.

Some communities are similar throughout the Balkans (continental, more mesophilous communities), while communities, which are more under the influence of Mediterranean climate (Macedonia, Greece, southern Bulgaria, Montenegro, B&H and Croatia) show greater degree of differentiation.

Our analysis has also shown that the upper layer of *shibljak* formations, albeit 'shrubby' in the appearance, is comprised of tree species with high cover value, so we argue if those communities belong to scrub and mantle vegetation of *Buxo-Syringion* or to the oriental-hornbeam forest of the Central and Southern Balkans of *Syringo-Carpinion orientalis*.

Invasive plant species distribution is structured by habitat and land use type in the city landscape

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The city is a particular place for research on the expansion of alien and invasive alien plant species due to the highly diverse habitat niches. Most of them were shaped by human activity. There are also semi-natural and natural habitats. Most of alien species appear as a result of arranging urban greenery and then get into the natural environment. The study of habitat preferences and expansion paths of alien species is particularly important due to the need to control the spread of these species to natural habitats. Previous studies indicate the relationship of individual species with the land use.

The city of Torun is located in the valley of the Vistula river, which is one of the biggest plant migration route in Poland. Diaspora of native and alien species move along the river and land transport routes.

Our research focused on the relations between invasive alien species distribution and the land use types in the city. We assumed that 1) there is relation between species pattern end environmental factors, 2) some species are directly related to certain type of land use type 3) this relation can be connected with the way of species spreading

Floristic presence-absence data was collected in the ATPOL squares with a resolution of 500x500 m. Raster analysis enabled generalization of land use maps and soil types to the size of the ATPOL grid by determining the dominant values in a given square. The species-environment relations have been analysed by GIS and ordination methods. We included environmental factors as soil type and land use type.

In the flora of the city of Torun we identified 66 alien species, which have in Poland status of invasive plants. Some of them are already fixed component of the urban flora, some find their starting points for the further expansion. The most important for species distribution were: presence of free environmental niches (disturbed areas along river banks, on housing areas and on industrial and post-industrial areas), sources of diasporas (allotment and home gardens, alien tree plantations) and transport routes (river valley and roads). The results demonstrate also that alien species are spreading around single-family housing areas, allotment gardens and city parks. Leading vectors for the propagation of some species have been shown. We also identified factors that increase the risk of invasion.

The priority effect shapes the pattern of goldenrods (*Solidago* and *Euthamia*) invasion in Silesia, Central Europe

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Anthropogenic species movement was the primary driver of plant invasion. The subsequent effectiveness of invasion, considered as an efficient distribution and habitat infilling within the new range, is driven by the interacting environmental factors (land-use system, climate, habitat disturbances and resident vegetation), propagule pressure and biology of the invasive species. The effect of these interactions is highly contingent in their context, e.g. community composition, and/or availability of suitable space and resources, as well as the time since a population had been established. Numerous studies indicate that the order of arrival into an ecosystem, the so-called 'priority effect', can influence local community assembly. As a result, ecological contingencies can govern the success of colonisation and limit the distribution of invasive species. Several habitats can nowadays be multiple invaded, thus knowledge about the interactions between non-native species becomes critical for understanding their distribution and abundance. In this study we assessed the role of ecological niche differentiation and historical contingency in distribution of invasive goldenrods (*Solidago gigantea* Aiton, *S. canadensis* L., *S. altissima* L. and *Euthamia graminifolia* (L.) Nutt.) in Silesia (Central Europe, studied area approximately 32 000 km^2). Since the studied species are similar in resource use and strongly affect the environment, the priority effect could be particularly strong. Within the study region, we established 309 plots, placed in nodes of 10x10 km regular grid. For all the plots, the shortest distances to the initial infestation location (distribution before the WW II) were calculated. The obtained results suggest that the effect of historical contingency is more prominent than ecological niche differentiation on goldenrods distribution pattern and invasion effectiveness.

Environmental correlates of neophytes richness – results of regional scale analysis in Carpathian Mountains and its foreground

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Processes driving neophytes richness (NR) operate at different spatial scales, and the effect of a particular environmental factor (EV) on NR, as well as its interactions with other EV is context-dependent. Thus, the nature of interactions between drivers can vary from region to region, depending on the broader ecological context. In macroecology, for examination of such dependencies, plant distribution atlases have been used. The atlases have rather coarse scales, in Europe typically 10x10 km or more. It allowed to well-establish relationships at a large spatial extent, but relationships at a regional scale are less well known. As a result, understanding the distribution of alien species, even in well-studied areas such as Europe, is still a challenge. In our examination we have used EV which represent different spheres of environment (soil, landscape, landrelief, climate, and anthroposphere), to explain spatial distribution of NR at a regional scale in Carpathian Mts. and its foreground, Central Europe. The data on neophytes derived from a distribution atlas showing NR in 2x2 km grid (studied area ca. 31,200 km², 7800 grid cells altogether). For modelling we have used boosted regression trees (BRT) methods with implemented tool for calculating partial dependency plots (PDP). The PDP modelled effect of a particular variable on the NR, after accounting for the average effects of all other variables in the model. While these graphs are not a perfect representation of the effects of each variable, particularly if there are strong interactions in the data, they provide a useful basis for interpretation and offer some insight into a potentially causal relationship between NR and each of the EV. It seems to be particularly useful because at coarse spatial scales it is extremely difficult or impossible to apply a classical experimental approach, and we must infer ecological mechanisms from models only. The obtained results reveal the crucial EV for modelling NR at a regional scale. The PDP exhibit course of dependencies between NR and particular EV – the relationships were usually curvilinear and revealed some threshold values of EV beyond which NR changed considerably.

Understorey response to the management-induced overstorey changes in montane forests of the Western Carpathians

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The impact of forest management on the understorey plant and fungal diversity was widely discussed and frequently studied in European temperate zone. However, various contradictions arose from studies and meta-analyses as a consequence of a heterogeneity of compared material. To avoid these discrepancies, we investigated the overstorey-understorey relationships over life-cycle in managed age-class Norway spruce and European beech forests, and compared them to primeval fir-beech forests of the same site type in the volcanic Poľana Mts. (Western Carpathians). Understorey vegetation, macrofungi, overstorey structure and environmental properties were sampled using two spatial scales within a series of 230 randomly placed plots.

Both vascular plant and macrofungal communities were significantly affected by a management-induced tree-species change, and they differed within the age classes. Vascular plant diversity changed considerably over the development of managed stands. This temporal dynamics was driven mainly by decreasing tree density. We observed a rapid decline from species-rich forest clearings (maximum richness and diversity 6-7 years after cutting – over 100 species on 314 m^2) to species-poor dense and young stands aged 30-40 years, followed by slow recovery reaching the average of old-growth forests (40 species) at the harvest age (over 100 years). Clear-cuts enriched a species pool of the managed forests, but mostly by non-forest species. Despite of that, the average alpha-diversity was the highest in the primeval stands. Macrofungal diversity showed an opposite trend in the spruce stands – it was decreasing in forests older than 40 years. The response of the macrofungal communities (especially wood-inhabiting fungi) was more pronounced in terms of species turnover compared to plants. Macrofungal communities were more affected by tree-species composition, while understorey plants responded more sensitively to the stand structure.

The results highlighted an importance of species turnover evaluation and considering a life-cycle in the age-class managed forests for the biodiversity assessment. Finally, we emphasized the need for structurally complex mixed close-to-nature forests to maintain diverse plant and macrofungal communities.

Joining hierarchical clustering, diagnostic species and expert system definitions into a coherent classification approach: dry grasslands of the Balkan Peninsula as an example

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Aims: Developing a hierarchical classification system of dry grasslands of the Central and Eastern Balkan Peninsula.

Methods: We extracted from the Balkan Dry Grassland Database (BDGD) with the European Expert System those plots that presumably correspond to the eight classes of dry grasslands reported from the region. This initial dataset (5,734 plots) and later the plots within each of the derived subunits corresponding to orders separately were subjected to a new numerical approach: Starting with an initial partitioning (here: based on expert-interpreted TWINSPAN classifications), diagnostic species (defined by absolute phi values + phi value difference to the closest unit) were determined, they were then fed into an expert system (ES) to create a new partitioning and so forth, until diagnostic species and species of the ES converged.

Results: The iterative optimisation procedure converged in all cases. With our approach we succeed to classify 95% of all plots to alliance level. We distinguish four classes with eight orders and 12 alliances: 1. Sub-Mediterranean acidic grasslands (class and order unclear) with *Trifolion cherleri*; 2. sub-Mediterranean basiphilous grasslands (class and order unclear) with one unclear alliance; 3. *Festuco-Brometea* with *Brachyopodietalia pinnati* (with *Chrysopogno-Danthonion calycinae* and *Cirsio-Brachypodion pinnati*), *Festucetalia valesiacae* (with *Festucion valesiacae*), an order of rocky steppes (with *Pimpinello-Thymion zygoidis*) and an order of rocky grasslands (with *Centaureo-*

Bromion fibrosi, *Saturejion montanae* and *Saturejo-Thymion*), 4. *Koelerio-Corynephoretea* with *Sedo acris-Festucetalia* (with *Festucion vaginatae*) and *Trifolio arvensis-Festucetalia ovinae* (with *Armerio rumelicae-Potentillion* and a new alliance with *Poa molinieri*).

Conclusions: Building on the widely used concepts of electronic ESs and diagnostic species defined by phi values, we created a unified hierarchical classification framework. This proved to allow the classification of a large heterogeneous dataset into meaningful units of several hierarchical levels with hardly any unclassified plots. This approach thus has high potential for similarly complex classification tasks at national to continental levels, particularly if in the future it would be fully implemented in a single computer program.

Mire vegetation features in the mountains of South Siberia

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Siberian mountain mires are unique wetland type contrasting with the largest in the world West Siberian plain peatlands. We observed more than 100 mountain mire massifs in the large mountain land at the south of West Siberia, in Altai Mountains, in a wide range of environment conditions with climate variyng from hyper-humid on the western macro-slope of Kuznetsky Alatau ridge in the north of the region where precipitation reaches 3000 mm per year, to arid with only 120 mm per year in the South-Eastern Altai (N 49°04'-55°38', E 83°57'-89°52'). Mires occupy concave and flat areas such as large depressions, high-mountain circuses, river valleys, saddles, flat tops, slopes foots and gentle slopes of the mountains. The most of investigated mires are peatlands. We conducted about 800 geobotanical releves and carried out more then 50 peatlands coring; peat samples analized for botanical composition, degree of decomposition and mineralization to reconstruct past ecological conditions of mire development process.

Investigated peat mires started to develop at the end of the Holocene thermal optimum, 4500-5000 years ago, having accumulated up to now maximally 3.9 m peat deposit depth. Plant remains of sedges (mainly, *Carex altaica*), brown mosses and sphagnums are found most frequently at the peat deposits. Today, mountain mires are covered by sedge, sedge-brown moss, dwarf shrub-sedge brown moss and sedge-sphagnum plant communities.

Mires are critical for conserving and promoting biodiversity, especially in arid regions of Altai, where they are natural refuges for hygrophilous plants and their communities. They differ from other ecosystems by the large variety of habitats they include. This habitat diversity increases with the altitude and allows the existence of not only characteristic mire plants (sphagnums, *Oxycoccus species*, *Comarum palustre, Menyanthes trifoliata*, etc.), but also many alpine and plain species originating in steppe, tundra, forest. Some plant communities are rare in Siberia (such as crooked birch *Betula alba* ssp. *tortuosa* community of the wettest and snowiest region of Altai – Kuznetsky Alatau ridge) and some species are rare, endangered, or vulnerable (such as mire orchid *Liparis loeselii* and many others) because of habitats lost, overgrazing, low productivity and disturbance factor. Thus, mountain mires not only act as natural filters, reservoirs, and sources of clean water but also provide a significant contribution to biodiversity.

The research was supported by RFBR grant (№ 15-29-02599) and the Tomsk State University competitiveness improvement programme.

Syntaxonomic revision of the semi-dry grasslands of Central and Eastern Europe

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The Eurasian semi-dry grasslands are among the most species-rich and most valuable habitat types of the northern hemisphere. For our syntaxonomic revision, we used a dataset of 34,173 plot records which were assigned to the class *Festuco-Brometea* by the EuroVegChecklist expert system. In the first step, we classified the dataset into orders and alliances. As starting point, a TWINSPAN classification of the whole dataset was done and the diagnostic species of the main clusters (first and second division level) were determined. The plots were re-assigned using formal definitions of the orders, and then the subset of the order *Brometalia erecti* (=*Brachypodietalia pinnati*), corresponding to all semi-dry grasslands of the study area, was classified again. On the basis of this second TWINSPAN classification, formal definitions of the alliances were established. We distinguished the following alliances: *Bromion erecti* s.str. (=*Mesobromion*), *Cirsio-Brachypodion pinnati* (incl. *Fragario-Trifolion montani, Agrostio-Avenulion schellianae, Scabioso ochroleucae-Poion angustifoliae, Adonido vernalis-Stipion tirsae*), *Scorzonerion villosae* and *Chrysopogono-Danthonion*. The fifth alliance "*Koelerio-Phleion phleoidis*" is transitional towards the class *Koelerio-Corynephoretea* and its status needs further study.

We also established formal definitions of all associations of the *Bromion erecti* and *Cirsio-Brachypodion pinnati* within the study area. The other alliances were not further classified in the present study. Associations were identified using (i) the TWINSPAN classification of the whole order, (ii) TWINSPAN classifications of regionally restricted data sets (typically all *Brometalia* plots of one country) and (iii) existing national classification schemes. All formal definitions were written in the expert system language of the JUICE program.

Vegetation biodiversity and soil enzymes activity on post-mining heaps

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Vegetation biodiversity is influenced by many factors. The abiotic and biotic habitat conditions are considered as the most important factors in shaping the Vegetation biodiversity. One of the crucial biotic soil parameters are the activity of soil enzymes. The Soil enzymes participate in releasing minerals to plants, detoxification of xenobiotics and decomposition of organic matter. Microorganisms are the main source of soil enzymes. However, the functional structure of microbial communities present in soil is frequently influenced by the most abundant plants. There is little data on the relationship between plants biomass, biodiversity and soil enzyme activity within spatial patches of spontaneously growing vegetation on post-mining waste dumps. The aims of this work was to investigate whether there is a relationship between the dominant species biomass and plants biodiversity in the studied patches of vegetation and selected soil enzymes.

The patches dominated by *Calamagrostis epigejos* were characterized by the highest biomass and lowest diversity index. Negative correlations between plant species diversity and biomass were also obtained in case of natural systems. Activity of soil urease and dehydrogenase did not differ significantly among vegetated and control patches. The highest activity of alkaline phosphatase was determined in soil from *Calamagrostis epigejos* patches, whereas the highest activity of soil acid phosphatase was observed in *Poa compressa* patches. A low percentage of the variance explained by most of the models may be due to the fact that activity of soil enzymes is more affected by soil substrate properties, than plant biomass and biodiversity.

Both plant biomass and diversity may affect, to some extent, the activity of soil enzymes on post–mining waste heaps, but there are factors (e.g. soil properties) that have a greater effect. *Calamagrostis epigejos* had the highest impact on the activity of soil enzymes.

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Diversity of Central European scree and ravine forests

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This study deals with syntaxonomy of scree and ravine forest vegetation of Central Europe including Switzerland, Germany, Austria, Czech Republic, Poland, Slovakia, northern Hungary and western Ukraine. According to the latest version of European classification system of plant communities, scree and ravine forests are classified within the order *Aceretalia pseudoplatani* with two Central European alliances, *Tilio platyphylli -Acerion* comprising mesophilous sycamore maple forests and *Melico-Tilion platyphylli* containing thermophilous lime forests. Aim of this study is to assess whether such delimitation of the alliances is convenient and to unify syntaxonomical system of the studied vegetation in Central Europe on the association level.

We performed several numerical analyses on a dataset of nearly 4500 phytosociological relevés obtained from European Vegetation Archive (EVA) supplemented by original relevés recorded mainly in undersampled areas. First level of division distinguished group of scree and ravine forests usually dominated be *Acer pseudoplatanus* from the group of forests occurring in lower altitudes dominated mainly be *Acer platanoides, Carpinus betulus* and *Tilia platyphyllos*. These two groups can be identified with the two above mentioned alliances. Among each of them, several validly described associations can be identified. Their overview will be presented during the oral presentation.

Posters

Large-scale assessment of alien plant invasions in European grasslands

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Invasive alien species can have serious environmental and socioeconomic impacts, therefore we need to know more about plant communities most at risk and mechanisms responsible for habitat invasibility. Our study focused on European grassland vegetation aims at finding more general patterns than previous studies with a regional scope or recent syntheses based on extrapolation of limited vegetation data. This will be achieved by identifying (1) habitats most vulnerable to invasions, (2) and environmental variables that affect the levels of invasion, and (3) mapping the levels of invasion for the most common grassland types in Europe.

We use grassland vegetation data sampled within geographically delimited Europe (excluding Macaronesia, Anatolia and Cyprus), provided by the European Vegetation Archive database. Thanks to great effort of all EVA data contributors we obtained information from more than 300 000 vegetation plots that fit our criteria (georeferenced plots sampled after 1970, of the plot size 1-100 m^2). Alien or native status of species was assigned based on the DAISIE database of alien taxa in Europe, with respect to different origin status in different countries. We considered only neophytes (non-native species that arrived in the region after 1500 AD), and divided them in two groups, according to their origin from or outside Europe.

We will present a list of the most frequent alien species that occur in the grassland types of the EUNIS habitat classification and provide a preliminary ranking of grassland habitats by level of invasion and compared across countries.

Degradation of vegetation in halophyte nature reserve between 1995 and 2016

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Semi-natural plant communities are sensitive to changes in the type and intensity of human impact. An example of changes caused by the decline in the intensity of anthropopressure are the transformation of the structure of plant communities within the boundaries of the halophitic vegetation reserve in Ciechocinek. Halophyte reserve Ciechocinek in central Poland has been established in 1964 to protect inland salt-marsh vegetation, today Natura 2000 habitat *1340. In that time halophytes as *Salicornia europaea* and *Aster tripolium* dominated in this area. After melioration of the Vistula River valley in late sixties, degradation of halophilous vegetation has been observed. Few research reported decrease of area occupied by halophytes and expansion of glycophytes. Nevertheless, in 2009 in this area Natura 2000 was established to protect *1340 habitat.

Our research aimed at recognition of current state and trend in vegetation changes in the reserve. We hypothesised that: 1) degradation of halophilous flora continues, 2) the protected area can be supported by diasporas of halophytes from surroundings of graduation towers of the health resort.

We mapped the vegetation of the reserve and took phytosociological relevés to characterise distinguished types of vegetation. In the transect from graduation towers to the reserve we took samples for halophyte seed bank assessment. The current map of vegetation we compared with vegetation maps from previous research with the use of Q-GIS software. The vegetation was analysed by CANOCO and Past 3.xx.

Results demonstrate that halophytes are limited only to the ditch crossing the reserve. *Aster tripolium, Puccinellia distans and Spergularia salina* dominate in any patches. Triglochin maritimum and Glaux maritima disappeared from the reserve. Area of domination of *Salicornia europea* decreased from ca 1398 m^2 in 1955 to ca 95 m^2 in 2016. Current dominant species belong to *Molinio-Arrhenatheretea* class. We did not find seedlings of halophytes in seed bank samples what suggest that metapopulations in the reserve are not supported from outside.

Based on the results we confirmed our first hypothesis, that degradation of halophilous flora continues and reject second one about metapopulation support from outside. The further existence of the halophilous vegetation in this site will be possible only with brine support.

Effects of management on vegetation change in wet meadows (*Molinietalia caeruleae*) and sedge-bed marsh (*Magnocaricetalia*) in south-western Lithuania: a case study from Žuvintas Biosphere Reserve

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Background: The abandonment of wet meadows and sedge-bed marsh is taking place widely in Europe. These processes of vegetation dynamics are typical in all protected wetland areas of Lithuania, where, due to Soviet nature conservation practice, farming activity was prohibited.

Methods: To monitor vegetation dynamics in 2011, we distinguished 94 botanical monitoring plots and carried out phytocoenological relevés every two years. Also, we employed data of vegetation inventory gathered during our investigations in the biosphere reserve in 1996-1998 as well as the monograph of Žuvintas Biosphere Reserve published in 1968.

Results: Literature data and monitoring plot analysis show that the main changes occurred due to the hay meadows and sedge-bed marsh falling into neglect. Orthophotos taken on 1951 show that a major part of the territory was mowed by hand. Many areas were abandoned around 1965. Scrubs were removed between 2003 and 2011, and regular mowing was started in the territory in 2013. Because of the absence of farming activities, the meadows from the alliance of the *Molinion caeruleae* became extinct – in most cases, *Selino carvifoliae-Molinietum caeruleae* replaced by *Carex disticha* phytocoenon (*Calthion palustris*) and *Galio veri-Molinietum caeruleae* occupied by forbs phytocoenoses (*Lysimachio vulgaris-Filipenduletum ulmariae* and *Cirsietum rivularis*). Areas of meadows from the *Calthion palustris* alliance increased because they were patchily overgrown by reeds or in other cases, *Filipendulo ulmariae-Geranietum palustris* and *Caricetum cespitosae* replaced by *Lysimachio vulgaris-Filipenduletum ulmariae* or *Cirsietum rivularis* (in few cases by *Carex disticha* phytocoenon). Since 1960, the area of the *Magno-Caricion elatae* in the reserve has decreased by more than one third. The areas where *Caricetum elatae* predominated declined most; the communities covered with reeds transformed into *Phragitetum australis* phytocoenoses. Reinstating maintenance, such as removal of shrubs and mowing prompted the gradual restoration of *Caricetum elatae* communities. After five years, due to reed mowing, their projective coverage fell to 30 %, and sedge coenopopulations stared to thrive and formed a continuous carpet. However, mechanized mowing is pernicious for *Caricetum appropinquatae* phytocoenosis – mowing destroys tussocks and as a result, the plant communities vanish and are being replaced by *Caricetum diandrae* and *Peucedano palustris-Caricetum lasiocarpae*.

How the replacement of different types of native forests by black locust (*Robinia pseudoacacia*) plantations affects species diversity of understory vegetation?

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We have evaluated the influence of black locust (*Robinia pseudoacacia)* dominated forests on the composition and structure of herb synusia in comparison with the forests dominated by native trees. The study is based on 141 twin plots (282 relevés) collected in Czech Republic, Hungary, Romania, Slovakia and Ukraine in 2014-2017. Every black locust relevé is paired with neighbouring (max. 250 m) relevé from native forest. Three groups of relevés based on related native forest were formed: i) floodplain forests (30 twin relevés) ii) oak forests (53 twin relevés) iii) mixed oak-hornbeam forests (58 twin relevés). The data were sampled by standard methods of Zürich-Montpelliér school. For each relevé percentage number and cover values for alien species, native species, and Shannon-Wiener index and equitability with number of all species were calculated in JUICE program. For comparison of variables was used paired t-test and Wilcoxon pair test in R program. According to the DCA analyses made in CANOCO 5 and Ellenberg indication values species from floodplain forest indicate moisture localities. Together with paired black locust relevés they indicate also most nutrient rich soils. The black locust relevés paired to the native oak forests indicate the lightest and warmest conditions. The mixed oak-hornbeam forests with their black locust twins indicate mesophilous and more shaded environment.

The main message is that the species spectrum always changed significantly but differently under the black locust trees in comparison with different types of native forests. Percentage number of alien species in the understory is always significantly higher for black locust plots in each of three compared native forests. The floodplain forest was the most invaded native forest type and so were its black locust twins. There are several possible explanations. Black locust comes into leaf later and its canopy stays sparse and gappy. It facilitates occurrence of the spring and the heliophilous species. Ability of black locust to fix aerial nitrogen to the soil improves conditions for nitrophilous alien species. A lot of alien species are nitrophilous and likes disturbed areas, which black locust plantations surely are. Increase of cover of several alien and nitrophilous species in black locust stands can causes their lower total number of species and species diversity and homogenisation of forest communities.

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Syntaxonomical notes on *Dryas octopetala* L. dominated communities from Sharri Mts., SE Europe

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South Eastern European high mountains represent the southern distributional limits of several arctic-alpine plant species. In this work, syntaxonomical notes about the composition of *Dryas octopetala* L. dominated plant communities in the Kosovarian part of Sharri Mts. are provided. Additionally, a comparison with other related plant communities from the region is offered. In order to determine the syntaxonomic position of the plant community which develops in the subalpine belt of the Sharri Mts, 22 relevès made on calcareous bedrock were compared with communities similar in the floral composition. Due to the dominant presence of the species *Dryas octopetala* and *Carex sempervirens,* the research community from the massif of Luboten, was compared with the associations *Carici-Dryadetum octopetalae* Jovanović-Dunjić 1955 and *Carex laevis-Carex sempervirens* Rajevski 1990. After the made extensive comparative analysis, researched community, showed the greatest syntaxonomic affinity with ass. *Carici-Dryadetum octopetalae* because of the presence of its characteristic species: *Dryas octopetala, Carex sempervirens, Arctostaphylos uva-ursi* and *Saxifraga paniculata.* In the floristic composition of the vegetation relevés made in our research, except that were registered all characteristic species of the association, the dominant presence of the *Juniperus communis* subsp. *nana* which define its physiognomy, and presence of species as. *Carex laevis* and *Sesleria nitida* should be considered as new subassociation *juniperetum nanae* subass nova. Obtained phytocoenological relevès belong to the alliance *Seslerion rigidae* Zoly, of which were registered following characteristic species: *Dryas octopetala*, *Eadrianthus graminifolius*, *Festuca pancicana*, *Arctostapyhlos uva-ursi*, *Helianthemum oelandicum* subsp. *incanum*, and Sesleria tenuifolia. Characteristic feature of communities of alliance is high coverage and constancy of dwarf shrubs (*Dryas octopetala* & *Salix reticulata*) and mesophytic low herbs and sedges (*Carex laevis*, *Oxytropis halleri* subsp. *korabensis*, *Pedicularis brachyodonta, Myosotis sylvestris*). Plant communities of alliance *Seslerion rigidae* are from small to medium sized assemblages and they occupy xeropphylous high mountain grasslands on calcareous substrates. These plant communities are found at N, NE and E steep slopes (average 20º) of high elevation (1793 up to 2350 m. a.s.l.). Based on the plant species composition, the most abundand life forms are Hemicryptophytes (69%) followed by Chamaephytes (18%); while the most predominant floristic elements are divided between SE-European (18%), Balkan (17%) and Euroasiatic (16%) accordingly. They are characterized with high level of diversity, from 22 relevès were recorded 98 plant species, therefore they shall be regarded as highly valuable natural habitats.

Towards a new electronic archive for European pine forest: CircumMed+Euro Pine Forest database

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Vegetation-plot databases are a useful tool in the context of vegetation classification and beyond. In October 2017 we started a project called "Formalized classification of European Mediterranean and temperate pine forests" in the context of the European Vegetation Survey (EVS). For this purpose, we are building up the *CircumMed+Euro Pine Forest* database.

The database is managed by the Vegetation Science Group, Department of Botany and Zoology of Masaryk University in Brno (Czech Republic) and it stores data that have never been deposited in any other database. It currently stores more than 3000 pine-dominated vegetation plots and plots of related vegetation types from more than 15 countries across Europe and the adjacent areas in the Mediterranean Basin. The data were collected through a detailed literature search in the main vegetation journals. We also included neglected or unpublished plots contributed by different researchers from several European, Eastern Mediterranean and Northern African countries, mentioned in the present abstract as "data contributors". All plots were digitized, georeferenced and coordinates stored with different degrees of precision according to the accuracy reported by the original authors. All information present in the original publications − locality, country, relevé area, total/tree/shrub/herb cover, bedrock, reference, association, alliance, order, class, holotype − was digitized. Standardized and up-to-date nomenclature of taxa is also provided for all plots.

The pine forest data of the *CircumMed+Euro Pine Forest* database fills the gaps present in the EVA (European Vegetation Archive). The database will soon be registered in the Global Index of Vegetation-Plot Databases (GIVD) and will be accessible through EVA or by asking the custodian.

Alliance *Salicion eleagno-daphnoidis* (Moor 1958) Grass 1993 in Ukraine – a preliminary overview

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The alliance *Salicion elaeagno-daphnoidis* belongs to *Salicetea purpureae* class and includes shrubby vegetation on gravel beds of montane to submontane rivers with fast-flowing water and powerful erosion-accumulating activity. This alliance includes three associations: *Salicetum elaeagno-purpureae, Salicetum purpureae, Salici purpureae-Myricarietum germanicae.* In Ukraine they occur mainly in the Carpathians, while they are rare and often fragmentary in the lowland. Alpine rivers and their ligneous vegetation with *Myricaria germanica* and *Salix elaeagnos* belong to the natural habitat types of community interest (code 3230, 3240) according to the Directive of European Union 92/43/ECC. There is no information about diversity and distribution of this alliance on the territory of Ukraine.

Our researches based on the field geobotanical description. Abstract presents data from 27 plots, in which we recorded all vascular plants. Basic ecological parameters are recorded for each plots. The communities analysed showed high species densities (from 31 to 78 species). At generally there 156 plant species were found.

The first association *Salicetum elaeagno-purpureae* occurs on gravelly river beds and is characterized by *Salix elaeagnos*. Most stands are co-dominated by *S. purpurea*. The communities are characterized by highest species composition (max. 78 species per 100 m^2). The best developed stands occur along the Rika river, but some stands can also be found along the other rivers in the Ukrainian Carpathians approximately between 270 and 365 m a.s.l.

The communities of the second association *Salicetum purpureae* are dominated by *Salix purpurea*, and sometimes are accompanied by *S. euxina*, *S. triandra* and *S. viminalis*. They occur in the lowest mountain level and on the lowland in the Western part of Ukraine (between 110 and 280 m a.s.l.). They prefer sandy or gravelly accumulations and are the most floristically diverse communities with widest range of distribution. Number of species fluctuates from 31 to 58.

The communities of the third association *Salici purpureae-Myricarietum germanicae* occur more rarely and occupy small areas. They prefer gravelly river beds with very low amount of sediment on the elevation about 400-500 m a.s.l. Number of species is relatively high (40-50 species per 16 m^2) with very low total coverage (40-50%).

Most localities strictly depend on hydrodynamics and, due to human regimentation of waters, disappeared in the second half of the 20th century.

The non-native *Pinus nigra* forests in Central Europe and their effect on the environment and the diversity of undergrowth

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Although the plantations of non-native trees form a significant part of the European forests, their impact on the diversity of undergrowth has so far been limited to a few studies. *Pinus nigra* native area extends from the Mediterranean to the southern slopes of Alps. North of this area black pine is one of the most frequently planted non-native tree. In this study, we focused on potential changes in environmental conditions and on the diversity of undergrowth in non-native stands of black pine compared to forest communities dominated by the native trees. Between years 2015 and 2017, 87 pairs of phytosociological relevés (the size of 400 m^2) with the dominant *Pinus nigra* species and adjacent natural forest communities (maximum distance 250 m) were collected. The abiotic conditions (elevation, exposure and slope) remain the same. In addition to the species composition and species cover, we also recorded the cover and height of the individual vegetation layers and the cover and thickness of litter layer. We also measured the light conditions using the GLAMA application. The obtained variables were supplemented by the pH of the upper part of the soil by collecting and analysing soil samples. Using the Wilcoxon pair test, we compared the characteristics of the environmental variables measured directly in the field or indirectly using Ellenberg′s indicator values and diversity (the number, relative number and cover of native, non-native, diagnostic and constant species and Shannon-Wiener diversity index). We found out, that black pine forests planted outside its native area create lighter and drier conditions of lower layers. They also allow better development of shrub layer, resulting in lower cover of herb layer. Soil analysis showed that *Pinus nigra* did not acidify upper layer of soil compared to twin native forest. The number of all species in black pine forests and native forests does not differ, however the occurrence of native species is lower. The neophyte and archeophyte species are more frequent and the presence of characteristic and constant forest species is lower in black pine forests.

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Functional traits variation along elevation gradient are climate-context: the case of sub-Mediterranean mountain grasslands

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According to niche theory environmental factors operate like a filter promoting the coexistence of species with similar ecological niches. Contrary, competitive interactions promote niche differentiation increasing functional traits dissimilarity of co-occurring species. These two processes act simultaneously but given a small study scale, the predominance of one over the other should depend on the intensity of environmental restrictions. Elevation gradients have been extensively used to test these assumptions, as environmental constrained increase along elevation, mainly due to temperature decrease. However, in the Mediterranean region precipitation increases along elevation determining an overall humped-back gradient of environmental restriction, with higher restriction at the lower and higher elevation. We analysed changes in functional trait patterns relative to Leaf-Height-Seed scheme along a sub-Mediterranean elevation gradient to test whether community functional patterns responded to this particular environmental gradient. We hypothesized that trait dispersion is higher at middle elevations and that trait means reflected the communities' response to environmental restrictions. The study area was carried out on dry grassland of the Velino massif (Central Apennines). We collected species cover for 45 environmentally homogeneous plots (4 m^2) along and elevation gradient from 1325 to 2375 m a.s.l. To explain changes in functional patterns at community level, we performed generalized least square models with elevation as explanatory variable, choosing the most appropriate variance structure by the minimum AIC criteria. We found that all functional indices responded to elevation changes, except for mean values of specific leaf area. We found at lower and higher elevations, communities displayed adaptation to more environmentally restricted conditions, i.e. low plant height and low seed mass. Moreover, lower trait diversity values at low and high elevations indicate that climatic conditions restricted the number of strategies in the community. On the contrary, more favorable environmental conditions in the intermediate part of the elevation gradient seems to lead to higher trait diversity. Our results are in accordance with both niche theory and the stress gradient hypothesis. Nevertheless, the also pin-point the necessity of considering the specific climatic context when trying to generalize the elevation-functional patterns relationships.

Does isolation decrease genetical diversity of saline vegetation?

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The genus *Salicornia europaea* is considered one of the most salt-tolerant plant species in the world, widely distributed in coastal and inland salt marshes. *Salicornia* can achieve extremely high population densities or can be isolated in specific regions. In Poland this species is very rare and threatened with extinction in natural saline stands. Local populations of *Salicornia* currently are known only from three natural places: Chrząszczewska Island in the Szczecin Lagoon, Kołobrzeg-Budzistowo and inland from Ciechocinek. They are endangered, but few is known if the isolation of this plant could decrease the genetical diversity and increase the extinction risk. Therefore, we decided to compare isolated and decreasing *Salicornia* population in Ciechocinek (C) with realativlely big population in an industrial area of Inowrocław (I).

We hypothesised that: 1. It could be an important correlation between the environmental characteristics and the genetical diversity of two *Salicornia* populations. 2. Isolation of *Salicornia* population may affect its genetical diversity.

We took plant samples (30 individuals in each site) on saline meadow near soda factory in the town of Inowrocław-Mątwy and second in the area affected with natural brine in the nature reserve of halophytes "Ciechocinek" (PLH 040019 Ciechocinek). We proposed to use the DNA (RAPD) fingerprint method since it has been reported as a fastest and simplest method to investigate the patterns of genetic variation. Three random primers were selected for the analysis K01 (5'-CATTCGAGCC-3'), K15 (5'-CTCCTGCCAA-3') and M02 (5'-ACAACGCCTC-3'). The RAPD-PCR was carried out for 35 cycles consisting of denaturation at 94°C for 1 min, annealing at 30°C for 1 min, and extension at 72°C for 1 min, using an automated thermal cycler. The RAPD fragments were separated by AGE and visualized by UV. The bands that commonly appeared in each population are defined as monomorphic bands. On the other hand, the bands whose presence or absence varied among the plant individuals are consider as polymorphic bands. The RAPD markers are scored as 1 for a positive marker and as 0 for a negative marker.

Finally, the results of this study are expected to provide important information in the understanding of how isolation could affect the genetical diversity of saline vegetation. In case of significant decrease in genetical diversity support of diasporas from outside should be considered to lower the risk of population extinction.

Light intensity and structural elements of vegetation in two grassland habitat types

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A strong relationship exists between plant canopy, plant structure and understorey light conditions. Density of plants, their life form and growth type determine structure of vegetation and consequently portion of available light intensity in different vegetation layers. Vegetation structure determines heterogeneity of ecological niches and microclimatic conditions. Thus, it is among other (plant-plant and plant-soil, plant-herbivorous interactions) also important factor for assessing nature conservation value of habitat types.

We used hemispherical photography in two grassland habitat types (HT 6410 – *Molinia* spp. grassland and HT 6510 – *Alopecurus pratensis* grassland) that are threatened by changes of agricultural practices to search for eventual differences among light parameters. Vegetation structure of these two habitat types is crucial for preservation of different endangered animal species (e.g. HT 6410 for butterfly *Coenonympha oedippus*). On each plot, 25m^2 in size vegetation relevés were made, with measured vegetation height and cover, cover and thickness of above-ground litter and portion of bare ground. We also calculated Ellenberg indicator values.

Significant differences between both habitat types in light indices, light indicator values and majority of structural parameters were confirmed. *Alopecurus* dominated meadows have denser herb layer and more species with planophile leaf orientation and less litter than *Molinia*-dominated grasslands. Habitat subtypes defined by plant composition within each studied habitat type did not significantly differ in light indices, presumably due to great impact of soil properties.

Hemispherical photography has proved to be fast, standardized and reproducible method also in grassland habitat types; although it should be tested on more grassland types with different management to provide more detailed conclusions.

Syntaxonomy of *Filipendula ulmaria* dominated communities in two nature reserves (NW Russia)

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The *Filipendula ulmaria* (meadowsweet) dominated communities are widely distributed in Europe, including the European part of Russia. As a rule, they represent secondary vegetation that arose on the site of cut down wet forests or because of mowing cessation in wet meadows. In nature reserves exclusion of agricultural use causes successional changes of meadow vegetation and lead to formation of meadowsweet communities in wet sites. The aim of our study is to classify meadowsweet communities in two nature reserves in NW Russia and to reveal the main ecological gradients determining the vegetation.

The relevés were made in 2012-2015 in the Polistovsky Nature Reserve (Lat.: 57°00′-57°20′N, Long.: 30°21′-30°44′E, Pskov Oblast') and the Central Forest State Nature Biosphere Reserve (Lat.: 56°26′-56°39′N. Long.: 32°29′-33°01′E, Tver' Oblast'). The classification procedure was carried out by using cluster analysis and indicator species analysis. We applied ordination approach and phytoindication assessment to evaluate ecological conditions according to the Landolt`s scale.

The meadowsweet dominated vegetation was classified into one class, *Molinio-Arrhenatheretea*, order *Filipendulo ulmariae-Lotetalia uliginosi* and alliance *Filipendulion ulmariae*. We identified 2 associations: *Filipendulo ulmariae-Geranietum palustris* Koch 1926 and *Lysimachio vulgaris-Filipenduletum ulmariae* Bal.-Tul. 1978. These syntaxa are connected with abandoned wet sites. Ass. *Filipendulo ulmariae-Geranietum palustris* was revealed in the Polistovsky Nature Reserve for the first time in Russia. Communities of the association are a habitat for *Gladiolus imbricatus* that is a regionally protected species (Red Book of Pskov Oblast'). Ass. *Lysimachio vulgaris -Filipenduletum ulmariae* is widely distributed geographically and was revealed in the both reserves. We found out one regionally protected species (*Salix phylicifolia*, Red Book of Tver' Oblast') in these communities in the Central Forest Reserve. The main ecological gradients were soil moisture, soil particles size and humus content.

Method and experience-dependent variation in visual estimates of forest species cover

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In vegetation science including community ecology and phytosociology methods of visual estimates are one of the most popular. The reasons for such situation are lower costs and lower amount of work and saving time of measurements in the field. The various scales are used e.g. Braun-Blanquet, Londo, Domin scale etc. They chiefly differ in number of degrees of a scale. The method of visual estimates was criticized and its repeatability was tested among observers and within an observer. We wanted to examine reliability of results of fieldwork usually included in diploma works of students or citizen science and other projects using technical field assistance of students. Two groups of students: biologists and engineers (10 raters in each group) visually estimated cover of plants in broad-leaved forest on permanent plots. The students of biology and nature engineering had theoretical knowledge and minimal or no experience in fieldwork. Three scales were used: traditional 7-degree Braun-Blanquet, modified 9-degree Braun-Blanquet scale and optional percentage scale. The variation of cover of individual plant species was surprisingly very high (from 0% to 144% of coefficient variation, CV%), however, there was no significant difference between two groups of students (Wilcoxon sum rank test, p-value=0.3791). The values of intra-class correlation, statistics that measures repeatability, were generally higher in biologists (0.509-0.822, $p<0.001$) than in engineers (0.05-0.118, $p<0.05$). Regarding comparison of methods they differ in median of CV% (Kruskal-Wallis test, p-value=0.0009135). The method of estimates that yielded in the most diverse results was percentage method (CV%=68.5) followed by modified Braun-Blanquet (47.9) and Braun-Blanquet method (32.8). It can be inferred that Braun-Blanquet scale is the most repeatable in spite of its highest inaccuracy. The experience in vegetation sampling is the most crucial factor that affects reliability of the results. Young adepts of vegetation science should work together with professional botanists at the beginning of their career.

Tracing the signs of dispersal in a temperate forest understorey

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Dispersal is one of the main processes structuring plant communities, but once the community is established, it is hard to infer what lies behind the spatial patterns we observe, whether dispersal, environmental filtering or some other process.

We asked whether species presence or absence in the immediate vicinity of the plot can help to explain variation not explained by environment. We hypothesize that this extra part of variation (not explained by environment but explained by species occurrences the plot neighbourhood) can be attributed to dispersal. To examine this hypothesis, we used small-scale data from herbaceous layer of a thermophilous oakwood with a set of nested plots. For a subset of more frequent species, we calculated the deviances in occurrences attributable purely to species frequencies in plot neighbourhood. Further, we explored the relationship between those deviances and functional traits describing generative or clonal reproduction.

There was a clearly positive relationship between species occurrences in the plots and in their neighbourhood. This was to a varying degree caused by environment but the pure neighbourhood effect was also important. Looking at dispersal, species with seeds having a pappus tended to have weak relationship with neighbourhood, most likely because their dispersal radius is farther than to the next cells, at the small scale it can be virtually unlimited. That being said, we were astonished by the prevailing inability of dispersal traits to explain small-scale relationships in forest ground layer vegetation. What lies behind is uncertain. Possible explanations range from scaling issues, to sample size, to the representativeness of traits themselves.

Multivariate analysis of xerothermic plants associations in the Lublin Region (south-east Poland)

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The Lublin Region is situated in south-east Poland and it is located on the xerothermic species migration route from Podolia to north-west. The occurrence of xerothermic grasslands and shrubs is typical for this area. Thermophilous species grow on balks, road banks and marginal parts of fields, but the typical xerothermic plant associations develop on steep slopes of river valleys and limestone outcrops. The research was carried out on the area of 3 geographical regions: the Lublin Upland and parts of the Volhynian Polesie and the Volhynian Upland that are in Poland borders. The study area is situated at an altitude of 220-310 m above sea level and it is characterised by temperate transitional climate with mean annual precipitation of 600-640 mm and a mean temperature of 7 °C. Several plant associations and communities from *Festuco-Brometea* class were given from this area: *Sisymbrio-Stipetum, Koelerio-Festucetum sulcatae, Thalictro-Salvietum pratensis, Origano-Brachypodietum, Brachypodio-Teucrietum, Adonido-Brachypodietum pinnati, Asteri-Linetum flavae, Ononisetum spinosae, Inuletum ensifoliae*. To show their actual differentiation, 250 surveys made with Braun-Blanquet method on 86 sites with xerothermic plant associations paths were analyzed (numbers of surveys on particular site depended on association path's size and habitat diversity on a site). The plant communities and associations were distinguished with multivariate methods, mainly TWINSPAN. The environmental factors affecting on their differentiation where detected using Principal Component Analysis. Three main trends of plant communities were distinguished, depending on the type of soil. On the loess soil, communities with *Elymus hispidus* predominated (*Thalictro-Salvietum pratensis*). On the initial rendzinas and pararendzinas, *Inuletum ensifoliae* occurred. In more mesophilous habitats, communities with dominance of *Brachypodium pinnatum* developed. It formed both on the rendzinas and on the loess and was the most heterogeneous in terms of floral composition and species richness.

Threatened Grassland habitats of Northern Serbia

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Aim of this paper is identification and the actual occurrence of threatened grassland habitats in Northern part of Serbia (Vojvodina). At present, 11 types have been identified, compatible with the classification of EUNIS, Annex 1 of EU Habitats Directive and Red List of European habitats. This representing near 40% of the recognized European threatened grassland habitats, (according European Red List). Some of them are narrowly distributed with high risk of collapse, while others are widely spread, although they are often unique according to local special features and deserve special attention.

The identification and assessment of the condition of the endangered grasslands was carried out on the basis of a data from EU-RS-004 Vegetation Database of Northern Part of Serbia (AP Vojvodina) and current field research (2012-2016). We characterized distributions of individual habitat types and identified diagnostic, constant and dominant species of habitat types based on uniform statistical criteria (fidelity measures, constancy thresholds and cover values).

The most vulnerable ecosystems are those with restricted distribution, mostly threatened by a unique driver of change. Some grasslands are threatened by natural dynamics, and decline in area by processes being linked to human activities. Evaluation of the status of endangered habitats at the national level and assessment of terrestrial ecosystems in Vojvodina in accordance with the European Red List of Terrestrial and freshwater habitat**s,** enabled us to set and respond to many critical issues. Some of the issues are the selection of habitat classification, the definition of natural characteristic species, integration of different communities or interpretation of collapse risk.

Riparian forest communities in Slovenia

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The research deals with elaboration of data about riparian vegetation in Slovenia. We collected the relevé material dealing with riparian vegetation: paraclimatic vegetation maintained by river. We collected 836 relevés that were subject to numerical analysis. We found three well defined groups of associations showing specific ecological conditions. The forest from the first group appear on initial habitats, on gravel material in the river upperstream and sporadically also downstream. The second group appears in floodplains, in the area of material is deposited and taken away during floods, but during the years such habitats can be dried out. The third group contains forests that appear in back swamps, where water is maintained all over the year. Within each of these three groups we can detect the zonation in correlation with duration of influence of water. On initial habitats, on gravel, we can find scrub communities dominated by *Salix eleagnos*, which is followed by *Alnus incana* forests. On the driest sites we can find forests dominated by *Carpinus betulus, Tilia cordata* and *Pinus sylvestris*. In floodplains, we can find *Salix triandra* dominated scrubs on river bank, that are in contact with *Salix alba* dominated forests. In the intermediate position we can find *Fraxinus angustifolia* and *Ulmus laevis* dominated forests. The driest habitats are covered by *Quercus robur* dominated forests. In swamp, the wettest habitats are occupied by *Alnus glutinosa* forests. On less humid sites appear *Fraxinus angustifolia* dominated forests, but *Quercus robur* dominated forests are in contact with zonal oak-hornbeam forests. It was found out that *Alnus glutinosa* forests have a wider ecological niches, as they can appear also in drier conditions, in the zone where *Quercus robur* dominated forests appear.

Quercus pubescens forests in Italy. A syntaxonomical issue over three vegetation classes

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The Downy Oak (*Quercus pubescens* s.l.) in Italy is a quite common tree species. Although its occurrence in all the Italian administrative regions, and a potential role for forming zonal forest throughout the whole Italian Peninsula it is not easy to find *Q. pubescens* woods covering wide areas or exhibiting a sufficiently high cover degree of the dominant tree layer to not be considered a wooded grassland or shrubland. In fact, the *Quercus pubescens* woods find their coenological optimum within the south facing slopes of the colline and submontane belts where the millenary traditional agricultural land-use practices were carried out by the Italic populations. From a taxonomical point of view the pubescent-oaks are a still open issue. A wide degree of hybridization characterized all the species of white oaks occurring in Italy and hybrids exist even between those oak species seemingly showing very different ecological features (*Q. pubescens, Q. robur, Q. frainetto, Q. petraea*). Nonetheless, in addition to *Quercus pubescens*, the Italian taxonomical and phytosociological literature (especially that concerning the southern Italy) reports a wide range of other pubescent-oak names, some of them of still uncertain taxonomical status (e.g. *Q. virgiliana, Q. dalechampii, Q. leptobalana, Q. apennina, Q. amplifolia, Q. humilis, Q. congesta, Q. ichnusae*) which were widely used as guide species for phytosociological associations or even for the higher rank syntaxa. Owing to the wide ecological amplitude of *Quercus pubescens* s.l., both in terms of bioclimate and bedrock type, the classification of its woods at the class rank is also a highly debated issue. According to some authors (e.g. Brullo & Marcenò 1985; Brullo et al. 2009), the most of the southern Italy pubescent-oak forests are not to be referred to *Quercus pubescens* s.s. but to other pubescent-oak taxa (especially *Q. virgiliana* and *Q. dalechampii*) having a strictly steno-Mediterranean distribution and ecological features pertinent to the Thermo-Mediterranean and Meso-Mediterranean thermotypes. Accordingly their forests were classified within the *Quercetea ilicis* whereas the pubescent-oak associations occurring in the temperate zones of the Italian peninsula were included in the *Querco-Fagetea*. Other authors (e.g. Blasi et al. 2004) disagreed with this position and considered all the pubescent-oak s.l. associations as belonging

to *Quercus-Fagetea* by virtue of the deciduous character of the guide-species. The Eurovegchecklist (Mucina et al. 2016) put forth the proposition that all the pubescent oak forests are to be considered as the evolution (or the remnants) of a previous form of steppe-forests coming from the East and therefore to be classified in the *Quercetea pubescentis.* In this contribution we have statistically analysed all the *Quercus pubescens* s.l. communities described for the Italian Peninsula at present and proposed a syntaxonomic and coenological interpretation on the basis of floristic, ecological and epionthological considerations.

Habitats 7220 – Petrifying springs with tufa formations (Cratoneurion) in the basin of Dniester River (Ukraine)

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The habitat is represented a complex of interconnected communities which function as entire ecosystem formed by water pinching-out of carbonate deposits. It is localized in plane part of Ukraine, within Dniester canyon, which is 240 km long and several meters high. The canyon penetrates deposits of different age (from Silurian to Devonian), which form aquifuge, to porous Cretaceous and Miocene rocks. High temperatures (average temperature in July is +18 +19ºC) and annual precipitation (520-590 mm per year) promote travertine formation. There are several dickers of different waterfalls inside the canyon and left feeders of Dniester, the biggest waterfall among them is "Divochi sliosy" ("Girl's tears"). Communities *Montio-Cardaminetea* (*Lycopodio-Cratoneurion*, *Cratoneuretum filicino-commutatae*, comm. *Didymodon tophaceus*) are represented the central part of the habitat. They regulate water flows, adsorb carbonates and actively provide tufa formation. Emerald light-green patches of algae *Stigeochloeta tenuis* (*Stigeochloion tenuis, Cladophoretum glomeratae*) are developed in the places of water drop where content of carbonates decreases on 10-15%. Communities of dark cyanobacterial films *Gleocapsetea sanguineae* (*Gleocapsion sanguineae*) are formed along periphery of watercourses in conditions of low periodical or indirect wetting. Cenoses *Molinio-Arrhenatheretea* (*Lysimachio vulgaris-Filipenduletum ulmariae,* comm. *Palustriella commutate-Agrostis stolonifera*) are developed near foots of waterfalls, on coalluvial-dealluvial deposits. The habitat is valuable as a locality of highly specialized crenobionts, sensitive to changing of hydrothermal conditions. Some waterfalls essentially reduced their capacity during last decades and processes of tufa formation were decreased. The habitat belongs to the 3-rd category according risk estimation (sensitive to the influence of external changes, weekly reproduced) and 2-nd category according scientific significance (rare, which have limited distribution as small localities) (Didukh 2014, 2016). The estimation of the relative cost of habitat loss, which means significance of ecosystem service, is comparatively high – 63,5% (the 2-nd category). Therefore the biotopes require development of certain protection measures and should be selected as objects of monitoring.

Alien plant invasions in plant communities of Kuialnyk Estuary (Odessa region, Ukraine)

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Kuialnyk Estuary geosystem is characterized unique macro- and microclimatic, hydrological, geological and edaphic conditions. They cause a formation of richness and diversity of vegetation which represented by 73 associations, 38 alliances and 24 orders from *Lemnetea, Potamogetonetea, Phragmito-Magnocaricetea, Bolboschoenetea maritimi, Therosalicornietea, Juncetea maritimi, Festuco-Puccinellietea, Festuco-Brometea, Sedo-Scleranthetea, Salicetea purpureae, Carpino-Fagetea sylvaticae, Rhamno-Prunetea, Stellarietea mediae, Artemisietea vulgaris, Polygono-Poetea annuae* classes. The increase of anthropogenic pressure in the region due to the activation of various types of human activities (grazing, recreation, infrastructure development, etc.) leads to a disturbance plant cover integrity of the Kuialnyk Estuary, in particular, active invasions of alien species in phytocoenoses.

In general, there are 421 species of vascular plants in the coenoflora of the Kuialnyk Estuary. Among them 95 species, from 79 genera and 32 families, are alien ones. It has been established that 31 species have the greatest invasive potential. Mediterranean (35.5%) and North America (22.6%) regions have donated most plant species in coenoflora of the Kuialnyk Estuary. We recorded that *Anisantha tectorum, Echinochloa crusgalli, Capsella bursa-pastoris, Ambrosia artemisiifolia, Conyza canadensis, Bromus squarrosus, Centaurea diffusa, Carduus acanthoides, Grindelia squarrosa, Xanthium albinum, Elaeagnus angustifolia, Iva xanthiifolia, Brachyactis ciliata, Hordeum murinum, Papaver rhoeas* are widespread and have expansive life strategy. 15 invasive species are characterized by moderate activity, among them *Descurainia sophia, Portulaca oleracea* and *Onopordum acanthium* distributed sporadically, *Artemisia absinthium*, *Atriplex prostrata, A. tatarica*, *Cichorium intybus*, *Lactuca serriola*, *Sclerochloa dura*, *Senecio vulgaris*, *Setaria viridis*, *Sonchus arvensis, S. oleraceus*, *Amaranthus blitoides* and *A. retroflexus* spread widely. *Ailanthus altissima* has high invasive activity only in some territories of the Kuialnyk Estuary.

Among the invasive species 7 ones are transformers: *Ambrosia artemisiifolia*, *Anisantha tectorum*, *Centaurea diffusa*, *Conyza canadensis*, *Elaeagnus angustifolia*, *Grindelia squarrosa* and *Xanthium albinum*. We identified that the plant communities of *Stellarietea mediae, Artemisietea vulgaris, Festuco-Puccinellietea* and *Festuco-Brometea* classes have the highest level of invasion.

The ophiolitic communities of Shebenik-Jablanice National Park (Albania)

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The Shebenik-Jabllanicë National Park is located in east central Albania which is characterized by one of the most important outcrops of the Mirdita ophiolitic formation. Ophiolites are often serpentinized and rich in metals, and present therefore a specialized flora and vegetation, which has attracted much research, but which is still incompletely known. Here, we present the main communities of this vegetation, which comprise subalpine grasslands, scrubs and dry grasslands. 6 associations are presented as new (*Stachyo scardicae-Buxertum sempervirentis*, *Daphno oleoidi-Ericetum herbaceae*, *Carici sempervirentis-Seslerietum coerulantis*, *Carici macrolepidis-Genistetum hassertiana*, *Alysso bertolonii* subsp. *scutarinum-Euphorbietum glabriflorae*, *Sedo serpentini-Festucopsietum serpentini*) and a few others are presented without a formal description (*Bornmuellera baldaccii* community, *Astragalus angustifolius* community, *Viola magellensis* scree vegetation).

Serpentinicolous dry grassland vegetation of Shebenik mountains is compared to other communities of serpentines in Italy, Balkans and Greece and a new alliance is described for this community, *Festucopsion serpentinii* (*Halacsyetalia sendtneri*) vicariant of the *Centaureo-Bromion fibrosi* which occurs in n northern Albania and Kossovo. The alliance is characterized by a set of species which do not occur or are rare further north and by a relatively dry climate with Mediterranean affinity. We also present a thorny cushion vegetation with *Astragalus angustifolius*, which grows on limestone but is vicariant to the analogous community with *Genista hassertiana*.

Vegetation-environmental relationships and floristic patterns in the oriental beech forests of northern Iran

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Fagus orientalis (oriental beech) is the only species of the genus *Fagus* in the Hyrcanian forests of the north of Iran, and it widely covers the mountainous forests in these areas from Western to Eastern. The purpose of the current study is to indicate floristic patterns and to determine environmental effects on plant species composition in the oriental beech forests of the Hyrcanian region. Data were collected through areas of relatively pristine habitats in these forests, ranging from the lowland to the tree-line (260 to 2700 m a.s.l.). In total, 229 vegetation plots, 270 vascular plant species and many soil and topographic features were recorded. Our results from the modified TWINSPAN and DCA analysis in the JUICE and CANOCO softwares respectively, indicates that altitude is the major factor determining floristic composition in the oriental beech forests of northern Iran. Moreover, soil texture and soil pH are other important components influences on the vegetation. The results showed that there are 2 main groups of these beech forests based on the altitude gradient. The lower part (<1000 m a.s.l.) is covered by a mixed beech forest (with 112 plots and 166 taxa) with *Parrotia persica*, *Diospyrus lotus* and *Buxus hyrcana*, and in the upper part (>1000 m a.s.l.) there is a pure beech forest (with 117 plots and 235 taxa) that some herbaceous species such as *Cardamine impatiens*, *Galium rotundifolium, Vicia crocea* and *Lathyrus vernus* are considered as diagnostic species for this group. Moreover, *Galium odoratum* (with 77%) and *Carpinus betulus* (with 71%) are the most frequent species in all the plots, and also *C. betulus* is the most common tree species in the Hyrcanian forests. In contrast to the species richness patterns, the higher number of Shannon-Winner diversity index is recorded in the mixed beech forest compared with the pure beech forest (1.23 versus 0.59). However, there are some subgroups or associations within groups that are related to soil pH, soil texture and inclination.

In vitro propagation of *Himantoglossum adriaticum* in Hungary

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Nowadays, because of the environment-forming activity of people, the area and the number of natural habitats and species are decreasing all over the world. Despite the orchids world-wide dispersion and extreme plasticity, the majority of these species are of key conservation importance. The long-term persistence of plant populations in every case partly depends on seed production and their viability. Based on these facts, it's necessary to explore the reproductive capacity (viability) and the possibility of *in vitro* propagation of these species. Our aim is to present the results of the *ex situ*, *in vitro* propagation of the hungarian populations of *Himantoglossum adriaticum*, which is an extremely rare and strictly protected ochid species in Hungary.

In Hungary it has known only 5 populations of this species: in the Keszthely Hills, the Sümeg-Tapolca Region, the Bakony Hills, the Kőszeg Mountains and in the Sopron Mountains. The seeds we used in all of our researches are origined from the first four habitats, because the population in the Sopron Mountains is too weak to interfere with. At the first time, we sowed the seeds of same origin *in vitro* asymbiotically into different flasks, onto modified Fast medium (ph 5,5) in the orchid laboratory of ELTE Botanical Garden in Budapest. After get knowing if the medium is good for this species propagation (protocorms are appeared), we sow 5-5 flasks (250-250 mixed seeds) onto 5 different medium pH (pH 4.5-8.5 growing one by one) at Szent István University's laboratory to find out whether the pH value matters or not by the artifical germination.

During this *ex situ* germination, the modified Fast medium was good for germinating the seeds of *H. adriaticum*, and the first protocorm was appeared 9 months after sowing. 13 month after sowing, the germination rate in the flasks was 1,3%. As for the different medium pH, we made the conclusion that as the pH increases, the rate of protocorms appearance increases as well. Although the most of the protocorms appeared on pH 8,5, the best pH value for the germination was the pH 7,5 because in the shortest time (7 months) the strongest, biggest, whitest protocorms with more rhizoid fur was appeared in the flasks with this pH.

We can declare that the seeds from the Hungarian habitats are able to germinate artificially. The best pH result for germination is perfectly overlaps with the soil pH of the species on it's natural habitats in Hungary. So we can conclude from this, that the soil pH is really important for the appearance and for the spread of *H. adriaticum*. Our next step is to determine the specific mycorrhizal fungal symbionts of the species in the Hungarian habitats both from protocorms and roots, so that we could find out if this also plays an important role in the spread and conservation of this species.

Syntaxonomy as a mirror of evolutionary processes? – Some thoughts on the classification of bramble scrubs of the *Prunetalia*, *Rhamno-Prunetea*

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The *Rhamno-Prunetea* are remarkably rich in critical genera, like *Crataegus* (hawthorn), *Rosa* (rose), and *Rubus* subgen. *Rubus* (bramble). The knowledge of *Rubus* taxonomy steadily grew from the late 1960-s until present, but this knowledge is hardly implemented in the classification of scrubs. After some first studies were published from Germany by Tüxen & Neumann (1950) and Weber (1967, 1974), only in the Netherlands and Germany the species composition of bramble scrubs was studied more or less comprehensively. Comparison of the published tables bring remarkable incoherencies to light, with *Rubus* species forming seemingly random and occasional coalitions. The underlying cause for this phenomenon might be the relatively small, only partly overlapping distribution areas of many bramble species. Another problem of the hitherto published classifications is the fragmentation in many associations with only a small to very small distribution area.

Several propositions have been made to classify the *Rubus* rich *Rhamno-Prunetea* scrubs. In the most recent German overviews as well as in the Dutch national vegetation classification, one alliance is accepted, the ruricolous *Pruno-Rubion radulae* Weber 1967 (*Prunetalia spinosae* auteur). On the basis of many new relevés and published tables from Germany and the Netherlands we propose to return to an old scheme, and classify these bramble scrubs in two alliances, *viz.* the *Pruno-Rubion radulae* and the *Pruno-Rubion sprengelii* Weber 1967. These two alliances coincide with the two large *Rubus* districts that can be distinguished in this part of Europe, which have their background in the post-glacial evolutionary processes in the subgenus. Thus, the two alliances are not ecologically different, as supposed by Weber in the initial publication, but evolutionary founded vicariant alliances.

We will shortly discuss the merit of the above mentioned regional associations which are based on the occurrence of *Rubus* species with a limited distribution area. We conclude it might be better to distinguish less, more robust associations, in which the regional *Rubus* species define geographical races.

Plant's eye view of forest canopy informs vegetation ecology

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Questions: How does canopy openness affect species richness and composition of the understorey in temperate oak forest? How many hemispherical photographs and what angle of view do we need to obtain a biologically-relevant measure of canopy openness?

Location: Deciduous oak-dominated forest, Czech Republic.

Methods: We explored the relationship between differently calculated canopy openness and understorey vegetation at two spatial grains (3.14 m^2, 100 m^2) on 37 plots sampled under comparable environmental conditions. Using hemispherical photography, we calculated canopy openness for various angles of view and averaged one, five and nine photographs per plot.

Results: Canopy openness significantly correlates with species richness, species composition, and mean Ellenberg indicator value for light. Interestingly, canopy openness calculated from one photograph explained the same variation in species richness and species composition as five or nine photographs. Maximum of variation in species richness (50%) and species composition (13%) was explained by the canopy openness calculated from 100° angle of view. These results are consistent for both spatial grains.

Conclusions: Spatial variation of canopy openness explained substantial part of species richness, composition and mean indicator values in mature oak dominated forest. Canopy openness is therefore crucial driver of understorey vegetation variability and needs to be incorporated into predictive models and community-level analyses. We also found that one photograph is sufficient to determine the biologically relevant canopy openness at common-sized vegetation plot. Increasing the number of photographs per plot did not improve fit to neither species richness nor composition. Our results thus suggest that we do not really need a circular fish-eye lens, because the canopy openness value calculated from a 100° angle of view is the most relevant for the understorey vegetation. These findings support the use of photos from smartphones as well as other camera without fish-eye lens to derive biologically relevant canopy openness. However, generality of our findings needs further testing as it likely vary among different forest types.

Plant communities of the Svidovec and Chornohora Massifs in the Ukrainian Carpathians

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Polonina Svidovec is one of the longest mountain range in Ukrainian Carpathians with the highest peak Blyznycja (1881m). The Chornohora is the highest mountain range in the Ukrainian Carpathians. Hoverla Mt. at 2061m is the highest peak in both the Chornohora and Ukraine. Predominant geological bedrock is the Carpathian Flysch composed of layers of alternating sandstone and shale with small areas of limestone. With the aim to analyse grassland vegetation of Svidovec and Chornohora Massifs we collected data set consisting of 58 relevés.

Field sampling of grassland vegetation was performed during summer 2016 according to principles of the Zürich-Montpellier school on plots of 4x4 m. Within the each plot 1x1 m subplot was established where the presence and absence data were recorded. The phytosociological relevés were stored in TURBOVEG and analysed using the program JUICE 7.0.127. OptimClass determined the optimal classification algorithm and the optimal number of clusters. The Ward method with relative Euclidean distance as a similarity measure with Square Root Transformation was used for the numerical classification of relevés using PC-ORD 5.0 software. The Slovak expert system for identification of grassland syntaxa helped us to identify vegetation units. The position of a relevé in the DCA ordination plot or in non-metric multidimensional scaling (NMDS) was taken into account in the final syntaxonomical assigment of relevés using CANOCO 5. The Detrended correspondence analysis (DCA) was used to visualize the relationships among the delimited syntaxa and the relationships between species composition and environmental variables. For comparison of environmental conditions of individual syntaxa, we calculated plot-based unweighted means of Didukh indicator values and altitude. The Spearman correlation coefficient was used to calculate the correlation between environmental variables and the first two ordination axes.

Finally, 3 associtions and 2 alliances were determined in dataset: extensive pastures of *Soldanello hungaricae-Nardetum strictae* (22 relevés) and *Campanulo abietinae-Nardetum strictae* (9 relevés), acidophilous extensive pastures of *Vaccinio myrtilli-Calamagrostietum villosae* (7 relevés) and *Calamagrostion arundinaceae* (5 relevés) and mountaine intensive pstures of *Poion alpinae* (15 relevés).

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Database of aquatic and wetland vegetation of Ukraine

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A database of aquatic and wetland vegetation of Ukraine (WetUkraine) is a collection of digitalized phytosociological relevés and individual archives which are constantly replenished with relevant information and updates from time to time by the database manager. Its creation began in 2013 as a part of the development of the National Phytosociological Database of Ukraine (UkrVeg). The main aims of this project are to compile vegetation-plot data from all over Ukraine to conduct large-scale geobotanical, ecological, biogeographical and preservation studies of aquatic and wetland vegetation. It will enable to find out the patterns of territorial distribution of these plant communities, to identify the leading factors of their ecological differentiation, to give a sozological evaluation, as well as to observe the vegetation dynamics trends in space and time, especially in conditions of human impact growth.

On March 1, 2018, the database included 5245 plots from all over Ukraine which belong to aquatic and wetland vegetation or occurring in contact with them. All relevés are digitalized mostly by the release of the TURBOVEG software. Almost 60% of them represent *Phragmito-Magnocaricetea* class, about 25% – freshwater plant communities of *Lemnetea* and *Potamogetonetea* classes, 5% – fens, mires and bogs (*Scheuchzerio palustris-Caricetea fuscae* and *Oxycocco-Sphagnetea*). Other vegetation types (e.g. *Charetea intermediae, Ruppietea maritimae, Zostereta, Montio-Cardaminetea, Littorelletea uniflorae, Isoëto-Nanojuncetea, Bidentetea*) are counted by a comparatively small amount of relevés. The time range of registered plots is from 1937 to 2017. The plot density is higher in administrative-territorial districts and historical regions of the forest and forest-steppe zone of Ukraine. The plot sizes vary in very wide ranges – from 1 to 150 м^2.

WetUkraine is co-ordinated at the Department of Geobotany and Ecology, M.G. Kholodny Institute of Botany of the NAS of Ukraine. The manager of the database is Svitlana Iemelianova. Data store mostly under the semi-restricted access and can be request via e-mail to database manager by providing the project description, criteria of data selection and information of probable use.

The vegetation of the *Nerio-Tamaricetea* Br.-Bl. et O. de Bolòs 1958 along the eastern Adriatic coast, NE Mediterranean

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Nerio-Tamaricetea described by Braun-Blanquet and de Bolòs (1958) includes dwarf woodlands, scrubs and tall grass communities developing on initial soils of river beds, creeks and temporary pools of fresh, brackish or saline water, without running water during long periods of the year. According to Mucina et al. (2016), one order, *Tamaricetalia africanae*, and six alliances have been distinguished in the Mediterranean region: *Tamaricion africanae*, *Tamaricion boveano-canariensis*, *Rubo ulmifolii-Nerion oleandri*, *Securinegion buxifoliae*, *Rubo sancti-Nerion oleandri* and *Tamaricion dalmaticae*. The latter two belong to E Mediterranean group of alliances. The *Tamaricion dalmaticae* alliance was described for thermo- and meso-Mediterranean belts on the eastern Adriatic coast: in Croatia, Montenegro and Albania (Jasprica et al. 2016). Associations of this alliance mostly appear under the halophytic conditions. Along other characteristics, this makes the *Tamaricion dalmaticae* alliance analogous to the W Mediterranean *Tamaricion africanae*.

The aim of this study is to classify and describe all plant communities of the *Nerio-Tamaricetea* covering the entire eastern Adriatic coast and islands from north Croatia to south Albania, and to relate their species composition, chorotypes and life forms to environmental factors using Pignatti ecological indicator values. For each association, a brief description of its syntaxonomic and nomenclatural vicissitudes, the holotypus, *locus classicus*, distribution range, diagnostic, frequent and dominant taxa were reported. The analysis are based on relevés already published in phytosociological literature and own relevés collected in the period between 2008 and 2018.

The world suppressed. Verge management as leading factor determining roadside vegetation

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In recent years roadsides have been discussed as specific habitats in their own right rather than merely as small dispersal refuges or stepping stone habitats. Due to implemented management and enhancement schemes suppressing and promoting particular ecological processes verge habitats can provide a niche not only for plants but also for insects, reptiles and small mammals. The occurrence of plants and animals on the roadside is highly dependent on their management regime and local ecological factors allowing for the creation of semi-natural micro-habitats of sometimes high species diversity. Forms of a road and roadside management pre-condition future type of vegetation allowing for the existence of such uncommon inland habitats as calcareous grassland, high-diversity neutral grassland and wetland habitats, dwarf-shrub heath and aggregations of halophytic species resembling salt-marshes and salt-meadows. In those habitats, diverse vegetation including rare species may occur verges where native plants have been able to invade, establish and thrive under management currently in-place. However, in many situations, under improper management, they may become vulnerable to an expansion of generalist and non-native invasive species being transported and spread by mowing machinery and passing vehicles.

In our paper, we summarized results of our observations from five European countries including Poland, Finland, Sweden, Norway and Great Britain.

Macrophytes as hydromorphological pressure indicator in Latvian rivers

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Since adoption of Water Framework Directive 2000/60/EC, growing attention has been paid to hydromorphology as water quality determinator. Hydromorphological alterations (straightening, water level fluctuations due to hydropower plants) is one of most significant pressures within Latvian rivers but there is no method to assess it. In the whole, it is well known that hydromorphological pressure significantly affects streams but without proper methods we cannot prove it. Dams can change aquatic habitats in many ways: siltation could occur upstream and erosion and significant water changes can be observed downstream. Channelization reduces habitat heterogeneity and abiotic diversity. All biological quality elements (BQE), used to assess surface water ecological quality in Latvia, considers eutrophication as major pressure.

In this study we used data from Latvian Environment, Geology and Meteorology Centre. Surveys were carried out during vegetation season 2006-2015. In total, data from 111 surveys in 92 sites were used. For each site species abundance were recorded in nine ball scale and total overgrowth was assessed. Also, environmental data (nutrient concentrations, land use in catchment, bed slope) were used. Spearman rank correlation analyses, performed with PAST statistics, were used to link biological data with environmental variables.

Latvia has adapted their own version of Polish macrophyte index MIR but this index is related mostly to eutrophication. In our study we found out that total phosphorus alone explained about 43 % of MIR index variation. Morphological pressure did not have any impact on MIR index and MIR index showed good quality even in channelized streams with high nutrient concentrations. About 30% of studied streams were affected by dams upstream or downstream from sampling site. Hydrological pressure, caused by HPP, did not have significant impact on macrophyte index or number of observed species, indicating that current assessment methods are suitable only for eutrophication pressure.

As it can be seen, it is not possible to assess hydromorphological pressure using existing routine monitoring assessment methods used in Latvia. One of possible solutions could be development of new index which uses macrophyte species which are sensitive to hydromorphological alterations. One of problem could be combination of multiple pressures and it will hard to separate diffuse pollution (nutrient enrichment) from river straightening or land-use pressure. According to our results, possible indicatorspecies for hydrological and morphological indicators in rivers are: *Fontinalis antipyretica, Spirodela polyrrhiza, Phragmites australis*, *Veronica beccabunga*, *Hildenbrandia rivularis Typha latifolia*.

Effect of *Rudbeckia laciniata* L. invasion on abandoned meadow vegetation

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Rudbeckia laciniata is one of the oldest ornamental plants introducing to Europe from North America in the 17th century. Nowadays, it occupies natural communities in most European countries, however, only in Slovakia, Czech Republic, Austria and Poland it has been considered an invasive species. While the interest in plant invasions has increased constantly, the impact of *Rudbeckia laciniata* on natural vegetation has not yet been studied in detail. In this study we investigate changes in the meadow vegetation along the invasion gradient of *Rudbeckia laciniata*.

The vegetation data were collected from two types of abandoned meadow, within and outside river valleys. Each site was divided into three zones: a) heavily *R. laciniata*-invaded, b) medium *R. laciniata*-invaded and c) uninvaded – control. It was assumed invaded and uninvaded zones had the similar vegetation types before invasion. All plant species with their density and total plants cover were recorded in 300 (1 x 1m) plots in each type of abandoned meadow. To quantify the differences between 1) vegetation in both sites and 2) vegetation in every zone, one-way analysis of ANOSIM was applied. Similarity percentage analysis (SIMPER) was used to identify the species that contributed the most to the differences between zones. The diversity index, number of taxa and frequencies of species are also calculated.

ANOSIM test, revealed significant differences between the sites and the zones. The biggest dissimilarity was observed between heavily invaded and uninvaded zones while the smallest dissimilarity (R=0.1882) was estimated between two heavely-invaded zones from riverside and non riverside. SIMPER analysis indicated that *Rudbeckia laciniata, Arrhenatherum elatius* and *Elymus repens* mainly characterized the differences between zones. On average, heavy invaded areas have shown smaller number of species per plot (3) than medium-invided (9) and uninvaded (9) areas. In the heavily invaded zones, in addition to *R. laciniata,* the most frequent species were *Urtica dioica*, *Galium aparine* and Poaceae spp. while in control areas dominated Poaceae spp.

These findings confirm negative impact of *Rudbeckia laciniata* on meadow vegetation, within and outside river valley. Although in the early stages of invasion, *R. laciniata* does not adversely affect the richness and diversity of communities in which it occurs, at a later stage tends to form monospecific stands.

Morphological variability of *Gentiana cruciata* L. from different habitats

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Gentiana cruciata is a perennial herb found on soils rich in calcium carbonate, characteristic species of the dry grasslands *Festuco-Brometea* class. However, during the field work carried out in the area of Natura 2000 PLH 040040 „Zbocza Płutowskie", there was observed that the majority of its sites are located in dry forms of *Arrenatheretea* meadow communities. The presence of this species was also recorded in the initial communities, formed on now set-aside arable land in the direct vicinity of dry grasslands and meadows. The objective of the work was to find out how the different habitat influences the morphology of the species. We assume that 1) *G. Cruciata* can have high fidality not only in *Festuco-Brometea* grasslands, 2) its morphological features can depen on the occupied habitat.

In the research area 7 research plots each with an area of 100 m^2 with presence of *G. cruciata* were established. In each of them a phytosociological relevé was taken and measurements of morphological features of each individual were carried out: the number of vegetative and generative shoots, the height of the shoots, the number of leaf and flower nodes and the number of flowers. Numerical analyses were carried out. There were also 25 additional phytosociological relevés taken in communities with *G. cruciata*.

G. cruciata was found in three types of communities: dry grasslands *Festuco-Brometea* (poor form *Adonido-Brachypodietum*), dry form of fresh meadows *Arrenatheretum elatioris* and in the group of initial communities referring to communities from the classes: *Robinietea* and *Artemisietea vulgaris*. The highest population density (278 individuals/100 m^2) was recorded in the *Festuco-Brometea* dry grassland. However, individuals from the subpopulation in dry meadows and ruderal communities produced a larger number of shoots and flowers.

G. cruciata is characterised by a wide ecological scale and the ability to quickly settle the habitats released from human pressure. Locally, it has higher fidelity for dry form of *Arrhenatheretum elatioris* meadows than *Festuco-Brometea* dry grasslands.

Phytosociologacal and phytogeographic study of *Iris aphylla* L. in European Russia

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I. aphylla is a species of European importance. We have updated its distribution map basing on our original research and previously published data. The continuous part of its distribution area begins in Romania and extends eastwards uninterrupted up to the Volga River, mainly following the forest-steppe zone. *I. aphylla* indicates extrazonal forest-steppe biotopes outside the forest-steppe zone. During our inventory, we've mapped more than 700 extant local populations of the species in 22 Russian regions within the Russian Plain. We've also mapped the distribution of the species in the Russian Caucasus (about 200 localities) and other parts of Europe (more than 250 localities in Belarus, Czech Republic, Germany, Hungary, Moldova, Poland, Romania, Slovakia, and Ukraine).

The highest numbers of *I. aphylla* sites (about 75% of the total) reside in meadow steppes on slopes, including calciphyte communities on the slopes and steppes with various shrubs. About 20% of the sites are at the forest edges and glades. Not many sites are in plaquor meadow steppes and among oak forests. *I. aphylla* is a typical species of the meadow steppe biotopes. We found most abundant flowering plants in those communities, while in the forest or brushwood habitats *I. aphylla* blooms rarely.

I. aphylla is typical species of the alliance Festucion valesiacae Klika 1931, class *Festuco-Brometea* Br.-Bl. et R. Tx. in Br.-Br. 1949. In the Russian plain it has mainly a subordinate coenotic position but indicates communities rich in rare plant species.

I. aphylla is a diagnostic species of the class *Trifolio-Geranietea sanguinei* with the association *Trifolio alpestris-Iridetum aphyllae* Averinova 2010. Some new associations with *I. aphylla* were established by A.V. Poluyanov and E. A. Averinova for Kursk region steppes: *Veronico incanae-Inuletum ensifolia* Averinova 2010, *Lino nervosi-Bromopsietum ripariae* Poluyanov ass. nov., *Eryngio campestris-Stipetum tirsae* ass. nov. prov., *Bupleuro falcati-Bromopsietum ripariae* ass. nov. prov., *Nepeto pannonicae-Campanuletum bononiensis* ass. nov. prov., *Campanulo rotundifoliae-Stipetum pennatae* ass. nov. prov.; an additional community is *Hieracium virosum-Vincetoxicum hirundinaria* Averinova 2012.

Riparian forests with giant herbs on Sakhalin Island, the Russian Far East (*Salicetea sachalinensis*)

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Questions. What are the syntaxonomic positions of not-well explored riparian forests in insular part of Northeast Asia?

Location. Sakhalin Island, Russian Far East, 50° N 143° E, monsoon climate, southern boreal zone.

Methods. Field work was conducted in 2015-2017 in floodplains of 24 rivers of Central and Southern Sakhalin. Vegetation data (relevés) was sampled at 10x10 and 5x20 plots (n=81). We use JUICE and vegan package (R) for data processing.

Results. We describe a new all. *Filipendulo camtschaticae-Salicion udensis* of class *Salicetea sachalinensis* Ohba 1973 (syn. *Salicetea schwerinii* Achtyamov 2001, Amur River basin), based on our data and review of Russian and Japanese phytosociological literature analysis. The alliance includes forest communities of *Salix udensis* (=*S. sachalinensis*), *Alnus hirsuta*, *Populus suaveolens* s.l. and other trees species with giant herbs layer. The distribution of alliance corresponds to distribution of Far Eastern giant herbs communities including Hokkaido, Sakhalin, southern Kuril Islands, and Kamtchatka. Diagnostic species: *Carex dispalata*, *Cirsium kamtschaticum*, *Filipendula camtschatica*, *Heracleum lanatum*, *Senecio cannabifolius*, *Urtica platyphylla*. Main dominant species: *Alnus hirsuta*, *Salix udensis* (tree canopy), *Filipendula camtschatica*, *Matteuccia struthiopteris*, *Urtica platyphylla* (herb layer).

Two new association of this alliance were describe in Sakhalin Island. Communities of ass. *Petasito ampli-Salicetum udensis* inhabit the floodplains and bottoms of mountains along river valleys in the Southern Sakhalin and Kurils, Hokkaido. Diagnostic species: *Angelica ursina*, *Parasenecio hastatus* subsp. *orientalis*, *Petasites amplus*, *Symplocarpus renifolius*. Communities of ass. *Filipendulo palmatae-Salicetum udensis* widespread in the central part of Sakhalin Island in valleys of small rivers of the East-Sakhalin Mountain Range and basins of two largest Sakhalin rivers – Tym' and Poronay. Diagnostic species: *Carex sordida*, *Filipendula palmata*, *Fimbripetalum radians*, *Ligularia fischeri*, *Padus avium*, *Parasenecio hastatus*, *Rosa amblyotis*.

Classification of xero-mesophytic oak forest communities in the Republic of Tatarstan

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There is a certain type of deciduous forests in the Republic of Tatarstan (Eastern part of European Russia) with the dominance of *Quercus robur* in the tree layer and a large number of steppe species in the shrub layer and herbage. Based on an analysis of 311 relevés of this type of community, they were assigned to the order *Quercetalia pubescenti-petraeae* Klika 1933, the class *Quercetea pubescentis* Doing-Kraft ex Scamoni et Passarge 1959.

Thermophilic and mesophilic broadleaf forests, which include communities of the order *Quercetalia pubescenti-petraeae*, occupy a significant area in Central Europe. Further, they continue to spread eastward through Ukraine, the Republic of Crimea, northern Moldova, some regions of the Russian Federation. The easternmost points of the distribution of *Quercetalia pubescenti-petraeae* communities can be considered the western part of the Republic of Bashkortostan, bordering the Republic of Tatarstan.

Order *Quercetalia pubescenti-petraeae* includes 4 alliances, 3 of which are found only to the west of the Republic of Tatarstan and one alliance – only to the east.

The cluster analysis (modified TWINSPAN method was used) of communities of Tatarstan xero-mesophytic oak forests showed that most of them belong to the alliance *Lathyro pisiformis-Quercion roboris* Solomeshch et Grigoriev in Willner et al. 2015.

A comparative analysis of associations of alliance *Lathyro pisiformis-Quercion roboris* from Bashkortostan and the communities spread on the territory of the Republic of Tatarstan showed their significant differences. This can be the basis for the assignment of 4 new associations within this alliance. During processing, we also identified a separate group of plots, distributed on sandy substrata and characterized by a high proportion of species typical for pine forest communities. We tend to attribute them to the alliance *Quercion petraeae* Issler 1931, although there is a certain amount of doubt in this decision.

Xero-mesophytic oak forests of the Republic of Tatarstan represent an intermediate variant between the western and the most eastern variations of the order *Quercetalia pubescenti-petraeae* communities, which is another confirmation of the vegetation cover continuality.

The effect of cratering on diversity of open plant communities of an active military training area

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Vegetation of military training areas develops under conditions of complex disturbance regime, and it's often characterized by high species diversity. The study focus on explosion craters – small-scale disturbance events of high severity. Cratering process forms microsites within homogenous matrix and exerts long-term effect on habitat patch. Examined vegetation was located in active military training ground in Nowa Dęba (SE Poland) and represented open plant communities on nutrient-poor soils with wide range of moisture. The impact of cratering on species diversity was determined by comparison of 76 pairs of vegetation samples, each pair consisted of a crater and closely located control plot of the same size. Out of 135 species (72 vascular plants, 33 mosses, 9 liverworts, 22 lichens) recorded in all samples, 37 were found only in craters, while 19 occurred only in control plots. Both, number of species and Shannon index were significantly higher for craters than controls ($p<0,001$, Wilcoxon signed-rank test). The highest increase was observed in relation to bryophytes in moist habitats. Also red-listed species (e.g. *Drosera rotundifolia*, *Lycopodiella inundata*, *Campylopus pyriformis*) occurred more frequently in craters compared to control plots. In general, positive effect of soil disturbance was more visible in moist habitats than in dry ones. Furthermore, several species with strong preference to craters were found, the plants of the highest indicative value are *Atrichum tenellum* and *Dicranella cerviculata*.

Assessment of light conditions in forest phytocoenoses – canopy cover vs canopy closure

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The species composition and herb layer structure of forest phytocenoses are strongly connected with the amount and quality of light that penetrates through canopy cover. This habitat attribute is especially important for light-demanding plant species of the herb layer of xero-thermophile oak forests. The evaluation of the amount of light that reaches herb layer is based mostly on the assessment of canopy cover in vertical projection.

The method of light conditions assessment, based on hemispheric photography, involves registration of projection of the sky hemisphere onto surface and then analysis of the image in order to separate gaps, and modeling of light amount transmitted by the canopy.

For comparative purposes, a description of light conditions in xero-thermophilic oak wood was carried out, with methods used in geobotanical observations: direct – through the assessment of the cover of tree and shrub layers, and indirect – with Ellenberg light indicator values of the herb layer species. These data were related to the results obtained from the hemispheric photography analysis.

Spatial distribution of the canopy closure and canopy cover differ significantly (up to 30%). It applies, i.a. to these cases, when canopy gaps are in the range of 30-60^{o} of zenith angle, and the dense tree leafage is in zenith. No statistical significances were shown in case of canopy cover and light indicator values of the herb layer.

Spatial distributions of photosynthetically active diffuse and direct radiation differ in between themselves. It results, i.a. of a different hemisphere position of the same gaps in neighboring research points, which causes direct sunlight to reach one point and dispersed to reach others.

Canopy openness, diffuse and direct solar radiation, and the sum of these streams, are statistically significantly correlated with the light indicator value of the herb layer. The strongest relationships were found in case of direct solar radiation. Because light-demanding plants, that grow in the xero-thermophile oak wood, are also mildly thermophilus, the long-wave light reaching sunlit areas favors their development.

The analysis of hemispheric images allows precise evaluation of light conditions at a specific point in space. Obtained results show the possibility of using such images in ecological research of special structure and herb layer species.

Forest and steppe vegetation of the National Nature park "Karmeliukove Podillya" (Vinnytsia region, Ukraine)

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National Nature Park "Karmeliukove Podillya" is one of the youngest national parks in Ukraine. It was established in 2009 for conservation the forests and steppes, typical of the southeastern part of Podillya. Detailed botanical research in this area has been taking place intermittently for more than 30 years, but a comprehensive study of vegetation by J. Braun-Blanquet method has not been carried out so far.

The materials for the study were relevés from the territory that is now included in the park made in 2006 during the preparation of scientific justification, in 2010 by the international expedition of the European Dry Grassland Group, as well as after park creation in 2014, 2015 and 2017. The plot sizes for steppe vegetation were 10 and 25 m^2 and for forest vegetation 100 m^2. A total of 224 relevés were used for analysis, they were stored the Turboveg database and then analyzed in the Juice program using the integrated PC-Ord program. The data was not transformed, Sorensen coefficient was used to distance measure, and the Group Linkage Method was Flexible beta at -0.25. Diagnostic species of syntaxa were determined by the values of the *phi* coefficient; species with values of the *phi* coefficient more than 0.25 were considered as diagnostic, and with values more than 0.5 as highly diagnostic. The phytoindicative assessment of syntaxa was performed in the Juice software using Didukh ecological scales by 10 factors: soil humidity, acidity, salt regime, carbonate content, nitrogen content, thermal climate, humidity climate, continentality, cryoclimate, light.

According to the classification results the forest vegetation of the park is represented by two associations of the class *Carpino-Fagetea sylvaticae: Galeobdolono lutei-Carpinetum* with 3 variants and *Isopyro thalictroidis-Carpinetum* as well as one association of the class *Quercetea pubescentis – Quercetum pubescenti-roboris* with 2 variants. Steppe vegetation is represented by one association of the class *Trifolio-Geranietea sanguinei – Trifolio medii-Agrimonietum eupatoriae* and three association of the class *Festuco-Brometea*: *Festuco valesiacae-Stipetum capillatae, Salvio pratensis-Poëtum angustifoliae, Scabioso ochroleucae-Brachypodietum pinnati.* The leading factors of ecological differentiation for both types of vegetation are edaphic – soil humidity, carbonate and nitrogen content; from climatic factors leading are thermal climate and continentality.

An overview of the European annual weed vegetation

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Phytosociological studies of weed vegetation in Europe go all way back to the beginnings of the Braun-Blanquet approach. Tens of thousands relevés have gradually accumulated on the continent, but the ecological and synsystematic analyses based on relevé data have been done and concepts developed only regionally.

In the light of the newest concept of four classes by Mucina et al. (2016), describing weed and annual ruderal vegetation (*Papaveretea rhoeadis* S. Brullo *et al*. 2001, *Sisymbrietea* Gutte et Hilbig 1975, *Chenopodietea* Br.-Bl. in Br.-Bl. *et al.* 1952, *Digitario sanguinalis--Eragrostietea minoris* Mucina, Lososová et Šilc 2016), we compiled relevés from various sources and built a database for future testing of the proposed synsystematics of this vegetation types.

The EVA data-base interface served as the main source (about 15 000 relevés), additionally we contacted several individual researchers and national database custodians for further data (about 12 000 relevés), and last but not least, we explored many publications for data that needed manual capture (almost 6 000 relevés). These data sets will be combined into a new database, featuring European weed vegetation. We intend to present the structure of the new database, discuss the geographical distribution, and identified data-coverage gaps. Some preliminary results of classification of the data will also be presented.

Class *Asaro-Abietetea* on its eastern limit

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Northern slope of Khamar-Daban Ridge faced towards Baikal Lake characterized by special type of local climate warmer and more humid than in surrounding areas. Botanically it referred as habitat of thermophilous species among which there are several endemics, subendemics and relics of Tertiary humid flora (Epova, 1956). Few isolated Siberian refuges of Tertiary humid flora occur in hyperhumid sectors throughout Altai-Sayan mountain system. All of them coincide with so-called "chrnevaya taiga" vegetation which was just recently described in terms of Braun-Blanquet classification as class *Asaro europaei-Abietetea sibiricae* Ermakov, Mucina et Zhitlukhina 2016. Khamar-Daban Ridge is the most eastern refuge of Tertiary humid flora in Siberia and until now there is no any syntaxonomical analysis of its forest vegetation.

In our study we made two profiles across forest belt from timberline down to Baikal coast and collected 75 releves on sample plots 20x20 m each. Four syntaxa on association level were described according to their altitudinal position. Three of them belong to *Asaro-Abietetea* class. Two associations were described on islands in lower part of Snezhnaya river valley. They occur on high floodplain and on the first river terrace. Tree layer consists of two main species – *Populus suaveolens* and *Abies sibirica.* Upper canopy reaches 26-30 m height with an average trees DBH up to 100 cm. Herbaceous layer is well developed and species rich (up to 50 species per 100 m^2). Both associations belong to order *Carici macrourae-Abietetalia sibiricae* Lashchinskiy et Korolyuk 2016.

On steep slopes with shallow stony soils coniferous forests of *Vaccinio-Piceetea* Br.-Bl. et al. 1939 class are widespread but near the timberline coniferous forests with *Abies sibirica* dominance belong to *Asaro-Abietetea* class. These communities contain group of tall-herbaceous mountain species and clearly belong to order *Abietetalia sibiricae* (Ermakov in Ermakov et al. 2000) Ermakov 2006. All three associations contain distinct group of local species which differentiate them from other syntaxa of *Asaro-Abietetea* class.

So eastern limit of *Asaro-Abietetea* class represented by three syntaxa from two main orders – one is typical for mountains and another one for lowlands. All new syntaxa have strong regional specific in species composition.

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Does phenology affect classification of Natura 2000 habitat?

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Identification of Natura 2000 habitats conducted during the inventory of large areas is often based, because of the short time for field work, on the identification of a plant community (habitat identifier) based on its physiognomy and the presence of several key characteristic species. However, physiognomy of plant communities' changes significantly during the growing season. Moreover, depends on cyclical agrotechnical procedures especially in the case of semi-natural habitats (meadows). That is why our research focused on relations between phenology and correct identification of Natura 2000 habitat subtypes.

We investigated inland salt meadows (the code *1340) which are reported to have four distinct subtypes. The research area was located in central Poland (S1 – PLH040037 Salt meadows in Pełczyska and S2 – PLH300009 Ostoja Nadwarciańska). We visited randomly selected plots within saline vegetation three times during growing season (May/June; July; September) based on their very detailed GPS position. In each plot of 2 m radius we noted percentage cover of plant species. During each field inspection we classified each plot into subtype of 1340 habitat. In total we had 100 plots in S1 and 200 in S2. These numbers were related to the area of saline vegetation.

As a result we obtained classification of our plots into four subtypes of *1340 habitat. We compare the number of plots classified in the different way during the season. Next, we classified plots by cluster analysis to check the relationship between field classification and vegetation composition. We divided all plots into groups by TWINSPAN method and checked percentage of samples that were not classified in the same group.

The research was completed as part of the HabitARS project "The innovative approach supporting monitoring of non-forest Natura 2000 habitats, using remote sensing methods" co-funded by the National Centre for Research and Development within the framework of the "Natural Environment, Agriculture and Forestry" BIOSTRATEG II program.

Phytosociological analysis of forest communities in the Vrbas River Canyon (Bosnia and Herzegovina)

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This study deals with the floristic and ecological diversity of the forest and scrub communities in the Vrbas River canyon. Vrbas is the river in the western part of the B&H with the main flow direction from the south to the north. In the mid parts of its flow, it cuts the relatively deep canyons and gorges through the limestone bedrock. Mainly steep slopes, soils of various depth, variety of expositions, human impact and influence of mild Submediterranean climate from the south have caused the diverse, but mainly thermophilous forest vegetation to develop. Around 100 relevés were collected in the field and analyzed by the classification and ordination methods. Preliminary results suggest the existence of thermophilous and calciphilous forest vegetation dominated by *Quercus pubescens*, *Carpinus orientalis*, *Ostrya carpinifolia* and *Fraxinus ornus* of the *Carpinion orientalis* and *Fraxino orni-Ostryion*. However, these habitats were often under negative anthropogenic influence, which resulted in degraded scrub, dominated mainly by *Carpinus orientalis* and *Fraxinus ornus*. At the bottom of the slopes, there are often scree and ravine forests of *Ostryo-Tilion* developed. At the higher elevations there are thermophilous beech forests of *Aceri obtusati-Fagetum*.

The localities and habitat conditions of *Asclepias syriaca* L. in Kryvyi Rih (Ukraine)

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Asclepias syriaca (Asclepiadaceae) Sp. Pl. 214. 1753 [T.: Linn. Herb. London, no. 310. 14, photo!]. Taxonomic synonym – *A. cornuti* Dcne. in Dc. Prodr. 8:564. 1844. [Based on *A. syriaca* L.]. In the investigation region of *A. syriaca* – neophytes, ergasiophygophytes, colonophytes, potentially invasive species.

In Kryvyi Rih, the existing populations of *A. syriaca* have diffuse-local character of distribution, which is mostly caused by the accidental spread of its vegetative parts or seeds on the abandoned land. On the territory of the investigated region *A.syriaca* was noted in 4 localities, where it forms colonies and occupies significant areas (Lysohor, 2015). The total projective coverage of the detected plant communities reaches 90-100%. As a part of communities, *A. syriaca* dominates (up to 50%), sometimes participation is significant *Iva xanthiifolia* Nutt., *Ambrosia artemisiifolia* L., *Artemisia vulgaris* L., *Calamagrostis epigeios* (L.) Roth, *Elytrigia repens* L., *Lactuca serriola* L., *Poa angustifolia* L. With high persistence meet *Achillea submillefolium* Klokov & Krytzka, *Convolvulus arvensis* L., *Conyza canadensis*, *Melandrium album* (Mill.) Garcke, *Tanacetum vulgare* L., *Centaurea diffusa* Lam., *Lotus ucrainicus* Klok. and ect. The plant communities are floristic poor (the number of species in cenoses is 8-19). The similar communities with a complexlike of species are described in the Czech Republic and refer to the association *Asclepiadetum syriacae* Láníková in Chytrý 2009 (Alliance *Dauco-Melilotion* Görs ex Rostański et Gutte 1971) (Vegetace České republiky…, 2009). In the Russia the transitional plant communities with dominance of invasive species are estimated as derivative – the derivative plant communities *Asclepias syriaca* [*Artemisietea vulgaris* class] (Panasenko, 2012). In the Kryvyi Rih territories, the syntaxonomic position of the communities described remains unclear and provides for the continuation of research.

The Natura 2000 habitats found in Tomorr National Park, Albania

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In this poster we present the Natura 2000 habitats and vegetation in Tomorr National Park in Albania based on the respective distribution maps which we created in the framework of NaturAL Project IPA 2013. Located in Southern Albania, Tomorr National Park is influenced by both Mediterranean and continental climate, and is one of the most interesting natural sites. Already known as rich in steno-endemics, we present it diverse in habitats and vegetation. Calcareous rocky slopes with chasmophytic vegetation (8210), Alpine and subalpine calcareous grasslands (6170), Eastern Mediterranean screes (8140) and High oro-Mediterranean pine forests (95A0) are the most representative habitats in the National Park. We provide the distribution maps and list of habitats. The phytosociological aspects are briefly associated.

Phytocoenological characteristics of Scots pine (*Pinus sylvestris* L.) community on Nidze Mt. in Macedonia

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Locality of Belo Grotlo is situated on the top parts of the Nidze Mountain range in Southern Macedonia on the border with Greece.

The landscape characteristics of Belo Grotlo, natural values, vegetation, relief forms and richness of plant species, were cause this locality to be proclaimed as a strictly protected. On its territory can be found tertiary, boreal, glacial relicts and endemic species.

The appearance of community of Scots pine (*Pinus sylvestris* L.) with special ecological and floristic features of the site is registered and described. This community is presented with an analytical table with 14 phytosociological relevés. The data from all compared relevés from wider Balkan region and own made relevés were stored in Turboveg, and then process in Juice software.We determined a chorological spectrum and life forms of all groups of relevés. To confirm the influence of the major environmental conditions on the vegetation were used average of Ellenberg indication values.

Also, diagnostic species were determined of this community that are different than other described community of Scots pine.

Syntaxonomic scheme of the community is given, and ecological condition is described.

Importance of this community is that this habitat present primary stands of Scots pine (*Pinus sylvestris* L.) on the southern border of its range.

Ground vegetation development after shelter – wood cutting in Scots pine forests of hemiboreal zone, Lithuania

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The structure of forests is determined by climate, geomorphology, soils, historical factors and different kind of disturbances. Natural or anthropogenetic disturbances initiate secondary forest ecosystem succession. In managed forests the main disturbance factor is cuttings. Clear and shelter wood cuttings are the most important and have the greatest impact on forest ecosystems. Shelter wood cuttings are common type of commercial timber harvesting in pine forests in Lithuania. Tree layer density and composition affect composition of the ground vegetation. Abiotic and biotic conditions such as microclimatic variables (light intensity and duration, relative humidity, air temperature) and soil factors (pH, organic carbon, total nitrogen, available phosphorus, soil moisture and temperature) change after cuttings. Changes in tree layer also lead to the changes in the ground vegetation. The aim of this work was to investigate the changes of ground vegetation (mosses, lichens and shrubs) in pine forests after shelter wood cuttings.

The study area was located in south-eastern part of Lithuania and falls in the transitional deciduous coniferous mixed forest boreonemoral zone of Europe. The chronosequence approach was used to describe the succession by taking sites in similar environments but of different time periods after cuttings. 40 plots (10x10m) were selected in the shelter wood cuttings of the pine stands of different age (1-5 year). The resulting vegetation sequence was assumed to be the successional sequence. The species composition and projection cover (in per cent) of undergrowth, herbs and mosses were recorded.

The highest number of pine seedlings was recorded in second year after shelter wood cutting. Number of pine seedlings decreased in older shelter wood cuttings, while seedlings of *Betula pendula* reached higher number after 4 years of shelter wood cuttings. The overall average projection cover of herb layer increased after shelter wood cuttings. Average projection cover of *Vaccinium myrtillus* decreased, while average projection cover of *Vaccinium vitis-idaea*, *Calamagrostis arundinacea*, *Calluna vulgaris* increased. Average projection cover of mosses decreased after shelter wood cuttings.

Ancient settlements as refuges for steppe flora in southern Ukraine

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Steppes are among the most transformed biomes on the Earth. The transformation of the Ukrainian steppe into arable fields led to significant loss and fragmentation of steppe habitats. Steppe vegetation has been well preserved in a few steppe reserves, while beyond them it is scattered throughout the river terraces, ravines and some human-made landscape features. As our earlier studies on the vegetation cover of human--made landscape features (i.e. kurgans and old cemeteries) showed, these features or structures significantly contribute to the maintenance and conservation of steppe phytodiversity. Here, we aim to assess the conservation value of the flora of earthworks located on the steep, right bank of the Dnipro River, in Kherson Region (southern Ukraine). We studied ten hillforts originating from the ancient (Skelka-2, Stanislavske, Zolotyi Mys, Glyboka Prystan) or the Late Scythian (Velyke Tiagynske, Lvovske, Staroshvedske, Chervonomaiatske, Konsulivske) periods. In the ten sites studied we found 478 vascular plant species in total (195 species per archeological site on average). Since, the ancient settlements were abandoned many centuries ago, a quasi-natural steppe vegetation is well preserved. This is evidenced by the significant predominance of native species (75.1%) and by a high proportion of non-synanthropic plants (44.1%). The high conservation value of the flora has also been confirmed by a high range of steppe specialist plant species (34.1%) and a wide variety of protected plant species (25 species; 5.2%), seven of which are included in the world and European red data books and nine in the Red Book of Ukraine (i.e. *Astragalus borysthenicus* Klokov, *Elytrigia stipifolia* (Czern. Ex Nevski) Nevski, *Gymnospermium odessanum* (DC.) Takht., *Stipa capillata* L., *Stipa lessingiana* Trin. Et Rupr., *Stipa pulcherrima* K.Koch, *Stipa ucrainica* P. Smirn., *Tulipa biebersteiniana* Schult., Et Schult., *Tulipa gesneriana* L.). Our results emphasize the significant role of cultural monuments in steppe phytodiversity conservation, and the potential of these structures for future steppe restoration activities.

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The differences in habitat conditions of the riparian tall herb fringe communities in Poland and the conclusions for the syntaxonomy of the order *Convolvuletalia sepium*

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The riparian tall herb fringe communities of the order *Convolvuletalia sepium* Tx. ex Moor 1958 represent an integral part of the natural vegetation in river valleys. The surveys conducted in NW Poland (Central Europe) in 2008-2013 were aimed at understanding the relationships between the diversity and variability of this communities and various environmental factors. Samples were collected in all types of tall herb fringe vegetation found along 71 randomly selected sections of 24 rivers and the Szczecin Lagoon. For each vegetation sample (i.e. relevé according to the Braun-Blanquet method) environmental data were collected including hydrogeomorphic variables, soil parameters, potential and actual vegetation and land use.

A total of 24 vegetation units were documented, based on 300 relevés. Tall herb fringe communities occurring in valleys of large rivers (e.g. *Senecionetum fluviatilis, Fallopio-Cucubaletum bacciferi*, *Achilleo salicifoliae-Cuscutetum lupuliformis*, *Convolvulo sepium-Cuscutetum europaeae chaerophylletosum bulbosi* subass. nov., *Convolvulo sepium-Cuscutetum europaeae typicum*) showed floristic and ecological differences in comparison with plant communities from small rivers (e.g. *Eupatorietum cannabini typicum*, *Eupatorietum cannabini aegopodietosum*, *Eupatorietum cannabini cardaminetosum amarae* subass. nov., *Epilobio hirsuti-Convolvuletum sepium*, *Soncho palustris-Archangelicetum litoralis*, *Urtico-Convolvuletum sepium*). Significant differences include: the plant species richness, moss layer cover, contribution of river corridor plants, level of invasion, relative elevation and distance away from the river bed, degree of shading, proportions of all grain size fractions, soil pH, contents of organic matter, humus, organic carbon, total nitrogen, bioavailable phosphorus, potassium, magnesium and calcium in the soil. It fully justify the division of plant communities into two alliances: the *Senecionion fluviatilis* and the *Archangelicion litoralis*.

It was stated that the inclusion of the order *Convolvuletalia sepium* to the class *Epilobietea angustifolii* resolves the problem of classifying the community dominated by *Eupatorium cannabinum*, a species showing two ecological optimum: one in riparian tall herb communities and the other in natural gaps of the tree stands and clearings, and the problem of classifying the communities dominated by *Galeopsis speciosa* and *Rubus idaeus*, intermediate between riparian tall herb and clearing communities.

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Vegetation Cover of the Beringian Forest-Tundra Region (North Pasific Asia)

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Phytosociological data obtained in the Koryak Uplands and the Penzhina District in 2011-2017 served as a basis of the classification of vegetation occurring on the North of the Bering Sea Coast of Asia. Most peculiar for the area, the Siberian dwarf pine (*Pinus pumila*) elfin woods occupy zonal mesic habitats of plains, plateaus and gentle mountain slopes. These open woodlands occur in a severe sub-oceanic climate conditions with cold summers, harsh winters with moderate snow cover. They form a zonal vegetation type of *Beringian krummholz* related to the class *Vaccinio-Piceetea.* The polar birch (*Betula middendorffii*) shrubs (up to 1.5-1.7 m tall) and the dwarf-alder (*Alnus fruticosa*) thickets (class *Hylocomio-Salicetea glaucae*) are widely distributed and form another important vegetation type, associated with *Pinus pumila* open woodlands. These two vegetation types form a distinctive subalpine vegetation belt at lower elevations (up to 150-250 m a. s. l.). The Alpine vegetation belt (up to 350-400 m) is characterized by a complex of dwarf-shrub, graminoid and lichen-rich tundra communities (classes *Loiseleurio-Vaccinietea, Carici rupestris-Kobresietea, Juncetea trifidi* and *Salicetea herbacea*) that occur under conditions of a heat deficit and very short growing season. Alpine tundra communities develop on stony grounds in areas with low snow accumulation and characterize the cold subarctic climate within the forest-tundra zone. Azonal habitats, such as wide river valleys, are occupied by *Chosenia arbutifolia, Populus suaveolens, Salix udensis* and *S. schwerinii* flood-plain forests (*Salicetea purpurea*). In the floodplains of rivers and streams shrubby willow thickets widespread, predominated by *Salix pulchra*, *S. alaxensis, S. krylovii* and *S. hastata.* Several vegetation types, mainly coastal dwarf--shrub tundra, mires, salt marshes, mesic and hygric meadows, and isolated *Betula ermanii* groves (*Betulo-Ranunculetea*) are distributed on azonal sites. In waterlogged habitats of lowlands and depressions sedge-moss mires (*Scheuczerio-Caricetea*), *Sphagnum*-rich oligotrophic mires with 40-60 cm-thick peat layer (*Oxycocco-Sphagnetea*), hillocky mires, and polygonal mires develop. Tussocky tundras, which develop in the intermountain depressions, are characteristic to the Anadyr-Penzhina lowland with relatively stronger sub-continental climatic conditions. As the typical component of them appear sedge (*Carex lugens* subsp. *soczavaeana*), cottongrass (*Eriohorum vaginatum*), low growing polar birch (*Betula exilis*) and other hyparctic shrubs and dwarf-shrubs. In the western part of the Penzhina District larch (*Larix cajanderi*) open woodlands (*Vaccinio-Piceetea*) form the northern forest limit. In addition, there are groves of Japan birch (*Betula platyphylla*).

Crop density rather than ruderal weeds encroachment explains the response of ancient segetal weeds to cultivation intensification

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In the years 2014-2015, an experiment aimed at examining the influence of ruderal species encroachment and crop density on ancient segetal weeds was conducted at the Silesian Village Museum in Opole, Poland. The experiment was carried out on an experimental plots with three different sawing densities of winter triticale (×*Triticosecale*) and on plots without crops. Weeding of ruderal taxa was applied on the half of the plots to explore the relation between segetal and ruderal weeds. The populations of target species, *Agrostemma githago*, *Caucalis platycarpos*, *Scandix pectin-veneris* and *Bupleurum rotundifolium* were enhanced before the experiment by seed sawing. Explained variation in species composition by environmental variables was found by running the Redundancy Analysis (RDA). To find the unique explanatory contribution of the two environmental variables (crop density and weeding) we perform an interactive forward selection to find the most powerful factors and then conduct variation partitioning with "weeding" and "crop density" variables as explanatory ones. Additionally the effect of the crop density and weeding was tested separately for the segetal and ruderal species covers with the use of co-variance analysis (ANCOVA). To find out the seasonality and compositional changes during the experiment in species composition, we conduct the analysis for the whole data set and for spring, summer and autumn. The total number of taxa recorded in the whole data set was 80, with 39 ruderal and 32 segetal (archaeophytes) weeds. The overall species composition changes due to crop density and weeding revealed by the redundancy analysis was significant with the total explained variation of 15.7%. We found that crop density has stronger influence on species composition than weeding (56.2% vs. 47.2%). Weeding increases mean segetal weed cover from approx. 19% in not weeded plots to more than 35% in weeded. Along the vegetation period, weeding has the increasing explanatory power with the highest scores in the autumn. Combined effect of both variables explains the highest share of variation for summer data (54%), then for autumn (40%) and spring (35%). Crop density is much more influential on segetal weeds and drops inconsiderably from spring to summer and abruptly in autumn. For several species we found the optimum crop density being a loose stands with ca. 20% crop cover (e.g. for *Agrostemma githago*, *Veronica arvensis* and *Melandrium noctiflorum*).

Endangered European habitats present in the Silesia Province (southern Poland) and their threat status

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Published in 2016, the European Red List of Habitats lists 233 habitats deemed endangered in Europe. So far, no list of Poland's natural habitats has ever been compiled, except for the list of protected habitats, from the Annex I of the Habitats Directive, and the list of habitats present in the Baltic Sea area and in the Carpathian Mountains.

The paper presents 75 endangered European habitats (32%) that are observed in the Silesia Province. Among them, there are: 18 freshwater habitats, 7 mires and bogs, 17 grassland habitats, 13 heathlands and scrub habitats, 16 forests, and 4 sparsely vegetated habitats. 64 habitats are represented by 253 plant associations and communities endangered in the Silesia Province (over 94%), 5 habitats lack phytosociological diagnosis, in 4 habitats there are no endangered plant associations and communities, and 2 habitats are abiotic. 11 habitats belong to the most endangered (EN) habitats in Europe. 20 habitats are vulnerable (VU).

Given that certain quantitative criteria of the European Red List of Habitats (B. Restricted geographic distribution) refer to the entire continent, it is impossible to apply this methodology to determine threat levels locally, for a province. This is why the threat status was calculated as the average threat level for plant associations and communities that are determinants of a given type of habitat.

According to this calculation, among the most endangered habitats there are 38 types of habitats, and for 11 habitats the threat status remains undetermined. The nearly extinct (category: Endangered) habitats in the Silesia Province are: Alpine and subalpine ericoid heath, Calcareous quaking mire, Calcareous spring and spring brook, Intermediate fen and soft-water spring mire, Small-sedge base-rich fen and calcareous spring mire, Subalpine Pinus mugo scrub, and Temperate and boreal riparian scrub. The largest number of endangered plant associations and communities is present in the following habitats: Mesotrophic to eutrophic waterbody with vascular plants (37), Permanent oligotrophic to mesotrophic waterbody with Characeae (16), and Arable land with unmixed crops grown by low-intensity agricultural methods (14).

Thermophilous synanthropic vegetation of the *Eragrostion* Tx. in Oberd. 1954 alliance in the Ukraine

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Thermophilous late-summer weed vegetation (all. *Eragrostion* Tx. in Oberd. 1954) in the Ukraine preferring sandy light-textured soils, occur on cultivated areas and non-cultivated disturbed grounds. The floristic composition has a significant presence of C4 plants and neophytes of American origin. The most phytosociological significant species of the ukrainian *Eragrostion* communities are: *Amaranthus retroflexus*, *Conyza canadensis*, *Cynodon dactylon*, *Digitaria ischaemum*, *D. sanguinalis*, *Eragrostis minor*, *E. pilosa*, *Portulaca oleracea*, *Setaria viridis*, *S. pumila*, etc.

A syntaxonomic revision of the data set revealed four associations of the alliance: *Digitario sanguinalis-Eragrostietum minoris*, *Portulacetum oleraceae*, *Cynodontetum dactyli*, *Tribulo-Tragetum racemosi*. The community formed by *Hibiscum trionum* described from Carpathians and Transcarpathia (Hamor 1987, 1988; Solomacha V.A. et al. 1992) and Crimea (Bagrikova 1997, 2016) the following community of arable fields. Further, it needs to be clarified syntaxonomical status. Although sometimes cultivated *Panicum capillaris* escapes from the field and flower beds, but doesn't form communities association *Eragrostio poaeoidis-Panicetum capillaris.*

Three-dimensional model for cartographic representation of vegetation series and geoseries

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This work presents a three-dimensional model for cartographic representation of vegetation series, vegetation geoseries and phytoclimatic sectors, using a stereogram. The classic method used in vegetation mapping is that of vegetation maps (bi-dimensional model). Tri-dimensional mapping through stereograms is very significant because it emphasizes the relationships between vegetation distribution and physical factors (orography and geomorphology), and climatic ones (phytoclimate). The area mapped is the Altipiano di Piné (the Piné High Plain), m 800-1600, in the central Alps, Trentino, Italy. Three stereograms were done, one for the vegetation series (of which there are 16), one for the geoseries (9) and one for phytoclimatic sectors (2).

The vegetation of a peat bog in Trentino (Central Alps) as a result of various human interventions

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The Fiavé peat bog, 646 m, Central Alps, occupies a glacial basin of the Würmian and corresponds to a flat peat bog; the peat is about 3 m deep, with a pH between 6.5 and 7.2; the vegetation is given by the *Gentiano asclepiadeae-Molinietum* with some islands of *Trichophoretum alpini* and *Schoenetum ferruginei*. In 1853 the excavation of the peat began, with the formation of rectangular-shaped pits, today filled with water. The peat quarry ceased around 1960. The wet grasslands were regularly mowed, today completely ceased intervention; with the abandonment of the mowing the secondary succession process started with the formation of the *Salicetum cinereae*. The vegetation is conditioned by the following facts: plots of private property (rectangular), peat quarry, secondary succession. Most of the limits of vegetation are today of anthropic origin, as can be seen on the map of vegetation at the scale 1: 2.280.

Landscape and memory: flora and vegetation of abandoned villages in the Czech-German border area

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After the Second World War, many villages in the border regions of the Czech Republic were depopulated (it is reported that three million German people had to leave their homes). Once vibrant settlements were destroyed, completely or in part, woods and shrub communities appeared in their place, and arable land was afforested. A period of no agricultural management and homogenization of the landscape mosaic followed.

In 2017 we visited 14 abandoned villages consisting of at least three former buildings, situated in the Elbe Sandstones Protected Landscape Area and the Bohemian Switzerland National Park. On maps from the 1840s (of the so-called *Kaiserpflichtexemplar* of *Franziszeischer Kataster*) and on aerial photographs from the 1950s, we identified areas where fields, pastures and meadows were managed in the past but are now overgrown with mature forest. In these areas, we randomly recorded a total of 98 vegetation samples of 100 m^2 in area. In the vicinity of the ruins we inventoried every vascular plant species, including horticultural relicts.

The species composition of former pastures turned out to be the most recognizable. They are often situated on difficult to access terrain harbouring transitional and ecotonal communities with naturally greater species richness. On the other hand, the poorest communities are those that are found in places of former fields. It was possible to distinguish species-poor white birch stands, coniferous stands on eutrophic soils, and wetlands with the dominance of moor birch or alder and the presence of the largest group of ruderal species. Plant communities were sorted along nutrient and moisture gradients. Generally, nutrient-demanding and competitive species prevailed.

In old home-gardens, non-native species, such as *Syringa vulgaris*, *Symphoricarpus albus* or *Vinca minor*, formed large clonal populations. In total, neophytes constitute about 10% of the species inventory near ruins, which does not exceed the proportions usually found in the anthropogenic landscape. However, neophytes are much less frequent (around 6% of the species inventory) in surrounding habitats covered by the vegetation samples. We hypothesize that spontaneously vegetated plots are currently not under any major disturbance pressure that would facilitate the propagation of ruderals. We can conclude that village centres are diversity hotspots and alien refugia in the current landscape.

In comparison with the background species composition of forests in the study area, many grassland and nutrient-demanding species, together with the main invasive species *Impatiens parviflora*, occur in stands formed by natural succession. By contrast, non-settled areas harbour oligotrophic species and slow colonizers together with the invasive tree *Pinus strobus*, which was planted in forests on a massive scale in the 19th century.

Vegetation classification of Kedrovaya Pad Reserve (Russian Far East)

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Kedrovaya Pad is a small reserve in the southwest part of Primorsky krai, Russian Far East. Being one of the oldest nature reserves in the country, it was established to conserve unique ecosystem of conifer-broadleaf forest, rich both in boreal and subtropical species. However vegetation classification of Kedrovaya Pad is presented only by associations derived from dominant approach, with no attempts to classify vegetation according to Braun-Blanquet method and incorporate outputs into already existing syntaxa.

In current research we propose results of classification of 79 releves, collected by authors during 2014-2017 field seasons, and extra 10 releves, obtained from our colleagues. Using Juice software three approaches were applied: Modified TWINSPAN, cluster analysis using K-means and expert system, based on diagnostic species from 2006th Krestov et al. paper about deciduous temperate forests of mainland Northeast Asia.

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Regeneration ability from shoot fragments in *Solidago* ×*niederederi* (Asteraceae) and its parental species

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We conducted a preliminary study on regeneration ability from shoot fragments in *Solidago* ×*niederederi* and its parental species (*S. canadensis* and *S. virgaurea*), using shoot samples (100 shoots per species) collected from natural populations in Bakałarzewo, north-eastern Poland, on July 11, 2017. For each species, the basal parts of the collected shoots were cut off to prepare two groups of shoot fragments, namely 50 short fragments of the length of 5 cm and 50 long fragments of the length of 10 cm. The shoot fragments were planted in plastic pallets, which were filled with a universal garden soil for ornamental plants, and kept in a domestic garden. The number of regenerated organs (roots, leaf rosettes, and leaves) was counted on September 20, 2017. The highest percentage of regeneration was noticed in *S.* ×*niederederi*, reaching 48% of the short fragments and 56% of the long shoot fragments. The differences in the number of regenerated roots, leaf rosettes and leaves between the species were statistically significant in both groups of shoot fragments, according to the Kruskal-Wallis H test. However, the differences in the number of regenerated roots, leaf rosettes, and leaves between the long and the short shoot fragments were statistically significant only in *S. canadensis*, according to the U Mann-Whitney test. The obtained results suggest that the hybrid has a good regeneration ability from shoot fragments and the longer shoot fragments of *S. canadensis* can regenerate more roots, leaf rosettes, and leaves than the shorter ones. However, a further study is needed to clarify the speed of regeneration from shoot fragments and biomass allocation in the regenerated organs in the hybrid and its parental species.

Geographic and ecologic variability of low-level saltmarshes

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Questions: Tidal waters covers these low-level saltmarshes twice in a day. This study is dedicated to two associations of alliance *Puccinellion phryganodis* (class *Juncetea maritimi*): *Puccinellietum phryganodis* and *Caricetum subspathaceae.* These associations are widespread and have circumpolar distribution. Low-level salt marshes show not a complicated structure and poor in species composition. So if there are some variability caused by some climatic or ecologic reasons the differences are sharp. The investigation of variability in structure and composition of low-level saltmarshes' communities is the aim of the study.

Location: The communities of ass. *Puccinellietum phryganodis* and *Caricetum subspathaceae* are common in the Arctic and Subarctic regions and rare (but still exist) in boreal zone. Thus, we chose eight locations: Greenland, Island, Spitsbergen, Northern Norway, Murmansk region (Russia), Nenets AO (Russia), Kamchatka peninsula, Wrangel Island, South of White Sea.

Methods: The data set is 74 relevés for *Puccinellietum phryganodis* and 141 for *Caricetum subspathaceae.* All the relevés, except seven original ones, were taken from articles, published from 1939 to 2014. The data set was processed with TWINSPAN and ordination methods in PC-ORD.

Results: The ordination and cluster analysis showed practically a total absence of geographic variability in species composition in both associations. The ecological differences are clear between groups divided by TWINSPAN method, which could be interpreted as subordinate syntaxa. All the groups were analyzed using the ecological groups, ife forms and geographical features of the species. The communities from Russian Far East are the less similar to the other once. We also reviewed some ambiguous cases connected to selection vicariad associations: *Puccinellietum vilfoideae* for *Puccinellietum phryganodis* and *Triglochino-Caricetum subspathaceae* for *Caricetum subspathaceae.*

Invasive *Prunus serotina* impact on forest community composition in pine forests of Lithuania

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In the last two hundred years, forest managers introduced many non-native woody species. Such species can negatively impact ecosystems by invading and disrupting communities and ecosystems, changing biodiversity, nutrient and water cycling. The aim of this study was to determine the invasive *Prunus serotina* impact on forest community composition in pine forests of Lithuania. Species composition and structure of forest stands with *Prunus serotina* were recorded in 52 sample plots in pine stands. In each plot dendrometrical characteristics of stand, soil chemical properties and abundance of vascular plant and moss species were recorded in 2016-2017 summer period.

It was found that forests communities with *Prunus serotina* were associated with higher amounts of soil organic carbon and total nitrogen, soil pH fluctuated from 3,6 to 5,6. Forest communities with this invasive alien species were rich of plant species. The most common species of undergrowth, which was found in 70% investigated plots was *Quercus robur*, 60% investigated plots were taken by *Betula pendula* and 50% investigated plots ranked by *Acer platanoides.* The most common shrub species, which were found in more than 70% plots – *Frangula alnus*, *Sorbus aucuparia* and in 50% investigated plots *Padus avium* were found. The most common grass species were *Rubus idaeus* (in 80% investigated plots), *Fragaria vesca* (in 40 % investigated plots). Moss species - *Hylocomium splendens* (investigated in more than 42% plots) and *Pleurozium schreberi,* which were spread in 90 % investigated plots. In the future *Padus serotina* can negatively impact these native species or compete for nutrients, light, water, but more research is needed to confirm this species impact on pine forests communities' composition.

Distribution of the invasive plant species *Heracleum sosnowskyi* Manden. in the Republic of Tatarstan (Russia)

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The Republic of Tatarstan is located in the eastern part of European Russia on the East European Plain at the confluence of rivers Volga and Kama. The total area of Tatarstan is about 68000 sq. km, it includes various landscape types and vegetation units ranging from the formation of the southern taiga on the north to the fragments of typical steppe on the south of region.

The habitat invasion by non-native species is one of the largest threats to the global biodiversity. The most aggressive invasive alien plant species in European Russia is *Heracleum sosnowskyi*, commonly known as "giant hogweeds". It was introduced to northwest Russia as a potential forage crop in 1947, since 1980s it started to spread very rapidly as invasive plant. This species originates in the Caucasus and Transcaucasia and in northeastern Turkey. The modern alien range of *H. sosnowskyi* covers the European part of Russia, Belarus, Ukraine and Baltic States, it occurs also in Siberia, Poland, Germany and Hungary. There is no national program of hogweed control in Russian Federation, but several federal subjects have the regional ones. The key points of the control program are distribution mapping and its predictive modeling.

The aim of the research was developing species distribution model (SDM) to predict potential habitats for invasion.

To identify the locations of *H. sosnowskyi* we applied the original method using the Google Street View (GSV) service. Giant hogweeds are large plants that can be easily identified on GSV images both in groups and in separate specimens. Another important data source was the Vegetation Database of Tatarstan, which includes over 8500 vegetation plots on the territory of the Respublic of Tatarstan.

We used the data of WorldClim 2.0 and SoilGrids models as environmental variables and MaxEnt as modeling algorithm.

As result spatial distribution model was obtained. The model calibration test yielded satisfactory results, the ROC analyses revealed that the performance of the uncorrelated model was better than random. According to the result of the jack-knife test, bioclimatic ariables were the most important predictors. The most important predictors of *H. sosnowskyi* distribution were the factors related to precipitation. Resulted map showed that the highest probability of *H. sosnowskyi* presence was related to areas of forest zone on the north of Tatarstan, while in the steppe zone the probability is minimal.

The European Boreal Forest Vegetation Database

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The European Boreal Forest Vegetation Database aims to cover the forests of the boreal and the hemiboreal (boreonemoral) zones of Europe, comprising the following countries and regions: Iceland, Scotland, Denmark, Norway, Sweden, Finland, Estonia, Latvia, Lithuania, Belarus, north of the 52nd parallel in Poland and in European Russia, west from the Ural Mountains. Vegetation plot records of all types of forests occurring within the zone are included, zonal as well as azonal forest communities, e.g. wooded bogs and alder carrs. For the first time, this database will enable detailed investigation of vegetation patterns of boreal and hemiboreal forests on the European scale.

First, we requested data from the European Vegetation Archive EVA. Currently, boreal forests are poorly represented in EVA: particularly few vegetation plot records are available from Sweden, Norway, Estonia, Russia and Belarus. To fill in these gaps, we started cooperation within an international team of vegetation scientists to compile the European Boreal Forest Vegetation Database. Currently, we have managed to obtain significant amounts of data from Estonia, Latvia, Norway and large parts of Russia, but data are still missing or have insufficient quality especially from Sweden, Denmark and Belarus. Therefore, we are still looking for potential collaborators, from all of the countries within the study area, to contribute with vegetation-plot data and local expertise. Our ambition

is to digitalize already published vegetation-plot records from literature and to encourage complementary field surveys to cover the most obvious gaps.

The European Boreal Forest Vegetation Database can serve wide range of purposes in vegetation ecology. One of the intended aims is to create a unified classification of boreal forest types in accordance with both the EuroVegChecklist and the EUNIS (European Nature Information System) habitat classification, with formal definitions of the types, and to create corresponding Expert Systems for assigning new vegetation-plot data into the unified classifications. Currently, there exists only local or regional vegetation typologies with varying approaches to vegetation classification, which impairs the efforts of European-scale habitat conservation. Moreover, the database can also be used for gradient analyses of species-environment relationships and studies of species richness patterns. The database can, potentially, also be useful for addressing biogeographical tasks such as sharpening the definition of the border between the hemiboreal and boreal vegetation zones. Our clear ambition is that once established, the database will enhance the use of these data by a wide range of researchers.

The effect of environmental factors on habitat continuity of semi-natural grasslands

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Habitat continuity is known as an important factor influencing plant species composition and diversity in semi-natural grasslands. However, much less is known about why some areas are susceptible to changes in land use. In this study, we attempt to investigate the effect of environmental factors on habitat continuity of semi-natural grasslands of the class *Molinio-Arrhenatheretea* using a large set of vegetation-plot data and data on climate, geodiversity, as well as maps on the past land use. Considering a wide range of ecosystem services provided by semi-natural grasslands, studies on habitat continuity are desirable for the maintenance of grasslands biodiversity. We hypothesized that old and recent grasslands in plant species composition and diversity. These two categories of grasslands were recognized using historic Messtischblatt maps, which contain information about land use from the 30's of the last century. We used 2722 georeferenced vegetation-plot data from the Polish Vegetation Database. All these data were collected from a wide and representative variety of grasslands after the year 2000. The study area was 19,947 km² comprising lowlands, foothills and mountains (<800 m. a.s.l.) of Lower Silesia in south-eastern Poland. The vegetation-plot data was subjected to geographical stratification, and as a result, the final data set for the analysis was reduced to 709 vegetation-plot observations. For each vegetation-plot, we assigned two sets of environmental variables including climate and geodiversity. We also calculated Ellenberg's indicator values (EIVs) for each plot. Our results show that about the half of current grassland sites were formerly arable lands. Using univariate and multivariate analyses we showed that old grasslands differ from recent grasslands in terms of environmental conditions and species composition patterns. Based on the interpretation of topographic indices and EIV for moisture, we found that majority of old grasslands were located in more humid environs. Old grasslands showed also higher beta-diversity than recent grasslands. Our results suggest that less humid sites are particularly exposed to future land use changes.

Low colonization ability of forest specialists in tree plantations of the Pannonian sand forest steppe region

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Due to the environmental changes native oak forests in the Kiskunság sand region of the Great Hungarian Plain have limited spontaneous regeneration ability. Dominant forestry practice of renewal includes full soil preparation, with removing of stumps and the topsoil.

In our research we studied the colonisation ability of forest specialists in native and foreign tree plantations. Approximately 200 of 20x20 m phytosociological releves were made in native peduncular oak, white poplar, and in non native locust tree, pine and exotic poplar plantations. We used seminatural lowland sand oak forest releves from the Hungarion Phytosociological Database as reference.

Our results show that although in the forest steppe zone the seminatural forest are relatively poor in forest specialists, in the plantations even after 20-30 years only a small part of this species pool can be found. Mostly the same 5-6 disturbance tolerant zoochor species could appear. Native plantations have slightly higher regeneration potential then non-natives. Analyzing abiotic and landscape history factors affecting the colonization success landscape scale temporal continuity of the presence of seminatural forests is the determinant.

Summarizing our findings current forestry practice seriously threatens the biodiversity of these forests. Due to their small extent and fragmentation conservation should have the highest priority in their management.

Plant diversity: can we trace its history using pollen data?

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Palynological reconstruction of Holocene vegetation changes requires understanding of cross-scale relationships between floristic and pollen diversities. We explored the relationships in two regions of the Czech Republic differing in environmental condition and diversity patterns. The White Carpathians are a biodiversity hotspot of thermophilous vegetation comprising dry grasslands and broad-leaved forests while the Bohemian-Moravian Highland is dominated by species-poor spruce forest, meadows, and wetlands. In each region, 40 sites covering major habitats were sampled for plants and pollen. A detailed floristic survey in radii of 10 and 100 m and in two transects of 1,000 m was conducted at each site. Recent pollen was sampled in a moss polster in the centre of each site. Almost 1,600 species were recorded during the floristic survey, and more than 180 taxa were found in the pollen assemblages. Interestingly, the total number of species was similar in both regions (approx. 1,100 species). Considering biases of pollen analysis, especially pollen productivity, we based our comparison on i) the standard pollen sum, ii) the sum modified by pollen productivities and iii) representation factors. Surprizingly, pollen productivities (PPE) and representation factors (RF) calculated from the same pollen-vegetation dataset did not improve the diversity relationship. In both regions, the main factor influencing the relationship of pollen-floristic diversity was the dispersal-deposition bias. Forested sites had a higher proportion of the regional pollen component (*Ambrosia*, *Artemisia*, *Chenopodiaceae* family) than open sites. Implications for the reconstruction of Holocene vegetation diversity changes are discussed.

Occurrence or Stiff Clubmoss *Lycopodium annotinum L.* – naturaland expansive aspects within lands managed by the Latvia's State Forests

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With 3.8 million ha of forests or 60 % of the territory, Latvia is among the most forested countries in Europe. The highest amount and diversity of nature values in Latvia occur in the State forest managed lands.

Functional management of forests covers various aspects, the basis of longterm sustainable development is to balance interests of nature conservation and economics. Since 2010, great attention has been dedicated to implement these aims. Registration of rare and endangered species – as a point or polygon in a LKS 92 coordinate system. As well, a monitoring of habitats of these species, has been initiated as a one aspect to maintain biodiversity within lands managed by the LVM. In cases where a habitat of a target species meet criteria of a certain European Union importance habitat, separately has been marked a code, variant and quality of the protected habitat type.

The objective of this study is to analyse quantitative and qualitative aspects of occurrence of registered findings of Stiff Clubmoss *Lycopodium annotinum*, such as vitality of a finding, habitats and their quality. This basis information gives an overview about distribution and it possible correlation with core habitats and their quality.

General analysis of the species findings since 2011, shows:

I species findings, since 2011 – 2611 findings together, in general have homogenous and aligned spatial distribution – species findings are registered in all Physio-Geographical and Geobotanical regions of Latvia within lands managed by the Latvia's State Forests;

II one trend from non-disturbance natural and semi-natural habitats towards habitats of significant impact on hydrology – where some findings of the species show outspoken expansive aspect; in significantly drained areas a Stiff Clubmoss *Lycopodium annotinum* has expansive behaviour till as an indicator of natural ecosystem degradation indicators;

III Species occurrence in natural, semi-natural and even degraded habitats, which must be an object of further studies, leads to open a discussion towards deeper understanding of the species ecological requirements as well as, sufficient protection regime in certain cases.

This study is further step after the first results (2015), where a general analysis of the species findings since 2011, showed one trend from non-disturbance natural and semi-natural habitats towards habitats of significant impact on hydrology – where some finding of the species show outspoken expansive aspect.

This study has been done on a basis of field surveillance data since 2011, about the Stiff Clubmoss *Lycopodium annotinum* registered by the LVM Environmental experts: Ugis Bergmanis, Ojars Demiters, Vija Kreile, Dace Krogere, Diana Marga, Ilze Reriha and Ieva Rove.

Species diversity of reservoirs formed in subsidence basins and its role in reclamation and provision of ecosystem services

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Water reservoirs created in subsidence basins are an example of the indirect impact of underground mining. This artificial unintentionally human created water reservoirs cause a serious transformation in the surface and in the landscape.

The aim of the research was to find out: i) whether reservoirs, despite similar origin, differ in the level of species diversity; ii) whether the quality of water and soil and the metric characteristics of the reservoirs affect the diversity of vegetation; iii) which functional groups of plant species play a key role in the reclamation of reservoirs and the provision of ecosystem services by these habitats.

The research was carried out in the Upper Silesia area, within 10 tanks formed in subsidence basins. The reservoir-related ecosystems and services provided by them based on the CICES V 4.3 list have been identified.

The obtained results showed that reservoirs, despite similar origin, differ significantly in terms of species diversity level ($H=109.9571$, $p=0.00$). The diversity of the stated vegetation diversity is statistically significantly influenced by the size and depth of the reservoirs as well as the humidity of the habitat, the C / N ratio, the P_{total} concentration in the substrate and the clarity of the water and the dominant species present. Species diversity also reflects the range of ecosystem services provided by reservoirs and their surroundings. It has been shown that the formation of reservoirs in the subsidence basins, in the areas of underground mining exploitation, contributes to the enrichment of the environmental capital of these areas.

The impact of extensive management measures on non-forest Natura 2000 habitats in the Nature reserve Devínska Kobyla Mt. (Slovakia)

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Unique geographical position of Devínska Kobyla Mt. (Malé Karpaty Mts) resulted in the extraordinary physical-geographical conditions with specific, rare and species rich steppe vegetation. The occurrence of xerothermophilous grassland communities in studied area is in direct relationship with human's agricultural activity. During the mid-20th century, the abandonment of traditional management (grazing, mowing) resulted in dramatic succession changes of dry grasslands and its degradation by shrub invasion. During the winter of 2015/2016 there were extensive management measures realised focused on removing of shrubs and trees and restoration of grazing of goats immediately after removal of woody plants.

To monitor the impact of management treatments, 5 permanent monitoring plots (4x4 m) with 8 sub-plots (0.5x0.5 m) were established in the autumn 2014. In the spring 2016 another 7 plots with sub-plots were established together with 7 control plots. The studied habitats are mostly habitat 6210 "Semi-natural dry grasslands and scrubland facies on calcareous substrates" in various stages of succession. To evaluate changes in vegetation, Detrended correspondence analysis (DCA) in CANOCO 5 package was used. For the ecological interpretation of the results, the Borhidi indicatior values were passively inserted into the ordinal chart as additional data. Species diversity (Shannon-Wiener index), the presence of various species traits (Biolflor) as well as the presence of target xerothermophilous species were evaluated on monitored plots.

As a result of cutting of the shrubs and trees, we have recorded a significant increase in the number of heliophilous and thermophilous species, such as *Pulsatilla grandis*, *Plantago media*, *Jurinea mollis*, *Astragalus onobrychis*, *Carex michelii*, *Chamaecytisus austriacus*, *Thesium linophyllon*, *Linum tenuifolium* after two years of monitoring. The total number of species was higher than before the realisation of management, especially stress-tolerant hemicryptophytes from surrounding dry grassland vegetation appeared. On the plots where *Pinus nigra* has been removed, the number of species has increased significantly, mostly herbs spreading by seeds and occurred in the seed bank (*Allium flavum*, *Crinitina linosyris*, *Petrorhagia saxifraga*, *Sanguisorba minor*, *Seseli osseum*, *Stipa joanis Thesium linophyllon*). In the plots that were established to assess the impact of grazing, goats largely suppressed shrub shoots and disturbed the turf, creating conditions for germination of therophytes.

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Riparian floodplain forests in Slovakia – drivers of species composition and richness variability

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Riparian floodplain forests in temperate zone form well-established vegetation types along lowland and mid-altitudinal large rivers, medium to small streams up to montane areas and also on waterlogged soils in seepage habitats. Their plant species with different ecological requirements and origins reflect interplay between site conditions and natural disturbance events. Numerical classification and ordination techniques were used to show differences in species composition at alliance level, whereas Generalised Linear Model (GLM) was applied to fit variation in species richness of total vascular plants and alien plant species. Major variation patterns were explained using climate (altitude, mean annual temperature and precipitation), landscape-scale variables (stream power index – SPI, topographic wetness index – TWI) and Ellenberg indicator values (EIVs; used only in case of unconstrained ordination). Phytosociological material of 1160 relevés previously classified within single alliance *Alnion incanae* was split into two main clusters which correspond to i) alder-ash riparian forests (*Alnion incanae* alliance) and ii) mixed elm-ash and oak floodplain forests (*Fraxino-Quercion roboris* alliance). While plant communities of the *Alnion incanae* most often occupied submontane and montane zones, the *Fraxino-Quercion roboris* stands were related mainly to lowland areas with warmer and drier climate. Species compositional turnover of floodplain forests was driven by combined effect of climate and EIV for soil reaction (first DCA axis), and EIV for soil moisture (second DCA axis). Species richness values of total vascular plants and alien plants were in range of 6-94 and 0-11 per relevé, respectively. The GLM identified significant response of total vascular plant richness to TWI (negative linear trend), SPI (hump-shaped trend) and altitude (hump-shaped trend), which together accounted for 23.2% of variation in species richness data. The GLM of alien richness was determined only by altitude (both linear and quadratic terms were found to be significant), which explained 27.5% of its variation.

Vegetation dynamics of post-peat-extraction area of Baltic Bogs (Bagno Kusowo, NW Poland)

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The Baltic bog, Bagno Kusowo is one of well-preserved peatlands of that kind in Poland, despite its earlier drainage, peat extraction and partial afforestation. It is represented by vast expanses of peat moss associations and bog forests preserved to a different degree. In 2004 the bog was covered by reserve protection system. Since 2007 protection activities have been going on there (weirs and sluices in drainage ditches). In the most transformed part of the post-peat-extraction area regeneration processes of peatland vegetation have been observed for years. It is probable that these processes were initiated in the 60's of XX century, immediately after the cessation of peat extraction. Fragments of degenerated areas are primarily the ridges between the former peat extraction sites overgrown with bog forests. Northern unexploited part undergoes natural succession changes. The analysis of changes in open patches of moss associations of the bog (on the basis of aerial and satellite images from 1968 and 2005 and also satellite images from 2014) indicates the overgrowing of both exploited and unexploited parts. Although in recent years succession processes were inhibited, the dynamics of overgrowing with trees is greater on former post-peat-extraction sites. Conducted since 2004 observations of vegetation changes on permanent study objects, have not been spectacular. The dominant species, characteristic of particular communities have not changed. Only slight qualitative changes have been recorded, a slow colonisation of open areas or appearance or disappearance of species due to wet years. More evident changes such as: moss associations inundation or tree losses, refer only to a few post-peat-extraction sites. They undoubtedly, result from implemented protective activities. The response of the post-peat-extraction vegetation to violent hydrological changes is continually being monitored.

Invasive plants in the area of Natura 2000 "Starodub w Pełkiniach"

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The area of Natura 2000 "Starodub w Pełkiniach" is located in the SE Poland within villages Pełkinie, Ujezna, Jagiełła and Rozbórz. The main subject of protection is the population of *Ostericum palustre*. In addition, two of the habitat types protected are present: 6410 molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) and 6510 fresh meadows from the *Arrhenatherion*. Besides, there are protected and endangered plant species like *Cnidium dubium, Dianthus superbus, Gentiana pneumonanthe, Gladiolus imbricatus, Iris sibirica* etc.

In year 2015, floristic and phytosociological studies were conducted in the area of Natura 2000 "Starodub w Pełkiniach". The aim on study was to prepare a list of invasive plant species and analyze their impact on protected objects and endangered native species. 24 invasive plant species were discovered in the region: 9 not harmful species (e.g. *Bromus carinatus, Juncus tenuis, Lolium multiflorum, Rhus typhina, Vicia grandiflora*), 1 potentially invasive species (*Juglans regia*), 7 weeds (e.g. *Conyza canadensis, Echinochloa crus-gali, Galinsoga parviflora, Setaria pumila*) and 7 transformers (*Echinocystis lobata, Impatiens glandulifera, Impatiens parviflora, Robinia pseudoaccacia, Rudbeckia laciniata, Solidago gigantea, Veronica persica*). From among invasive plant species the biggest impact on the structure of plant communities and biodiversity was exerted by *Solidago gigantea*.

What kind of communities do lichens, bryophytes and vascular plants form on snags?

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The dead standing trees i.e. snags are known as habitat for epiphytic and epixylic species including first of all lichens and bryophytes. The vascular plants are much rarer on this type of coarse woody debris (CWD). The eighty snags (CWD elements higher than 1.5 m) mostly belonging to Norway spruce *Picea abies* and beech *Fagus sylvatica* in the Karkonosze Mts were examined for the presence of lichens and plants. The height of snags, their decomposition stage, cover of bark, diameter at breast height (DBH) as well as site conditions (elevation, slope and aspect, presence in forest community) were measured and noted. The percent cover of plants and lichens were estimated on each snag. In total 99 taxa were recorded. There lichen species were dominant (44), followed by mosses (34), liverworts (13) and there were only 8 vascular plants. On snags the total species richness varied from 1 to 22 taxa. The majority of floristic records were collected from spruce snags (553), beech (102) and 8 from rowan (*Sorbus aucuparia*). The species composition of flora growing on snags was subjected to ordination and statistical analyses. They revealed that the species identity of snag is one of the most factors in terms of species composition. The number of species is positively correlated with DBH whereas decomposition stage, presence of bark, height of snag are not significant factors. The species richness increases also with altitude what is connected with higher abundance of spruce snags. The communities occurring on snags are of synusial character but they also depend on the neighbourhood. Despite of some observed patterns in colonization of snags they are important habitat only for lichens.

Short-lived nature of lichen forests in Poland

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In Central Europe, lichen pine forests are restricted to certain areas with extremely nutrient poor and xeric soil types. In recent decades, a retreat of vegetation of oligotrophic habitats has been observed in Central Europe. We assessed changes of lichen pine forests in Poland: within the main area of the range in Central Europe. We used two sets of data: 1) relevés collected on semi-permanent plots in the Bory Tucholskie forest (local scale data) and 2) relevés from Polish Vegetation Database (regional scale data). At the local scale we analyzed changes in the structure and species composition of lichen pine forests over 33 years (between 1975 and 2008). At the regional scale we analyzed differences in species richness and vegetation structure in tree time periods (1) between 1951-1969, (2) 1970-1989, and (3) 1990-2011. For identification of lichen pine forests in Polish Vegetation Database we determined a group of co-occurring *Cladonia* species.

We found that changes in lichen pine forests are primarily quantitative at both scales. The abundance of *Cladonia* species is limited by vascular plants and bryophytes, which are promoted by eutrophication and climate warming. Only pine forests with a minor abundance of lichens have chances to persist in the vegetation of Central Europe, while the most valuable communities with high abundance of indicators are seriously endangered. An assessment of a total decrease in the area of lichen pine forests was not obtained, however, local observations indicate a large decline in the area of lichen pine forests in Central Europe. Their conservation seems to be a serious challenge, because it is difficult to provide optimal conditions for all indicators.

Vegetation dynamics in riparian forest buffer strips in Latvia

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Knowledge of the ecological functions, dynamics and diversity of vegetation in riparian forests have aroused attention concerning the protection of transition zones between terrestrial and aquatic ecosystems, water quality and provision of many products and ecosystem services. We investigated the vegetation composition in riparian forests along the streams with different water quality, graded as high, moderate and low according to water chemical purity. We also included the comparison of differences in vegetation between sample plots closer to river margins (I) and more into forest interior (II).

The study was conducted in three geographic regions of Latvia. In total 90 sample plots were established for analysis. Vegetation survey was made using Braun-Blanquet method. The plant functional groups (n=16) were used to see detailed changes in vegetation composition in riparian forests.

The results showed significant differences in coverage on moss and shrub layers in forests between low and high water quality streams. Species richness, diversity and evenness were also lower in the forests along the high quality streams. Plant functional types showed significant differences between stream water quality and sample plots (I vs II). Our results demonstrated that stream water quality can be used as an indicator to evaluate forested riparian buffer strips.

Anthropogenic communities of halophytes in Lower Silesia (SW Poland)

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In Poland, the flora of halophytes is rather poor, originally associated with dunes or wet salt meadows along the Baltic coast and with over a dozen inland sources of salt water in central and south-eastern part of the country. Native species of dry and warm salt steppes or semi-desert habitats have not been recorded.

In Lower Silesia, there are no natural open salt deposits, saline soils or sources of salt water, so halophytes are originally absent. Up to now recorded stands of a few halophilic species, e.g. *Glaux maritima*, *Puccinelia distans* were sporadic and ephemeral, but as an effect of intensive salt deicing during the last 20 years rapid expansion of halophytes along roadsides is being observed. The soil salinity is the highest in the beginning of vegetation season and strongly limits germination of native not halophilic plant species. We documented 82 patches of halophilic vegetation, all associated with roadsides. As a result of the Twinspan analyses two main groups of vegetation plots were distinguished. According to Ellenberg Indicator Values calculated for samples, both groups have similar light and temperature requirements but differ in water requirements, soil reaction and trophy:

1) community of *Puccinellia distans*; requires moist substratum (W: 5.1), tolerates less fertile soils (Tr: 5.4) and higher pH (R: 6.8); plant cover 10 to 70%; number of species in the relevés 1 to 16 (avg. 8); patches developed in wet habitats of shallow puddles with periodically standing salt water; it refers to association *Puccinellietum limosae* Soó 1933 of the class *Festuco-Puccinellietea* Soó ex Vicherek 1973.

2) communities dominated by thermophilic therophytes; are more drought resistant (W: 4.6), require more fertile soil (Tr: 6.6) and tolerate lower pH (R: 6.6); plant cover 10 to 90%; number of species in the relevés 3 to 34 (avg. 17); patches occupied dry and warm well drained road sides and highway middle lanes; almost all were dominated by alien species *Dittrichia graveolens*, *Senecio inaequidens* or rarely *Atriplex micrantha* germinated 4-8 weeks later than native plants.

In total, 136 species of vascular plants were noted in all samples, however the composition of patches seems to be rather accidental and about 50% of the species occurs sporadically. *Ditrichia graveolens* and *Senecio inaequidens* deserve special attention – in spite of presence for a short time in the region, both spread rapidly and form new type of plant communities on saline roadsides.

Differentiation of natural shrub communities of *Cotoneastro-Amelanchieretum* group in Central Europe

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Aims: To recognize a compositional and geographical differentiation of shrub communities described from Central Europe as a part of widely treated *Cotoneastro-Amelanchieretum* (=*Junipero-Cotoneasteretum*) rocky shrub communities.

Methods: Relevés with participation of *Amelanchier ovalis*, *Cotoneaster* sp. dif. and *Juniperus communis* were obtained from phytosociological databases (Slovakia – 1338; Czech Republic – 49; Poland – 126; Austria – 18) as well as literature sources (229 relevés). From the initial dataset we excluded relevés in which the cover of shrubs and trees was <25% and >25%, respectively. We also removed relevés representing both the subalpine communities of the *Betulo carpaticae-Alnetea viridis* and *Roso pendulinae-Pinetea mugo* classes as well as secondary shrubs with *J. communis* developing on the abandoned thermophilous grasslands. The final dataset of 331 relevés, covering the range from France to Slovakia, where then subjected to further analyzes. The vegetation types were identified using a K-means method with a power transformation. The best results were obtained using with *a priori* six clusters designed.

Results: The analyzed shrub communities show a great habitat and geographical diversity, thus should not been treated as the same syntaxonomic unit. We distinguished the following types of phytocoenoses:

1. Acidophilous with a constant share of *Amelanchier ovalis, Avenella flexuosa, Teucrium scorodonia, Calluna vulgaris, Genista pilosa, Frangula alnus* (reported in central Germany).

2. Neutrophilous with a constant share of *Cotoneaster integerrimus, Festuca pallens, Hylotelephium maximum, Vincetoxicum hirundinaria, Asplenium septentrionale, Polygonatum odoratum*, *Calamagrostis arundinacea* et al. (Czech Republic, SW Poland and SE Germany).

3. Calcicolous shrubs with a constant share of *Cotoneaster integerrimus* and *Festuco-Brometea* species (the most widespread group: Germany, the Czech Republic, Austria, Poland, Slovakia).

4. Mountain shrub communities with *Amelanchier ovalis*, *Rosa glauca, Hippocrepis emerus, Berberis vulgaris, Viburnum lantana* and others (reported in France and Switzerland).

5. Mountain, calcicolous shrubs with *Cotoneaster tomentosus*, *Lonicera alpigena, L. caerulea, L. nigra, Rosa pendulina, Salix appendiculata, Sorbus mougeotii*, *Sesleria varia* and many subalpine species (Alps in Switzerland and on the German/Austrian border).

6. Thermophilous shrubs with *Quercus pubescens, Ligustrum vulgare, Viburnum lantana, Acer opalus* and *Prunus mahaleb* (reported in southern Germany, Austria and Switzerland).

The changes of the cover of plant groups during meadows restoration after *Solidago* spp. invasion

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Grassland communities are widespread within many biogeographical regions of Europe, from lowlands to mountainous areas. At present, almost half of semi-natural grassland habitats are considered threatened within the European Union. The species diversity decline on meadows is caused, among others, by management abandonment. Such fallowed lands are susceptible to biological invasions, especially North American goldenrods (*Solidago*). Goldenrods are considered to be one of the most invasive species in the world and are able to penetrate many plant communities and displacing native species.To restore the native biodiversity of ivaded grasslands, it is necessary to restore the habitats.

The presented study shows the results of the experiment aimed at the effective restoration of the semi-natural grassland on site invaded by *Solidago canadensis* and *S. gigantea*. Three treatments of invaders eradication: rototilling, scalping, glyphosate herbicide, as well as two methods of seed application: sowing of fodder grass mixture and fresh hay were used. Along the course of the experiment moving twice per year was applied. The changes in cover of various plant groups (invasive golderods, graminoids, herbs and legumes) were observed in 2014-2016.

The results show a negative correlation between *Solidago* cover and the cover of: graminoids, forbs and species richness. A strong negative correlation between the graminoids and herbs cover was also observed. The increased proportion of herbs in the sward is correlated positively with the species richness of the restored meadow. Redundancy analysis showed that the use of glyphosate and the application of fresh hay had a positive effect on the participation of graminoids and legumes, and reduced the *Solidago* cover. The sowing of a mixture of forage grasses results in a smaller coverage of forbs and a lower species richness.

GLOBALP – a project for analysing global diversity patterns of alpine vegetation

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Altitudinal treelines represent one of the most abrupt transitions in life-forms and define the starting point of the alpine zone, the only bio-geographic unit on land with a global distribution. Here, we present a project for providing a first overview of the diversity of alpine vegetation at the global scale, considering the diversity of alpine habitats across biomes and continents. By taking advantage of Google Earth Engine's computational power and its open-access datasets, we first developed a new approach to isolate the world's alpine areas by modelling the treeline altitude and to provide the first bio-climatic characterization of habitats above the treeline worldwide. We further compiled a comprehensive dataset of zonal alpine vegetation, which includes dominant plant communities above the climatic treeline dominated by cryomorphic forms of vascular plants, including graminoids, forbs and dwarf shrubs. The data was initially provided by sPlot, the global vegetation database established by the German Centre for Integrative Biodiversity Research (iDiv), with a major contribution of the European Vegetation Archive for Europe and nearby regions. We also compiled additional data collected by new contributors to improve the global sampling coverage as much as possible. The result is the first dataset of alpine vegetation at the global scale, including several thousands of plots spanning from the tropical alpine Andean Páramo to the temperate alpine grasslands of New Zealand's Alps, covering all macroclimatic zones excepting the Arctic. In the next steps, we will use these data to perform a global analysis of taxonomic and functional diversity in alpine vegetation, comparing different regions across latitudes and modelling plot-based attributes against environmental factors.

Changes in alpha biodiversity patterns along a coastal dune gradient in southwestern Europe

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Coastal dunes are ecosystems exposed to harsh environmental conditions along a sea-land gradient which show different vegetation types and related habitats: embryo, mobile and fixed dunes. To understand their structure and functioning, functional (FD), taxonomic (TD) and phylogenetic (PD) diversity need to be taken into account. This study took place along a 700 km coastal stretch, belonging to four biogeographical sectors, in the south-west of France and northwest of Spain. From each sector three locations were sampled and in each location four 100 m^2 plots were sampled within each dune habitat. In each plot two 10 m^2 subplots were set in the corners following a nested sampling design. A total of 288 subplots were sampled and species abundance, TD, FD and PD at the alpha level were measured. Ten different traits were analyzed. For the LHS framework, SLA, height and seed mass of the most abundant species were measured. For less abundant species and other traits data were collected from online databases. NMDS analysis, PERMANOVA and linear mixed effects models were used to explore differences between sectors and habitats for species composition and each derived taxonomic, functional and phylogenetic index. We found different species composition for each habitat. For embryo dunes it was constant along biogeographical sectors, while it changed for mobile and fixed dunes. TD, FD and PD diversity indices did not show changes at sector level despite the species change in mobile and fixed dunes. We also found an increase in TD from embryo to fixed dunes followed by an increase in functional divergence. In habitats more exposed to sea, wind and waves, such as embryo dunes, few phylogenetically non-related species were selected by their traits leading to functional convergence. This could be due to environmental filtering. Fixed dunes, a more sheltered habitat, showed higher taxonomic diversity and trait divergence, which could be related to competitive exclusion of species similar in functional traits. In conclusion, on the one hand coastal dunes showed different biodiversity patterns along a sea-land gradient, and on the other hand, despite a change in species, functional and phylogenetic diversity remained without changes along a geographical gradient.

Which predictor is more important for grassland vegetation in the small river valleys: soil properties or topography?

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Vegetation diversity at the local scale is determined by edaphic qualities, small landscape features as well as their anthropogenic usage. In Lithuania, grassland vegetation could occur because of human usage, and most of natural grassland vegetation exist only in the river valleys, the grasslands in other territories were shifted into agricultural lands or forests. It is clear that more than one environmental factor creates suitable conditions for the occurrence of certain vegetation, but still unclear which is weightier?

The goal of our research was to clarify which predictor is more important for grassland vegetation diversity at the local scale – soil properties or topography?

The data were collected based on the Braun-Blanquet vegetation research principles. One hundred and seventy three relevés were made at three different river basins. Relevés were made on different landscape features and in the communities of two vegetation classes – *Molinio-Arrhenatheretea* and *Festuco-Brometea*. Two main landscape features (slope aspect and inclination angle) and five soil components (soil pH, total nitrogen, total organic matter, soluble phosphorus and soluble potassium) were analysed. The classification of vegetation was done using TWINSPAN in JUICE software, the multivariate analysis was performed using CANOCO.

We figured out six vegetation types that belong to different syntaxonomical units. Two of these belong to the *Molinio-Arrhenatheretea* class, the rest four – to the *Festuco-Brometea* class. The first gradient (1st axis) is explaining 4.54% of the total variability in the species composition, whereas the second – 2.88%. The results of fitting the soil and topography variables show that there is a strong correlation of the species-based axis with environmental data (Pseudo-canonical correlation – 0.79). The strongest correlation was observed between the first axis and topography features, which shows a connection with the first gradient as well as importance of these features. We could assume that topography features play general role to small river valleys.

Assessment of macrophyte biological diversity and ecological quality of streams in Latvia

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The importance of macrophytes in river biological assessment is formally recognised under the Water Framework Directive and this group of organisms is an obligatory element in the monitoring of ecological status of surface waters.

Macrophyte survey data were obtained from Latvian Environment, Geology and Meteorology Centre. Surveys were carried out in Latvian rivers between 2006 and 2016. This study consisted of two parts: adaptation of MIR index to Latvian conditions and application of this newly adapted MIR index to Latvian state environmental monitoring survey data. Data from 356 macrophyte surveys in 186 rivers were used. MIR index was adapted mainly for European intercalibration type IC-R4, which corresponds to two Latvian river types: medium-sized fast (R3, slope > 1 m/km) and slow flowing (R4, slope < 1 m/km) lowland rivers. In this study we tested also possible use of MIR index in other national river types.

In total, 83 plant taxa were found in Latvian rivers. Average number of species in potamal (on average 10.9 species) rivers were higher than in rithral (9.1), mean MIR index values in rithral (39.4) rivers were slightly higher than in potamal (38.6). Smallest number of macrophyte species was observed for R1 type (mean 6.9) and in many cases, it was not sufficient enough to calculate ecological quality index. Largest number of species was observed in large river types R5 (on average 13.3 species) and R6 (12.7).

Species composition analysis confirmed that R3 and R4 types are the most similar with each other, little larger differences were observed between middle sized rivers and large rivers (catchment area 1000-10000 km^2). Species composition in small rithral rivers (R1) were significantly different from other river types.

Spatial structure of the tundra plant communities within the forest-tundra ecotone of Taimyr Peninsula

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The decreasing influence of permafrost on the spatial structure of vegetation, along the transect crossing the subzones of the southern arctic tundra and of the forest-tundra, causes the change in the type of the horizontal structure of phytocenoses from irregularly discrete to a more homogeneous regular-continual one with elements of a mosaic structure of permafrost origin (thermokarst areas on frozen mounds and clay medallions, which occupy in total no more than 7% of the surface). Micro-relief elements play an important role in maintaining the diversity of plant species and biomorphs, associated with the habitats dynamics and vegetation succession. Medallions with a convex and flat surface are characterized by irregular type of overgrowing by plants and lichens, which gradually cover the ground surface. Quite often, along the edges of such medallions, a border of *Dryas punctata* Juz. and bryophytes are formed. The overgrowth of medallions with a concave surface, in which water normally accumulates, occurs due to bryophytes and more hydrophilous species of vascular plants (*Carex marina* Dew., *Juncus biglumis* L.).

The formation of thermokarst areas is associated with the destruction of the ice core of the frozen mound, which creates special conditions for succession. In the first stages, the bryophytes *Hylocomium splendens* (Hedw.) Bruch et al., *Aulacomnium turgidum* (Wahlenb.) Schwägr., *Tomenthypnum nitens* (Hedw.) Loeske, *Pleurozium schreberi* (Brid.) Mitt. absolutely dominate here. As the frozen mounds are destroyed, vascular plants and fruticose lichens are included in the process, but often prostrate dwarf shrub *Betula nana* L. is obtained. As a result, spots with predominance of bryophytes are formed, separated from the rest of the surface by a characteristic roller formed by the remains of a frozen mound.

In wet depressions, which occupy about 30% of the surface of non-forested landscapes of the Taimyr forest-tundra zone, tussock communities dominated by *Eriophorum vaginatum* L. prevail.

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Management impact on dry grasslands in Sub-Mediterranenan Slovenia

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Species rich grasslands (natural and semi-natural) are one the most threatened ecosystems in Europe due to various reasons: change of traditional management, abandonment and re-growth or land-use intensification (eutrophication, fragmentation …).

To monitor changes in floristic composition of species rich grasslands due to intensified management we selected 15 farms in western part of Slovenia (Karst region) at the junction of Alps, Dinaric and Sub-Mediterranean regions. This is one of the hot spots of species biodiversity in Europe.

Fifteen farms were selected and on each farm two locations/ grasslands with known, but different intensity of management (particularly regarding fertilization) were chosen. On sample plots (25 m^2) a vegetation relevé was made, soil samples collected, forage/ biomass yield determined, and farmers interviewed regarding their fertilization management.

Species richness of plots was not affected by the use of fertilizers (average 36.6 versus 40.1 species on non-fertilized plots), and only portion of legumes was higher on plots with higher P_2O_5 content in the soil. A higher share of species important for nature conservation was found on non-fertilized plots, but this was in positive correlation with pH and not with K_2O and P_2O_5 content of the soil. Forage from the areas where species important for nature conservation were found was characterized by lower concentration of net energy for lactation. Among invasive alien species *Erigeron annuus* was most frequent on fertilized plots.

Syntaxonomy of the *Festuco-Brometea* class vegetation in the Berda River Valley (Ukraine)

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The Berda River is the medium-long river in the South-Eastern part of Ukraine (Zaporizhia and Donetsk administrative regions, 125 km length). It flows in a generally easterly (its upper part) and southerly (the lower part). The vegetation of the Berda River Valley has previously only been described in general terms (Vakarenko et al. 1996; Vakarenko et Mosiakin 1999).

We collected 60 relevés of the different subtypes of the steppe vegetation using a Braun-Blanquet methodology to describe this type of vegetation in the Berda River Valley. The data were classified using the Modified TWINSPAN classification in JUICE 7.0, resulting in three alliances, 7 associations and one unranked community. Two alliances represent the zonal types of steppes, and the third one represents edaphic type. The vegetation of *Poo bulbosae-Stipion graniticolae* Vynokurov 2014 combine the xeric communities on shallow or unformed soils above the granitic outcrops of the Ukrainian Shield. It is represented by two associations: *Ephedro distachyae-Stipetum graniticolae* Vynokurov 2014 and *Artemisio marschalliani-Botriochloetum ishaemi* Vynokurov 2014. This alliance is characterized by the diagnostic endemic species *Stipa graniticola* Klokov, *Jurinea granitica* Klokov, *Asperula graniticola* Klokov. The major part of the zonal steppes in the Berda River Valley represents the forb-bunchgrass steppe of the alliance *Stipo lessingianae-Salvion nutantis* Vynokurov 2014 (associations *Stipo lessingianae-Salvietum nutantis* Vynokurov 2014 and *Cariceto praecocis-Bromopsidetum inermis* Vynokurov 2014). Another subtype of the steppe vegetation is distributed in the bottom part of the river valley – bunchgrass steppes of the *Tanaceto millefolii-Galatellion villosae* Vynokurov in Kolomiichuk et Vynokurov 2016. Its communities are distributed on the slopes of the Berda River Estuary which flows into the Azov Sea. This alliance is represented by the associations *Ephedro distachyae-Stipetum capillatae* Kolomiychuk et Vynokurov 2016, *Tanaceto millefolii-Salvietum nemorosae* Krasova et Smetana 1999 and *Stipo ucrainicae-Agropyretum pectinati* Tyschenko 1996. Also, one unclassified cluster was separated during the analysis. It combines the steppe shrubs vegetation, mainly with the *Caragana frutex* (L.) K. Koch. Its communities are common in the middle and upper part of the river valley.

The effect of meadow burning on selected morphological traits of *Inula salicina* L.

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The investigations of the effect of the spring meadow burning on selected morphological traits of clonal plant species *Inula salicina* L. were carried out in the year 2017 in Krakow-Kostrze (southern Poland). The observations were conducted in homogenous patch of *Molinion caeruleae* partially burnt in the year 2015. In burnt and unburnt areas 10 permanent plots measuring 4 m^2 (distant 5 meters of each other) were established in parallel transects. In central part of each plot one subplot measuring 1m^2 was established for investigations of abundance of vegetative and generative shoots (ramets) of *Inula salicina*. Moreover, in each plot the following morphological traits of generative shoots were observed: height, number of leaves, length and width of the greatest leaf, number of capitula, diameter of the largest capitulum.

According to statistical analysis the number of generative ramets per plot was much greater in burnt area (16.6), than in unburnt one (3.6). Also, the shoots were considerably higher in burnt area, than in unburnt one, where they meanly reached 65.9 cm and 32.6 cm respectively. Similar tendency showed other traits such as the length (63.9 cm and 30.3 cm) and the width (12.8 cm and 6.0 cm) of the greatest leaf, as well as the diameter of the largest capitulum (12.2 cm and 5.2 cm). On the other, hand the number of leaves per shoot in burnt and unburnt area was rather similar and achieved 35.3 and 18.5, in sequence. Also, the number of capitula per generative ramet did not differ and amounted 1.1 and 1.9, respectively.

Summarizing, it should be pointed out, that performed studies suggesting the significant spatial variability of chosen morphological traits of *Inula salicina* will be continued in subsequent years.

Current state and changes of aquatic and rush vegetation of Rzeszów Reservoir (SE Poland)

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Dam reservoirs most often serve retention and recreational functions, while contributing to improvement of landscape aesthetics and increasing habitat diversity. Due to moderate management or partial abandonment of land use, they can become sites of occurrence of valuable plant communities, and a refuge for rare plant and animal species for which they constitute important ecological corridors.

Rzeszów Reservoir located within the administrative limits of Rzeszów was established in 1973 by building a dam on the 64th km of the Wisłok River. Originally, it covered an area of 118 ha and had a capacity of 1.8 million m^3; however, it underwent considerable shallowing due to intense deposition of material carried by the Wisłok River. The aim of the study was to analyse changes taking place over 20 years in the vegetation cover (floristic and phytosociological richness) represented by aquatic and rush communities in Rzeszów Reservoir. The analysis was based on 250 phytosociological relevés made at two time points in 1994 and in 2016.

In the first period of the study, 23 types of plant communities comprising 125 species were distinguished and 22 phytocoenoses with 107 species were identified in the second period. The value of the species diversity coefficient of the entire flora was H'=1.4-3.28 (mean 2.012) in 1994 and H'=0.68-2.218 (mean 2.031) in 2016. In 1994-2016, large variability was noted in the communities from the classes *Lemnetea* and *Potametea* and from the alliance *Salicion albae*. Among permanent components of vegetation, there was a growing tendency in the vegetation surface area in the class *Phragmitetea*. The long-term observations demonstrated disappearance of 13 phytocoenoses, e.g. *Lemnetum gibbae*, *Potametum crispi*, *Potametum pectinati*, *Ranunculetum circinati*, *Elodeetum canadensis*, *Myriophylletum verticilati*, and *Oenantho-Ririppetum* and emergence of 13 new and yet undescribed communities, with special emphasis on the association *Trapetum natantis* (the largest locality in south-eastern Poland), which occupies a significant area of the reservoir.

The process of succession observed in the reservoir can be attributed to the natural silting process taking place in the reservoir associated with the sediments deposited by the River and human activity (nutrients). The intensity of these factors has a modifying effect on the habitat resulting in a change in the species composition and diversity of phytocoenoses.

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