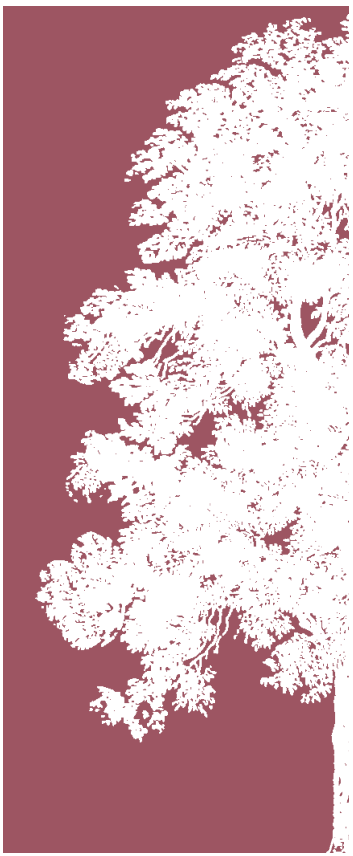
Abstracts



September 13-16 2017

26th Congress of the European Vegetation Survey, Bilbao

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Universidad del País Vasco

Euskal Herriko Unibertsitatea

European Vegetation Survey

26th Congress of the European Vegetation Survey

Scientific topic

Diversity patterns across communities in the frame of global change: conservation challenges

Bilbao, 13-16 September 2017

The Plenary Sessions and Registration will be held
in the «Bizkaia Aretoa» of the University of the Basque Country

Bizkaia Aretoa

University of the Basque Country
Avenida Abandoibarra, 3
48009 Bilbao

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Universidad del País Vasco
Euskal Herriko Unibertsitatea

CIP. Biblioteca Universitaria

Congress of European Vegetation Survey (26th 2017. Bilbao)

Diversity patterns across communities in the frame of global change : conservation challenges / 26th Congress of the European Vegetation Survey, Bilbao, 13-16 September 2017. – Bilbao : Universidad del País Vasco / Euskal Herriko Unibertsitatea, Argitalpen Zerbitzua = Servicio Editorial, D.L. 2017. – 128 p.

D.L. 1283-2017. — ISBN: 978-84-9082-701-7

1. Plantas – Europa – Congresos

581.9(4)(063)

ISBN: 978-84-9082-701-7
Depósito legal: BI-1.283-2017

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ABSTRACTS

Plantation harvesting effect on understorey vegetation

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Nowadays, native forest area is declining throughout the world while plantations (mainly exotic coniferous and eucalyptus species) are increasing. Nevertheless, there is an increasing societal demand to obtain multiple outputs from silvicultural systems, thus a greater emphasis is now being placed on the restoration and enhancement of native woodlands. In this context, we assessed the impact of two different harvest treatments in understorey plant species composition of *Pinus raditata* plantations as tools to recover native woodland vegetation in northern Iberian Peninsula. Common clear-cut treatment and restoration-clear-cut where only pine trees were removed (i.e. reducing the disturbance effect over understorey vegetation) were compared against understorey plant species composition of young and old-plantations. The aim was to identify the possible effects of clear-cuts on understorey vegetation in sites were the aim is to restore native vegetation.

The understory plant species composition and diversity were monitored in 10 sampling sites of 2-3 ha within the UNESCO Biosphere Reserve of Urdaibai (Bizkaia, northern Iberian Peninsula), representing 5 types of habitats (two sites each): (a) reclaimed mountain tracks; here the soil removed was dumped back to the site path with reclamation purposes two years before sampling (Tracks); (b) clear-cut stands; where pines and all shrub and tree species were removed two years before sampling (CC); (c) clear cut stands where only pine trees were removed two years before sampling, preserving understorey vegetation, shrubs and tree species (RCC); (d) 10-12 years old pine plantations with 500 trees/ha and 8 m2 of basal area (Young_P); and finally (e) 30 years old pine plantations with 214 trees/ha and 9.5 m2 of basal area (Old_P). In this study, reclaimed tracks were included because after their use to collect harvested logs they were reclaimed dumping the soil back, as a consequence they are valued sites to identify early successional species in the area and compare them with the two clear-cut types analysed (CC and RCC).

The sampling was carried out at the end of June and beginning of July of 2014. In each site three plots ($10\times10m^2$) at least 100 m apart from each other were randomly determined (n = 30 plots in total). In each plot, the number and height form all trees species with diameter at breast height (DBH) greater than 7.5 cm were recorded. Thereafter, in each sampling plot three quadrats (2×2 m^2) at least 10 m apart from each other were located randomly (n = 90 quadrats in total). Results showed that Tracks had significantly greater richness than the rest of habitats (32 ± 3.97). Young-plantations and CC showed intermediate richness (19 ± 0.91), although they were not significantly different from old-plantations and RCC (13 ± 1.50). In general, both types of clear-cuts maintained species composition plus important understorey native species, some of them being restoration targets. However, both clear-cuts showed diversity reductions compared with old-plantations. Thus, the works to extract pine trunks should be monitored not to reverse the already established vegetation by natural succession.

Simulation of grazing abandonment delays the effect of monthly mean temperature on monthly aboveground net primary productivity in Atlantic grasslands of the Iberian Peninsula

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We used an Atlantic grassland system in the Iberian Peninsula to ask whether monthly climate variability explains variation in monthly above-ground net primary productivity (ANPP) and to test whether climate-ANPP relationships depend on simulation of grazing abandonment. In 2005 large herbivores were excluded through fencing from three 2,500 m^2 plots and adjacent grazed plots of equal size were set up. ANPP was measured monthly during the next three vegetative periods (2006-2008) and climate data, locally measured, were obtained from a public database. Since between-site variation in annual ANPP was not significant, we used data averaged across sites to test for the effect of monthly climate variability on monthly ANPP by means of dynamic regression. We found that variation in monthly rainfall did not contribute to explain monthly ANPP in either case. Instantaneous mean monthly temperature explained monthly ANPP under free grazing. By contrast, the effect of temperature on ANPP under grazing exclusion was delayed by one month. This delay can be explained by the development, only in the fenced plots, of a thick organic layer that insulates the soil.

Italian broadleaved evergreen species as relics of an ancient biome

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A footprint of the Late Neogene subtropical laurophyllous vegetation zone of Paleo-Europe is still present throughout the Mediterranean regions as extant populations of xeromorphic evergreen derivatives. Italy, as well as other Mediterranean peninsulas, acted as *refugium* for an array of plant species during the late Tertiary and Quaternary climatic deterioration. Indeed, the increased seasonality and summer aridity acted as filters on the laurophyllous Tertiary flora as long as a true Mediterranean climate established. Thus, species persisting in the area up to present days apparently were those which already were preadapted to the Mediterranean climate. They were scattered in Late-Tertiary azonal sclerophyllous forests, along with a stock coming from surrounding laurophyllous forests that were developing sclerophylly. The present study aims to analyse the extant and potential distribution of a selection of evergreen phanerophytes evolved from old lineages in order to explore whether traces of their different life-histories are still visible in their modern ecology.

From the "Nationwide Vegetation Plot Database – Sapienza University of Rome" 17087 forest relevés were selected. Species co-occurrence patterns in the relevés were evaluated and used to assess the suitability of the plot for the target species in the dataset (Beals' index of sociological favourability). These habitat suitability models were then explored using climatic variables and species indicator values for each relevé. Furthermore, the relevés were assigned to one of the major Italian forest biomes (broad-leaved evergreen, broad-leaved deciduous, needle-leaved). We produce scatter-plots of the most indicative variables for the models.

These models not only highlight ecological differences among species, they also predict fine-scale suitability of the relevés for the selected species. These results are particularly useful to understand their potential distribution in Italy.

Ecology and floristic-vegetational characterisation of the *Pinus nigra* subsp. *nigra* old reforestation areas in the central Apennines

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Pinus nigra subsp. *nigra* reforestation areas are widespread in the Apennine territory. These are forest communities that are mostly not managed and are thus subject to the natural dynamic processes of recovery by the native vegetation that occurs under the pine cover itself. In the literature, there are numerous studies of silvicultural and dendrometric-structural aspects aimed at the renaturalisation of black pine and conifer reforestation in general, both in Italy and in Europe. However, few follow a more ecological approach in general, and a phytosociological approach in particular.

We present a floristic-vegetational study of *Pinus nigra* subsp. *nigra* old reforestation areas (planted before 1950) in the central Apennines, from the upper mesotemperate thermotype to the upper supratemperate thermotype. The surrounding neighbouring native woods are used as the control. A total of 87 phytosociological surveys were carried out, of which 70 were in the reforestation areas and 17 in the neighbouring native woods near the reforestation.

The results allow us to highlight the floristic autonomy of these coenoses compared to the neighbouring native woods, which can be interpreted as the result of the effects of the prolonged presence of *Pinus nigra* subsp. *nigra* on the floristic diversity of the area. This is particularly evident in the upper supratemperate thermotype, where there is a significant autonomous plant species combination that is characterised by some rare plant species of biogeographic interest.

The *Pinus nigra* subsp. *nigra* reforestation areas investigated in this study can be considered durable stages of vegetational dynamics that deviate from the natural vegetation succession. This has implications in restoration ecology, and should therefore certainly be taken into account in the planning of future silvicultural actions.

Sand dune and ecosystem services restoration

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Human activity has and is transforming our landscape, leading to the reduction of our well-being. Despite the technical efforts in order to solve the problems created, "Nature based Solutions" are showing to be the best methodology for that. These consist on restoring ecosystems which functioning have positive effects on human well-being (Ecosystem services) and that are showing to be the best long-term inversions in order to achieve long term solutions. Within this framework, in the Bay of Plentzia (Biscay) a sand-dune restoration project was started in 2009. The bay was highly transformed at the beginning of the xx century reclaiming land to the bay. This lead to a reduction of beach surface and at the same time continue works in order to rebuild storm destruction and also sand road "colonization".

The restoration project consisted on planting in 2010 in an area of 62.000 m^2 (zone A) 80.000 individuals of *Ammophila arenaria*, *Elymus farctus*, *Festuca juncifolia* y *Pancratium maritimum*. In 2015 in the smaller site (zone B) of 2.092 m^2, just barriers to settle the sand and individuals of *Ammophila arenaria* were planted.

The sampling was carried out in 2016. The zone D1 was divided in two sub-zones (D1.A and D1.B) due to its big size. Thus, in each zone 9 transects were carried out perpendicular to the sea and following the dune profile. In each transect 2x1m quadrants were sampled every three metres. Plant cover was visually estimated, and one sand sample (2.5 cm diameter and 6 cm depth) was taken in order to know the pH and the organic matter content of the sand.

Zone D1 showed the typical succession of dune species following the sand profile (increment of organic matter and reduction of pH values), however, due to human disturbance sub-zone D1.B had the presence *Oenothera biennis* L. that might mean human disturbance (used by people to access to the beach), while *Tortura ruralis* (Hedw.) Gaertn appeared in the sub-zone D1.A, indicating a more stabilized dune. On the other had, the more recently restored dune (zone D2) had fewer plant species and smaller plant cover, but the presence of species such as *Aetheorhiza bulbosa* subsp. *bulbosa* (L.) Cass., *Eryngium maritimum* L. and *Malcomia littorea* (L.) R. Br., not present on zone A. The latters probably reached the site from the very close dune of Astondo.

The results showed the high restoration capacity of the dunes, specially the older ones but also the importance of close by similar ecosystems. Besides, the development of the sand-dune profile was already providing the ecosystem services expected from dune ecosystems mainly regulating (i.e. coastal protection, erosion control, soil fertility) and cultural (i.e. aesthetic value, scientific knowledge, environmental education).

An ecohydrology database for floodplain meadow vegetation management in the UK

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Wet meadows form a transition between terrestrial and aquatic systems, where either the ground water-table is usually at or near the surface or the land is intermittently flooded from surrounding water bodies. Wet meadows are of high nature conservation value, supporting considerable biodiversity, including rare & threatened plant species, vegetation types, important bird populations and a range of invertebrates. However, over 97% of the UK's floodplains have lost biodiversity interest in the last century, due to urbanisation, drainage & agricultural intensification. For successful restoration and maintenance of these systems, a thorough understanding of the functioning of vegetation, water regime, fertility and management is necessary. The availability of detailed long term data on such elements is of immense value to implement sound management decisions. In this connection, the UK Floodplain Meadows Partnership (http://www.floodplainmeadows.org.uk/) has been able to integrate vast amount of available data from various sources in to a database. The database accomplishes a number of functions. Firstly it is used a deposit for all available data categories (e.g. water levels, site details, plant observations, soil & climate) collected in from available floodplains. In this role, it has capability built to import new data, using set spreadsheet templates and facilitating database forms. Secondly, it is fully searchable by one or many data types/categories (e.g. year, location) using prepared database forms. Thirdly, it can be used to help calculate certain metrics (for e.g. hydrological indices) from other existing data types (for e.g. water levels) and display them as reports. Currently, the database encompasses data from 84 sites, >25,000 quadrats, >450,000 individual plant observations and >3.5 million water level measures collected over 20 years.

An example of useful output from the database is an index of hydrological niche preferences of species and vegetation communities. Using hydrological models built from inputs of water-table depth in the field, topographic variation, and soil characteristics, an index of water regime called Sum Exceedance Value is calculated. The index is helpful to account the levels of stress plants are able to tolerate and hence enables to determine species water preferences (i.e. hydrological niche). An understanding of niche breadth of species is useful in assessing species (and also the sites they occur in) for their vulnerability to change. It also helps in the development of adaptive strategies for scenarios that involve hydrological change.

In this paper, we will share challenges encountered and lessons learned in building and running such an extensive ecohydrological database. Technical challenges such as database design; data challenges such as quality assurance and acquisition; as well as institutional challenges such as capability to monitor and curate will be elaborated. The data is set to be shared on national and regional databases and with mutual understanding among interested partners both in the UK, Europe and internationally. It is hoped the findings will broaden scientific understanding to support conservation efforts.

Does functional soil microbial diversity contribute to explain plant community structure in two species-rich Iberian plant communities?

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Because, among other effects, soil micro-organisms influence organic matter decomposition, nutrient cycling and soil structure, the soil microbiota affects plants. Here we use two species-rich Iberian plant assemblages (a *dehesa* community in western Spain and an alpine grassland in the Urbión Peaks, central-northern Spain) to investigate the relationship between plant community structure and soil microbial diversity, while simultaneously monitoring water regime and topsoil chemistry. Specifically, we asked i) whether soil microbial diversity contributes to explain change in plant community structure, once that the effects of hydrological and chemical soil properties have been accounted for and ii) if so, at which spatial scale does microbial diversity operate?

Plant community structure, soil microbial functional types and soil chemical properties were sampled at both field sites. Hydrological models were already available. The resulting data were analyzed through redundancy analysis, which was used to partition variation in plant community structure into hydrological, chemical and microbial components. Additionally, we used sets of Moran's eigenvector maps to test for the spatial scales at which plant community structure change.

We found that, in the case of the alpine meadow, the contribution of soil microbial diversity to the explanation of plant community structure was negligible. In the case of the *dehesa*, the diversity of soil gram-negative microbes, contributed significantly but to a rather modest extent (R^2 = 2%), and at a relative medium spatial scale, to explain change in plant community structure. The abundance of a few *dehesa* species (e.g. *Trifolium dubium* and *Poa bulbosa*) was significantly associated with either increasing or decreasing soil microbial diversity. Since our data suggest that microbial diversity promotes or restrains the abundance of individual plant species, we concluded that microbial diversity may constrain plant community structure. Nonetheless, its effects seem to be weaker than those of other soil factors.

Conservation status of the Natura 2000 habitat 1410: Mediterraean salt meadows (*Juncetalia maritimi*); a focus on structure and functions

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The Habitats Directive (1999/43/EEC) and the Natura 2000 network are some of the main regulatory tools of the European Union policy regarding nature and biodiversity conservation. The Article 17 of this Directive requires for every State Member to assess the conservation status of its Natura 2000 habitats, every six years, at the biogeographical level. The implementation of the Directive into the French law makes compulsory the conservation status assessment of Natura 2000 habitats at site level. This leads to a growing interest in the relatively new concept of conservation status assessment.

In parallel, several papers have been published in order to adapt Red List categrories and criteria used for species to ecosystems or habitats. The last years saw the actual realization of this translation with Red Lists of habitats such as the European Red List of Habitats or the works led by the french delegation of the IUCN.

It would be useful to have a common set of indicators for these differents habitat assessments. Ideally these indicators should also operate at different scales and provide relevant information for conservation. We chose to focus on the "structure and functions" parameter of the Habitats Directive which roughly correspond to the "environmental degradation" and "disruption of biotic processes or interactons" of the IUCN guidelines for Red List assessment.

We used the indicator values of Pignatti (adapted to our study) and the life-forms of Raunkiaer to build the core of our evaluation. Two case studies at site level, carried out in the south of France (Occitanie region), and a regional analysis (mediterrean region of mainland France) served as a basis to illustrate the applicability of such an approach for the Natura 2000 habitat 1410: Mediterranean salt meadows (*Juncetalia maritimi*).

Large vegetation databases as a tool for the assessment of conservation status of the habitat type 9330 - *Quercus suber* woodlands

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We performed a Consistent Classification Domain of *Quercus suber* woodlands in Europe based on their floristic composition, geographic distribution and climate to provide a consistent definition for Habitat Type 9330 in Annex 1 of the Habitat Directive (92/43/CEE).

We compiled a dataset of vegetation plots from European woodlands with *Quercus suber* dominant. A total of 1235 plots were classified in major vegetation types by comparing the performance of different classification methods, using OptimClass to maximize the number of diagnostic species and the crispness of classification to select the optimal number of clusters. The resulting groups were characterized by their diagnostic and frequent species, and their climatic envelope, while the main patterns of geographic distribution were assessed by suitability maps using climatic variables and Maxent.

The Flexible beta algorithm with presence/absence data and the Bray-Curtis resemblance metric resulted as the most successful method, classifying the data in three clusters. The resulting vegetation groups were geographically differentiated from Iberian Peninsula, Western Mediterranean and the Tyrrhenian coastline. The distribution of the three groups in Europe was mainly driven by the seasonality of temperature and precipitation, with the highest differentiation between the plots from Western Europe and Central Mediterranean.

This study provides the first overview of the diversity and distribution of *Quercus suber* woodland in Europe, suggesting three major eco-geographical vegetation groups. These groups are consistent with the current knowledge on the phylogeography, plant sociology and climatic niche of *Quercus suber* in Southern and Western Europe. On the basis of the observed patterns, we propose a reviewed classification of *Quercus suber* forest habitats for the European Nature Information System and a formalized definition of the habitat type 9330 of the Habitat Directive.

Nitrogen-limited brown-moss rich fen vegetation in Latvia

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Nitrogen-limited brown-moss rich fen vegetation (*Saxifrago-Tomentypnion*) is one of the rarest mire vegetation types in Latvia. This alliance has been only recently recognized in Latvia and it is known to be present in four sites. Iron-rich springs were observed in two sites. Two plant communities were distinguished – one with well developed herb layer consisting of dense *Thelypteris palustris* stands and other – with scarce herb layer where *T. palustris* cover was low. The last one is associated with iron-rich springs. Only iron-rich spring fen community supports *Poa angustifolia* and *Rumex acetosa var. fontano-paludosa,* but *Sphagnum teres* hummocks and depressions with *Hamatocaulis vernicosus, Marchantia polymorpha, Calliergonella cuspidata* as well as *Saxifraga hirculus*, were found in both plant communities. Differences in plant species composition can be explained by spring influence as well as by different nutrient concentration.

Effect of low-dose fertilization on plant species composition of semi-natural grasslands

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Considering the low productivity of many semi-natural types of grassland, there is an interest if an application of digestate supports productivity without compromising biodiversity. To answer the question, a study was conducted, which aimed to investigate the effect of grassland management and applications of digestate on above ground biomass yield and biodiversity.

We study effect of low-dose fertilization on plant species composition of semi-natural grasslands in three experimental sites in Latvia. Semi-natural grassland vegetation corresponds to Annex I habitat types 6270* *Fennoscandian lowland species-rich dry to mesic grasslands* and 6210 *Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia)*. Dominant species in 6270* were *Festuca rubra* and *Agrostis tenuis*, but in 6210 – *Poa angustifolia* and *Centaurea scabiosa*. Before our study owners used mulching in two experimental sites with 6270*, but polygon with 6210 was unmanaged. In each site, four permanently marked management plots of 250-400 m^2 were established. Two of them were mowed and harvested, but two – mowed, harvested and fertilized. Fertilization was carried out by hand, applying digestate evenly across the plot. All plots were mowed once per season in July and August. Harvested material was collected and removed from the site with hands.

Fertilization took place in May 2015 and April 2016 with a dry fraction of digestate from a biogas plant (supplied with cattle slurry and maize silage).

Results of GLM model showed, that there were changes in dominant as well as characteristic species cover for each habitat type in 2015 and in 2016, but these changes took place in treatment as well as in control sample plots. The changes in plant species composition most likely took place because of different climatic conditions in 2015 and in 2016. Study will be continued this year. We hypothesize, that digestate application may have long-term delayed effect on plant species composition and we assume that these changes will be more pronounced in 6210 than in 6270*. The study was conducted within the framework of the EU-funded LIFE+ Nature & Biodiversity program Project "GRASSSERVICE" – Alternative use of biomass for maintenance of grassland biodiversity and ecosystem services (LIFE12 BIO/LV/001130).

Predicting alien species occurrence for plant biodiversity conservation in Natura 2000 coastal network

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A primary challenge in conservation biology is to preserve the most representative biodiversity hotspots while optimizing the efforts associated with their conservation. The implementation of the Natura 2000 network requires standard protocols for facilitating the identification of specific mitigation actions aimed at preventing the loss of biodiversity in Europe. One of the main threats to animal and plant biodiversity is represented by biological invasion worldwide. In this regard, Species Distribution Models (SDMs) have been widely used to predict the potential distribution of invasive species. However, despite the broad implementation of SDMs in invasion ecology, their practical application in conservation decision-making processes remains unclear.

We propose an integrative modeling approach that accounts for the simultaneous influence of propagule pressure (P), abiotic (A) and biotic (B) factors in determining the invasion success of the exotic plant *Carpobrotus* sp. in order to optimize the management actions aimed at preventing/controlling its expansion on coastal dunes sites of the Natura 2000 network.

We derived both the presence of the alien species and the PAB proxy variables from high-resolution remote sensed imagery along the dune system of the Lazio region. By means of a binomial Generalized Additive Model we modeled the relationship between the occurrence of *Carpobrotus* sp. and the PAB proxy variables. The obtained invasion risk map reporting the predicted probability of *Carpobrotus* sp. occurrence was classified according to 3 levels of invasibility (uncertain, medium, high). By overlaying the invasion risk map with the Special Area of Conservation (SAC) included in the Natura 2000 coastal network, we computed the proportion of each invasibility class in the SAC sites.

Although most of the SAC sites considered in the study area were already invaded, we observed that the risk of further invasion varies across them, ranging from invaded SAC with over 25% of the dunes featuring high invasion risk to not-invaded sites displaying low risk of invasion. These results allowed the identification of both SAC in which invasion is likely to increase in the future and sites where the expansion of *Carpobrotus* sp. is limited by the site-specific simultaneous effect of PAB factors. The use of invasion risk maps satisfies the Natura 2000 requirements of optimizing management actions in areas of conservation concern. In particular, maps of the predicted occurrence of alien plants could be used to differentiate management strategies according to the invasion status of the target area. Management actions aimed at limiting alien plant expansion should be prioritized in invaded areas that are prone to be further invaded. Coherently, prevention strategies should be taken into account in low risk sites not yet colonized by the target invasive species.

Implementation of the EUNIS habitats classification in Russia

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Russian Emerald Team has implemented two phases of the European Union / Council of Europe Joint Programme "Emerald Network of Nature Protection Sites" in 2009-2016. We have identified 1633 potential Areas of Special Conservation Interest (pASCI) in European Russia. Russian Reference Database contains data on the 131 habitat types of European importance as listed in Annex to the Resolution 4 (1996, 2010) of the Bern Convention. 120 of them occur in the pASCI's. The Emerald Database of European Russia contains 3940 records on their distribution on pASCI's.

The number of the mentioned habitat types varies among biogeographical regions. For example, we have identified nearly 50 habitat types of European importance in Northern Caucasus (Alpine bioregion), 20 ones in Novgorodskaya Oblast' (Boreal bioregion), and only 10 ones in Arctic bioregion.

Most habitats in European Russia meet related descriptions in the EUNIS habitat classification. Nevertheless, we note several typical problematic situations requiring special solutions:

1. In several cases Russia should be indicated in the habitat type description as a country where the habitat occurs – e.g. F4.2 Dry heaths.
2. A habitat occurring in Russia meet description of a habitat type but there is no appropriate subtype in the classification. Often, it's related with a regional climatic, geologic, or other specificity. Therefore, we need a new subtype. In some cases, the description of a new habitat subtype requires a special research – e.g. E.1.2_new for mountain steppes of Central Caucasus; G1.A7_new for high mountain oak forests of Eastern Caucasus.
3. A habitat type occurs in Russia but lack in the other Europe and is not mentioned in the classification. So, it should be entered there. If being rare or endangered, it should be listed in the Annex to the Resolution N 4 – e.g. G3.1_ new. Eastern dark polydominant taiga [*Picea obovata, Abies sibirica, Pinus sibirica, Pinus sylvestris*]; H5.new. or E1.new. Aralo-Caspian cool deserts; X_ new. Aralo-Caspian deserted steppes ("semideserts").
4. A habitat type has its place in the classification, is rare in Russia but not mentioned in the Annex to the Resolution N 4 may be because of lacking out of Russia – e.g. G1.919. Siberian steppe birch woods**.** We propose to add such habitat types to the Annex**.**
5. A habitat type of European importance is common in Russia – e.g. G3.A. Picea taiga woodland. In such cases we need the reconfirmation of its high conservation quality through inhabitancy of rare and endangered species.

We have compiled the list of habitat types of European importance occurring in European Russia and provided it with habitat type interpretation in Russian scientific terminology.

The brief analyses show that priority habitat types occur in the Asian Russia too. We expect to apply the approach as outlined above when extending the Emerald network principles to the all Pan-European Ecological Network.

Post-abandonment dynamics on Mediterranean and sub-Mediterranean grasslands: the edge vegetation of the class *Charybdido pancratii–Asphodeletea ramosi* Biondi 2016

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The study of the dynamic processes of Mediterranean and sub-Mediterranean perennial secondary grasslands led to the description of the class *Charybdido pancratii–Asphodeletea ramosi*. Indeed, after the abandonment of agro-pastoral activities, in the ecotone zone between the grassland and the wood mantle, macrophytic, sub-nitrophilous species spread rapidly. These species have underground organs of propagation (e.g., rhizomes, bulbs) that are mostly toxic to herbivorous animals, such as *Asphodelus* spp., *Charybdis* spp., *Ferula* spp., *Thapsia* spp., *Asphodeline* spp.. The class has got two orders. The first order is named *Asphodeletalia ramosi* and refers to heliophilous edge communities. It includes four alliances: *Charybdido pancratii–Asphodelion ramosi*, *Asphodelo ramose–Ferulion communis*, and *Asphodelion fistulosi* in the Mediterranean area; and *Asphodelino luteae–Ferulion glaucae* in the sub-Mediterranean area. The second order is the *Bellido sylvestris–Arisaretalia* which includes sciaphilous and semi-sciaphilous edge communities. Four alliances belong to this order: *Cyclamino hederifolii–Arisarion vulgaris*, which is the typus of the order for the eastern Mediterranean and Illyrian area; *Cyclamino hederifolii-Ranunculion bullati* which also occurs in the eastern Mediterranean area; *Leontodonto tuberosi-Bellidion sylvestris*, which has already been described for Sardinia, and also occurs in all the Tyrrhenian area down to Sicily; and *Ranunculion bullati*, which was previously described for the Baetica Province of Spain, and probably occurs in other areas of the Iberian territory; in a biogeographical sense, this last thus replaces the eastern European alliance *Cyclamino hederifolii–Ranunculion bullati*.

According to the international literature on secondary perennial grasslands of much of the Mediterranean basin (i.e., Europe, North Africa, the Middle East) we could assess the occurrence in these territories of the species considered to be important in the described dynamic processes. We can conclude that the same processes observed in the territories investigated in our research, occur across the whole Mediterranean basin.

The syntaxonomic schema that includes all of the communities described within the class and the synoptic table of all of the syntaxa that are part of the same class will be presented and discussed.

The functional ecotone in phytosociology

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The history of knowledge of dynamic processes in vegetation is one of the most important chapters of the path of phytosociology in more than 100 years since its foundation.

The term ecotone is introduced by American botanist and ecologist Frederic E. Clements in 1905, who considers it as an area of transition between two types of vegetation or ecosystems. Through the ecotone, streams of energy and material are realized. Forman & Moore compare it to cell membranes that filter the passage of the elements from one cell to another.

For phytosociologists, this area shows vegetation structures with their own floristic and ecological characteristics (mantle and vegetation edge). From these areas, different dynamic processes emerge that express the vegetation series. The classic and recurrent example, proposed for the explanation of ecotones, is the space located at the boundary between the forest and the secondary grasslands.

In order to be maintained over time, the grassland ecosystem must be managed with specific agro-pastoral practices, which must be repeated over time with a remarkable consistency because if they are abandoned, there is a floristic and ecological transformation of the grassland that determines, over time, the start of the recovery of the forest.

The phytosociologists have been investigating this area over the years recognizing complex types of vegetation from point of view of structural, floristic and, ecologically, which are highly functional in dynamic processes. In the ecotonic space, there is a gradual change of the luminosity, which is considered the main factor. It follows a gradient that can be traced through types of herbaceous vegetation which sciaphilous forest edge (class *Trifolio-Geranietea*, order *Origanetalia vulgaris*); mantles of vegetation, shrubs, on the margins of the canopy (class *Rhamno-Prunetea*) and in areas that are more distant from the woods, and therefore brighter, there are predominantly herbaceous formations (class *Trifolio-Geranietea*, order *Asphodeletalia macrocarpae*) in Temperate macroclimate areas, and macrophytes (class *Charybdido pancratii-Asphodeletea ramosi*, order Asphodeletalia ramosi) in Mediterranean and sub-Mediterranean areas. All types of vegetation found in the ecotone have considerable ecological importance, as they are particularly important for animal species (feeding, shelter and nesting) as well as for plant species.

Moreover, the dynamic processes that give rise to are the drivers that over time lead to the healing of the vegetation resulting from human activities at different times compared to the ecological characteristics of the sites and according to diachronic processes of deterministic type.

Botanical diversity of the Altai-Sayan orobiome along environmental gradients

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The issue of basic territorial units, which most representatively reflect the spatial patterns of the biotic cover, becomes primary importance for studying and estimation of the geography of biodiversity. The choice of these units is important in connection with comparative analysis of diversity, which is possible on the basis of geographically and typologically comparable data.

Biodiversity analysis at the regional level is possible in according to the concept of the ecosystem organization of the biosphere and the classification of terrestrial ecosystems. The basic unit of analysis is biome as a combination of ecosystems. The biota of these ecosystems most effectively uses the abiotic components of the environment due to historically conditioned adaptation to them. A complex of relationships between biotic cover and factors associated with the orographic structure is reflected in the system of biome organization of mountain territories through orobiomes. The integrity of the orobiome as a combination of altitudinal vegetation spectra is reflected in the similarity of floristic and cenotic features of vegetation belts. In the conditions of development of the Altai-Sayan group of types of altitudinal zonation of vegetation a spectrum of forest-steppe, subtaiga, mountain taiga (with chern forests), subalpine and alpine-tundra belts is formed. The regional specificity in structure of altitudinal zonality is associated with orographic features of mountain territory and mesoclimatic conditions. In the system of estimation and analysis of mountain biodiversity at the regional level, in according to the map "Biomes of Russia" (2015), these differences are reflected in geographic variants of orobiomes. For the Altai-Sayan orobiome four variants are distinguished: Minusinsk depression, Kuznetsk Alatau, Central Altai and East-Sayan – West-Sayan.

As data of botanical diversity, geobotanical descriptions of plant communities on the territory of the mountain systems of the Altai-Sayan orobiome were used. Also data of the global climatic network Bioclim were used. The analysis was carried out within 4 key areas, covering the complete altitudinal vegetation spectra in geographic variants of the orobiome. The diversity of vegetation cover in the system of factors was estimated by ordination (method of non-metric multidimensional scaling). The contribution of the basic abiotic factors of spatial differentiation of vegetation has been determined. Absolute elevation, morphometric characteristics of slopes and bioclimatic parameters (average annual temperature, annual precipitation) through the use of the Pearson correlation coefficient were adopted.

Through the regional specificity of the Altai-Sayan orobiome, along four types of altitudinal vegetation spectra, factors of the spatial organization of diversity were analyzed. Regional differences in orobiome, which are reflected in the typological diversity of vegetation and in the structure of altitudinal zonation, are significant determined by climatic parameters. These parameters have a different degree of contribution to the altitudinal vegetation spectra of geographic variants.

Plant mycorrhizal traits along an elevational gradient in the Pyrenees

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It is estimated that more than 80% of terrestrial plant species are associated with mycorrhizal fungi. Mycorrhizal symbiosis is known to provide water, nutrients, and abiotic and biotic resistance to plants in exchange for photosynthesized carbohydrates. As the extent of this plant-fungus interaction seems to be globally distributed, different aspects of its potential role and function in plant communities are now being investigated. One of the most important aspects of the mycorrhizal symbiosis is their variation along environmental gradients, along with their different potential roles for plant communities and ecosystems. So far two main plant mycorrhizal traits have been shown to have a deep ecological implication in plant-environmental relationships: plant mycorrhizal type and plant mycorrhizal status. Plant mycorrhizal types indicate which symbiotic mycorrhizal structure is formed and which major nutrient is facilitated by the fungus. There are four main types of mycorrhizal symbiosis, arbuscular (AM), facilitating the uptake of inorganic P, ecto (ECM), facilitating inorganic N and P (and fewer amounts of organic nutrients), ericoid (ERM) mainly facilitating organic forms of N, and non mycorrhizal plants (NM). In addition, plant mycorrhizal status indicates the frequency of being colonized by a mycorrhizal fungus, where mycorrhizal fungi can either never colonized a plant species (non-mycorrhizal; NM), or colonize it sometimes (facultatively mycorrhizal; FM) or always being colonized (obligately mycorrhizal; OM). Our aim is to (1) determine the distribution of plant mycorrhizal traits, using large scale communities along the Pyrenean elevational gradient, and (2) to analyze the environmental factors driving these patterns.

We used the Atlas of the Pyrenean Flora (http://www.atlasflorapyrenaea.org/florapyrenaea/index.jsp) to get the distribution of the flora with a community unit of 10 × 10 km. From the list of species and literature search, we crossed this information with the mycorrhizal information for around 1600 species. Then we used climatic and soil global datasets to define our predictor variables; soil pH, soil organic carbon (SOC) and net primary productivity (NPP), along with mean annual temperature (MAT), mean diurnal temperature range (MDR), annual precipitation (APP) and precipitation seasonality (PPS). Our results point toward clear gradients along elevational gradients with a distribution of plant mycorrhizal types distinctively along the gradient; with communities with increasing percentage of ECM and ERM species increasing with elevation, and proportion of AM being more abundant at lower elevations, while dominating at all elevations. Discussion will be focused on contrasting the previous hypotheses predicting clear mycorrhizal types turnover.

The impact of ski piste management on mountain grassland ecosystems in South Tyrol, N Italy

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Due to climate change in the Alpine environment and thus more frequent lack of snow during winter, ski pistes are increasingly created with artificial snow. According to the *Istituto Provinciale di Statistica-Astat* of the Province of Bolzano (2015), tourism is one of the leading sectors of the economy of South Tyrol. For this reason, the use of snowmaking is of crucial economic importance for this area, and it might even increase in future, since temperatures are expected to increase further both in winter and in summer. To our knowledge, no studies about the effects of artificial snow have been performed in South Tyrol before.

We want to fill the research gap of subnivean ecophysiology of plants under the artificial snow cover, putting a particular attention on the photosynthesis of the plants under a compacted and denser snow layer. This study focuses on the impact of ski piste management on grassland vegetation and soil in comparison to adjacent off-piste control study sites.

We follow the hypotheses that (1) increased snow density results in a decreased soil temperature, (2) the artificial snow conditions alter the composition, cover and functional groups of the vegetation, with a possible decrease or loss in the number of the plant species that tolerate low-nutrient conditions on the ski pistes. Additionally, artificial snow (3) leads to differences in summer-time leaf-level photosynthetic pigments, leaf N and C concentrations, leaf $\delta^{13}C$, leaf $\delta^{18}O$ and (4) to differences in the freezing stress tolerance of plants.

The study area is the ski resort "Ski Center Latemar" in South Tyrol (Italy). Our experimental approach follows a pairwise design of 14 plots on ski pistes and 14 adjacent control plots outside the pistes. We also consider the hypothesis that the lack of natural snow of the last winter could also cause soil frost outside the pistes with subsequent effects on vegetation.

A further objective is to get a general overview on the development of artificial snow in South Tyrol, also including economics, in cooperation with the Faculty of Education of the Free University of Bolzano.

Syntaxonomy of the hygrophytic vegetation in beaver-impacted floodplain of the Mezha river in Central Forest reserve (NW Russia)

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Floodplain ecosystems of small rivers in the Upper Volga basin are impacted by the disturbance regime created by activity of recently increased populations of European beaver (*Castor fiber* L.). The long-term influence of beavers on vegetation is expressed in the formation of herbaceous communities instead of forests. Over a few recent decades, in small river floodplains of the Central Forest Nature Biosphere Reserve (Tver' province, NW Russia), as well as in many regions of the forest zone in Russia, dynamic processes related to the activity of beavers have regularly been observed.

The spreading of beaver settlements into the territory of the reserve upstream small rivers began after catastrophic windfalls of 1987 and 1996 that caused destruction of tree stands along the originally forested floodplains. These processes led to the formation of herbaceous vegetation in these floodplains. The diversity of such communities remains unexplored because they only emerged not long ago.

The aim of my investigation is to reveal how diverse these herbaceous communities are and analyze the major factors determining the structure of hygrophytic vegetation in the beaver-impacted floodplain of the Mezha (one of the main rivers in the Reserve territory) using syntaxonomical and ordination approaches. I analyzed 75 relevés made in August 2016.

The herbaceous vegetation was classified into one class, *Phragmito-Magnocaricetea*, order *Magnocaricetalia* and alliance *Magnocaricion elatae*. I revealed 4 associations (*Caricetum rostratae* Rübel 1912, *Caricetum gracilis* Savich 1926, *Caricetum vesicariae* Chouard 1924, *Phalaridetum arundinaceae* Libbert 1931), 1 variant and 4 facies. All these associations are typical for floodplain habitats and widely distributed geographically. Nevertheless, *Phalaridetum arundinaceae* (the most widespread association in the investigated territory) has local peculiarities expressed in high abundance of *Urtica dioica*, *Filipendula ulmaria* and high constancy of *Alnetea glutinosae* species. Finally, using DCA-ordination and phytoindication assessment, the main driving ecological factors (soil moisture, soil particle size and nitrogen pool) were designated.

Species composition and diversity of herbaceous communities in Central Forest Nature Reserve (NW Russia)

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In the territory of Central Forest State Nature Biosphere Reserve (Tver' Province, NW Russia, Lat.: 56°26´–56°39´N, Long.: 32°29´–33°01´E) grassland mostly exist as small patches in the place of abandoned settlements surrounded by old-growth forests. These peculiar herb communities still remain poorly studied, while their area is declining due to forest expansion. The aim of the study is to survey herbaceous vegetation (meadows and ruderal communities) remaining after several decades of protection and compare them with currently managed local herbaceous vegetation in terms of species richness, species diversity, site conditions as well as functional and coenotic structure of floristic composition.

We analyzed 209 relevés made in 2013–2014. Classification procedure was carried out by using cluster analysis and indicator species analysis. For ordination we ran Detrended Correspondence Analysis (DCA). Landolt's and Ramensky's scales were used to evaluate ecological conditions.

The presence of four herbaceous community types was revealed: managed mesic meadows, abandoned mesic meadows, tall-herb meadowsweet communities, and ruderal tall-herb communities, which jointly account for 40% of the Reserve flora, including 4 red-list species (mainly confined to abandoned mesic meadows) and 16 alien species. These four types differ in present-day and past management patterns, floristic composition and ecological conditions as well as in coenotic and functional group shares (including participation of forbs, graminoids and woody species). Of special interest are the abandoned mesic meadows, which still look like grasslands and retain a high share of meadow species. Their coenotic and functional spectra are different from those of managed meadows and more similar to other abandoned grassland types.

Despite some successional changes after 25 years without management, the studied mesic meadows seem relatively stable, retaining all the key meadow features, although their area has shrunk, and the spread of woody and forest species increased. The facts suggest that meadows under protection regime have a natural ability to withstand expansion of woody vegetation and invasion of alien plant species. Nevertheless, they require special activities to maintain them, otherwise they may eventually disappear, which means a significant loss of biodiversity of the entire protected area.

Combining field data sets and remote sensing for vegetation classification at different space scales of Central part of Russia plane

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This work reviews the constraints and challenges of remote sensing for reflection of forest parameters from the plot scale and vegetation data sets to regional domains. The work is devoted to the identification of regularities of formation of the forest diversity through the use of digital elevation models (DEM), field and remote sensing data (RSD). The basis for large-scale interpolation of vegetation classes are Landsat 5, 7, 8 and relief data. The results of stepwise discriminant analysis demonstrate possibility to identify the relatively large number parameters of plant communities. We focus on the main steps modern technology, which nowadays allow reflecting structure and composition of forest cover for macro- and mezoecological studies. Each sampling plot was correlated with association group for forests communities and association class for non-forest vegetation. Other land cover classes (e.g., fields, settlements, and water bodies) were determined on the basis of topographic maps and RSD. Multidimensional statistics techniques included into STATISTICA, SPSS, and Fracdim software packages were used for data processing (parametric and nonparametric correlation analyses, regression analysis, variance analysis, discriminant analysis, cluster analysis, and multidimensional scaling).

The study area is located at the central part of Russian in Moscow region. In spite of significant modification of the vegetation cover due to human impacts, the species composition of the forest communities is sample reflecting the vegetation cover of the domain, the region, and confining to landscape elements. Special emphasis is placed on coenotic features of the Boreal, Nemoral and sub-Nemoral types of investigated forests, and how remote sensing products can help classify them. The eco-phytocoenotic approach, used for the classification, allows reflecting information on natural and transformed plant communities of different ecological condition in the legend of the map. The cartographic modeling allows recognizing the spatial mosaic of different forest types, and is followed by the series of geobotanical maps.

At large scale, we mapped 46 typological units, which characterized 43 association groups of forest and non-forest vegetation types and 3 land cover types of areas without vegetation cover. Analysis of the spatial unconformities in forest cover supports the ecotonal structure of the study area. It was found in the latitudinal distribution of geoecolological spectra of species.

Tracing the history of European vegetation in current ecosystems of Siberia

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Our recent studies of modern flora and fauna in the mountain systems of southern Siberia and their comparisons with fossil floras and faunas from Europe and northern Asia clearly demonstrated that southern Siberia harbours probably the best preserved refugium of full-glacial biota in Eurasia. This finding has been supported by a considerable similarity of modern pollen deposition in this area with fossil pollen spectra from the Late Pleistocene deposits in Central Europe, by the discovery of the whole community of terrestrial snails typical of the loess deposits from the coldest stages of the Late Pleistocene in the Russian Altai, and by revealing high similarity between recent mammal assemblages of the south-eastern Altai-Sayan Mountains and the Pleistocene faunas of several regions in northern Eurasia. Similarity between current Siberian biota and full-glacial European biota is paralleled by similarity between current Siberian climate and palaeoclimatic models for Europe.

The discovery of these relict ecosystems makes it possible to use them as models of vanished ecosystems that existed in Europe during the full-glacial periods of the Late Pleistocene. This modern analogue is especially important for understanding the ecology of steppe-tundra (also called mammoth steppe), which is a hypothetical ecosystem that was widespread across the whole of northern Eurasia in the cold and dry phases of the Late Pleistocene, but it almost completely disappeared after climatic amelioration in the Holocene. Still, knowledge of ecology of steppe-tundra is crucial for understanding the origin of current vegetation types and history of current floras.

In the past, modern analogues of the steppe-tundra have been sought especially in Beringia. However, modern Beringian steppe-tundra lacks many plant and animal species of southern steppes found in full-glacial fossil record from many parts of Europe and Siberia. Therefore we studied ecology of steppe-tundra ecosystems in the south-eastern Russian Altai. Steppe-tundra landscapes in this area comprise heterogeneous mosaics of different habitat types including low-productive desert-steppe and steppe, alpine grasslands and scrub, wet and saline grasslands along streams and in wet depressions, and patches of open woodland at moister sites.

Habitat pattern, primary productivity, nutrient content in plant biomass and species diversity of the steppe-tundra reflect mainly precipitation gradients across broader area and topography-dependent distribution of soil moisture at a landscape scale. Distribution of glacial relict species across the Altaian steppe-tundra landscape suggests that both dry low-productive and more mesic grasslands with higher productivity were components of the full-glacial steppe-tundra with loess sedimentation in Europe. These habitat mosaics supported a diverse Pleistocene community of mammalian herbivores, many of which still survive in southern Siberia.

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. Currently it includes more than 1.3 million vegetation-plot records from 70 databases. Founded in 2012, it started to provide data to various projects in May 2014. Since then it provided data to 52 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), 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.

Are Mediterranean wetland vegetation seriously threatened by *Cortaderia selloana*? Management implications related to biological behavior and seed bank persistence

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Most of the Mediterranean wetlands have been lost and disturbed more rapidly than other ecosystems, also overexploited and degraded by different factors and especially vulnerable to alien and invasive species. In this sense, *Cortaderia selloana* has showed a rapid expansion in the western Mediterranean Basin, threatening these habitats of special interest.

The main aim of this research is to understand the biological behavior pattern that has made the invasive *C. selloana* a potential threat for Mediterranean wetlands. In order to achieve the adequate knowledge of this potential role, a comparative study between this plant and *Saccharum ravennae* (L.) P. Beauv., a representative plant of Mediterranean marshlands and one of the species that is being affected by the expansion of *C. selloana* in these Mediterranean habitats, was planned. Some of the habitats inhabited by *Saccharum ravenae* are included in the annex I of the Habitats Directive (92/43/EEC), as humid dune slacks (code 2190).

The study evaluates the role of *C. selloana* in the soil seed bank and the potential competitive displacement of *S. ravennae* in a Mediterranean wetland of Spain, next to a protected area (L'Albufera Natural Park). Seed behavior of both species was analyzed through seed viability tests and seedling root development, under accelerated aging conditions, taking into account morphological characteristics, plant sexuality and seed maturity as influential factors

However, in recent years, this plant has begun to spread in humid depressions in coastal areas of the Mediterranean region, especially those with certain human pressure, our results concerning the studied factors, cannot proved that there is a clear evidence of the ability of *C. selloana* to displace other wetland grasses in Mediterranean areas.

The low longevity in the soil bank observed in this species is important, especially from an applied point of view, as key tool for eradication, useful in restoration and conservation programs.

Vegetation of the east coast of Spain: diversity and conservation status

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The studied area is included in the East Coast of Spain and occupies about 1,300 km; it is a very diverse territory situated between the north of Girona province (Cap de Creus) and the south of the Alicante province (Cap de la Nau). The wide variety of ecological conditions, orography, geology and climatic parameters, that occur in this area determine a great diversity and richness from the flora and vegetation point of view.

This great diversity of environments has resulted in a large number of coastal habitats corresponding to different associations. A list of all of them and the vegetation classes to which they correspond has been drawn up. On the other hand, its importance in the territory has been evaluated, according to the degree of representation, endemicity and threat. The most threatened communities as well as the different types of threats are also stand out.

From these data, a general assessment of the Iberolevantine coast, from the point of view of its vegetation diversity and conservation status, has been carried out

Temporal continuity of floristic features under the constraints of habitat modifications on continental sand dunes in Serbia

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Pannonian sandy steppe is critically endangered grassland habitat (European Red List of Habitats-E1.1a). Data on historic trends, particularly for the longer time period, are of great importance for the both conservation and management purposes. The main objective of our study was to investigate the floristic features of the sandy steppe vegetation in order to perceive the long term trend and the main pressures and threats that are shaping these endangered habitats.

We compiled a comprehensive flora and vegetation database of continental sands in Serbia, consisting of 285 relevés and over 7500 entries of floristic data, recorded between 1863 and 2016. We have used both literature sources and the results of our current research. The data were divided into five groups, in relation to the period from which they originate, and thereafter we calculated continuity of records of individual taxa. We also analyzed changes in the number of registered species per time unit and correlation between changes in the diversity of flora and its economic importance (exploitation), as well as the occurrence of invasive species, cultural and social history in the field of research (development of agriculture and afforestation, world wars, the construction of hydroelectric power plants, the declaration of protection areas). The analysis of all these factors, we have expressed in the light of changes in habitat quality.

Habitats on the sand in Serbia represent important centres of diversity of flora and vegetation. Natural vegetation on the sand is subject to very dynamic changes, but also under the constant pressure of human influence. Based on the analysis of the dynamics of flora and vegetation during the last century, there is established the presence of significant changes in the diversity of flora of sands in Serbia. Also, there are also detectable changes of vegetation, especially when it comes to the presence and coverage of diagnostic species of typical plant communities on sands.

The quest for the holy vegetation relevé field app

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Vegetation biologists and ecologist in general collect a large amount of field data from different locations. These data are often written on paper forms and are, mostly manually, transferred into a database after the fieldwork. This can be very time consuming and often introduces mistakes and a loss of information (e.g. detailed location).

Nowadays, new opportunities are created with mobile phones providing free GPS and Google maps on, for example, open source Android operating systems. A search on the web, provides many free and open source applications, application builders and sites to store these data. But what about the complexity of vegetation surveys?

We need an application that allows users to register geo-referenced floristic relevés in the field, into a personalized project. Every project should allow the creation of dynamic forms for data collection, using information fields such as texts, photos and/or taxon lists and a two-way communication between the mobile phone/field computer and a central database in which the data will be stored.

INBOVEG is the Flemish Vegetation database that enables vegetation relevé data to be collected and stored easily. It offers standardized species lists, habitats, life forms, scales ... INBOVEG stores original observations and later re-identified species. The data are accessible through a web application that allows both input and consultation. The application is usable in the field on a field computer. Network coverage, however, is often not sufficient, field computers are more expensive and less accessible. Solution? Find an app for the Android smartphones …

We explored different open source applications, such as EpiCollect (http://www.epicollect.net/), Google Sheet, Open Data Kit (ODK, https://opendatakit.org/), … These apps are evolving very rapidly, but until now the biggest issue is the very long species list which has to be consulted in a fast and easy way. Until now, ODK was the most satisfying because it has a function that allows a quick search in long species lists. But like the others, the length of these lists made it difficult to use in the field. All tested apps have a possibility to create a central website were the collected data can be stored, but for our purpose, we would need an extra import-tool to our own vegetation relevé database (INBOVEG).

So our quest is not over yet … our most workable is presented on the poster. Have a look!

Battle of the brambles - small scale scrub-dynamics between an endemic and an invasive alien

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Rubus armeniacus is an invasive alien bramble species in large parts of the temperate biogeographical regions worldwide. Although it is mainly found in disturbed anthropogenic sites, it can also invade more natural systems. However, it is not clear whether this species is a threat to other scrub species, especially native local or regional endemic *Rubus* species.

Texel is the largest of the Dutch Wadden Sea islands. "De Hors", the southernmost part of the island is used as military training area, and part of National Park "Dunes of Texel". It is also designated as Natura 2000 site. Nature management is restricted to small parts, whereas most of the area can develop without human interference. "De Hors" is a highly dynamic landscape with large areas of white dunes (*Ammophilion arenariae*), dry dune grasslands of the *Koelerio-Corynephoretea* and wet dune slacks belonging to the *Caricion davallianae*. Locally, large scrub-complexes occur, belonging to the *Salicion cinereae* (*Franguletea alni*), the *Salicion arenariae* (*Salicetea arenariae*) and the *Pruno-Rubion sprengelii* (*Rhamno-Prunetea*). The natural bramble scrubs of the Dutch coast were described recently as *Roso rubiginosae-Rubetum affinis*. At Texel, in this scrub-type, *Rubus thallasarctos* is one of the more typical, endemic bramble species. In the *Roso rubiginosae-Rubetum*, several other bramble species are found (*R. vadalis*, *R. umbrosus*, *R. gratus*, *R. affinis* and the sexual *R. caesius*), as well as common *Rhamno-Prunetea*-species like *Crataegus monogyna*, *Sambucus nigra*, *Rosa canina*, and *R. caesia*.

We studied small-scale vegetation dynamics in a 25 × 3 meter transect in the *Roso rubiginosae-Rubetum affinis* in which both the invasive *Rubus armeniacus* and the regionally distributed *Rubus thallasarctos* grow. Every year between 2010 and 2016 all scrub species (including the brambles) were mapped in detail. Our results show that after years of stasis, *R. armeniacus* expanded suddenly, but whether it will be able to displace *R. thallasarctos* is not yet clear; monitoring in the upcoming years is planned.

Dryness indices in the Southeast of USA (Arizona, Nevada, California, Oregon, Nuevo Mexico)

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The main aim of the present study is to know the different levels of dryness in the Southeast of USA; particularly in the Arizona, Nevada, California, Oregon and New Mexico states. To that effect, we have used 1130 meteorological stations existing in that territory with available data of altitude, longitude, latitude, mean temperature, mean maximum and minimum temperatures and rainfall. Data were provided by the Western Regional Climate Center.

The new index here proposed (Dryness Index, DI) needs the previous calculation of the monthly ombrothermic index (Io_i) according to the Rivas-Martínez, Rivas-Sáenz & Penas approach (2011). Dryness is considered to exist only when that value (Io_i) is lower than 3.6. The Dryness Index can be calculated at monthly ($DI_i = 360 - (100 \times Io_i)$), annual level

$$(DI_y = \sum_{i=1}^{12} DI_i)$$

or seasonal level.

According to that is possible to establish different levels of dryness for the studied territories. The spatial distribution of dryness is shown with 17 maps at monthly, seasonal and annual level.

Dryness in the Northwest of Mexico (Baja California, Sonora, Michoacán)

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The main aim of the present study is to know the different levels of dryness in the Northwest of Mexico; particularly in the Baja California, Sonora and Michoacán states. To that effect, we have used 638 meteorological stations existing in that territory with available data of altitude, longitude, latitude, mean temperature, mean maximum and minimum temperatures and rainfall. Data were provided by the National Meteorological Service of Mexico (SNM).

The new index here proposed (Dryness Index, DI) needs the previous calculation of the monthly ombrothermic index (Io_i) according to the Rivas-Martínez, Rivas-Sáenz & Penas approach (2011). Dryness is considered to exist only when that value (Io_i) is lower than 3.6. The Dryness Index can be calculated at monthly ($DI_i = 360 - (100 \times Io_i)$), annual level

$$(DI_y = \sum_{i=1}^{12} DI_i)$$

or seasonal level.

According to that is possible to establish different levels of dryness for the studied territories. The spatial distribution of dryness is shown with 17 maps at monthly, seasonal and annual level.

Numerical classification of vegetation series: methods and first results

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The dynamico-catenal phytosociology was proposed in the 70' by Tüxen (1977) and Géhu & Rivas-Martínez (1981). This approach allowed a better integration of vegetation dynamics, by describing the dynamic trajectories of vegetation series together with taken into account ecological gradients driving contrasts in plant series. This approach was used for the French national program designed for habitat mapping (CarHAB), since 2011. This program aims to typify and map the vegetation and vegetation serie of the continental France at the scale of 1: 25 000 and several experimental regions were studied:Corsica, French Channel-Atlantic coasts, Auvergne, Armorican Massif, Atlantic estuaries, Bas-Vivarais, Crau plain.

The methodology based on phytosociological approachand describes the dynamics and catenal designof the vegetation. To typify landscape units, synrelevés and géosynrelevés need to be analyzed using numerical analysis (supervised and unsupervised classification). Theses pilot studies gave opportunity to address the question raised, e.g. What are the main symphytosociological units of an area? What methodology should be applied to run numerical analyses at such a geographical scale? Which rules and method to set up a national and international sigmataxonomic reference system?

The results will be illustrated considering the studies conducted in Corsica and Clermont-Ferrand region. Perspective and application of the dynamic-catenal approach will thereafter discussed.

Coenological features and syntaxonomical classification of *Styrax officinalis* in Italy

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Styrax officinalis is an E-Mediterranean scrub that is widespread from the southern Balkans to the Turkey and Middle East and that exhibits three relic populations in Peninsular Italy. Two of these populations, located in the Campania administrative region, have only recently been recorded and are both composed of a low number of individuals. The third population, located in the eastern sector of the Rome countryside has long been known and covers a considerably larger area than the afore-menitioned two Campanian populations which comprises the Cornicolani, Lucretili and Tiburtini Mountains and a small part of the Colli Albani volcanic hills. The membership of *Styrax officinalis* to the Italian flora s still a matter of debate. In fact some botanists have considered it as an alien invasive species directly imported by the Romans under Adriano emperor about two thousand years ago. Other consider it as a native species and this assertion is based on the assumption that the *Styrax officinalis* communities are characterized by the simultaneous presence and abundance of other SE-European species such as *Carpinus orientalis, Pistacia terebinthus, Paliurus spina-christi*, and *Cercis siliquastrum* that are typical of the Balkan thermophilous deciduous scrub formations. The most interesting thing, however, is that in this area *Styrax officinalis* is not only dominant in the shrubland formations, but also exhibits very high frequency and cover values in various forest communities. The majority of these communities are dominated by *Quercus cerris* and have been here classified as *Rubio peregrinae-Quercetum cerridis carpinetosum orientalis*, Moreover *Styrax officinalis* occurs in the *Quercus frainetto* and *Quercus cerris* mixed woods of the sandy and partially volcanic substates of the flat areas (*Echinopo siculi-Quercetum frainetto*) and in the *Quercus pubescens* woods of the shallow limestone soils (*Pistacio terebinthi-Quercetum pubescentis carpinetosum orientalis*), while it occurs less frequently in the *Quercus ilex* woods (*Fraxino orni-Quercetum ilicis*). The over-exploiting and/or the complete destruction of these potential forest types led to their substitution with microwoods dominated by *Carpinus orientalis, Styrax officinalis, Acer monspessulanum,* and *Pistacia terebinthus* provisionally classified in the *Phillyreo latifoliae-Carpinetum orientalis* (originally described for some Macedonian areas). Moving to a lower structural woody level *Pistacia terebinthus* and *Styrax officinalis* give rise also to a typical scrub community here proposed as a new association named *Pistacio terebinthi-Styracetum officinalis*.

Spatio-temporal changes (1956-2016) of coastal ecosystems in southern Iberian Peninsula (Spain)

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In the last 60 years, the alteration of the Mediterranean coastal ecosystems has increased significantly as a result of human pressure on coastal areas. The main transformations in southern Spain are due to several factors: in the western area (Huelva, Cádiz, Málaga) the plantation of extensive areas with pines (*Pinus pinea*) to slow down the advance of dunes, while in the eastern area (Almería) the increase of agricultural activity with the implantation of crops under plastic. In general, the proliferation of urbanizations along the coast for recreational and tourist activities has been remarkable since the 1960s. In recent decades, the impact factors on these ecosystems have also increased with the result of a greater number and diversification of exotic species.

The aim of this study is to evaluate the changes experienced in areas of southern Spain based on the different anthropic activities. Three examples have been chosen: one on the Atlantic coast (Punta Umbría, Huelva) and two in the Mediterranean: Marbella (Málaga) and Punta Entinas-Sabinar (Almería). The three areas are currently included in the Network of Protected Spaces of Andalusia (RENPA).

In order to evaluate the conservation degree and/or the reduction of the psamophilous and halophilous communities in the last 60 years, the panchromatic digital orthophoto of Andalusia 1956-1957 of 1 m resolution and the digital orthophoto colour of Andalusia 2013, 0.5 m resolution was used. A comparative analysis has been carried out using the ArcGIS geographic information system, photointerpreting the large units at an approximate scale of 1:10,000. We have compared the data obtained with other vegetation historical maps as well as the personal information from our own observations in the period from 1975 to the present.

The results show the variations experienced in these places and the different impacts derived from the actions on the territory. Considering the three areas studied, the most disturbed is the coast of Marbella in which a small dune ecosystem of a little more than 19 hectares is maintained, the reduction of the dune ecosystem in Punta Umbría by the urban growth is also notable, while the best preserved is Punta Entinas-Sabinar, despite being surrounded by crops under plastic, it maintains its dune ecosystem and the brackish ponds that constitute a refuge for numerous birds.

Mapping species richness of Czech grasslands and forests using vegetation-plot data

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Mapping of species richness patterns is of special importance in biogeography, macroecology and community ecology, because species-richness maps provide basic information for studies of regional evolutionary histories and community assembly mechanisms. Such maps are also important from the conservation point of view, because appropriate management applied at species-rich sites can ensure protection of a considerable portion of regional biodiversity. Recently increasing availability of large vegetation-plot databases has created unprecedented opportunities for analysing and explaining patterns of fine-scale plant species richness across large areas and for individual vegetation types. In this study, we demonstrate how these data can be used to (1) prepare country-wide high-resolution maps of species richness and identify national diversity hot-spots for grassland and forest vegetation; (2) examine congruence among spatial diversity patterns of all, native, alien and Red List species; and (3) identify potential environmental drivers of these patterns.

Spatially referenced vegetation-plot records of grasslands (including heathlands) and forests (plots with more than 20% of tree cover) were obtained from the Czech National Phytosociological Database. We used only records made after 1950 in plots of 9–25 m^2 in grassland vegetation and 100–400 m^2 in forest vegetation (these were the most common plot sizes in the database). This initial dataset was resampled to reduce biases inherent to vegetation-plot databases. Random Forest method was used to map fine-scale spatial diversity patterns of all, native, alien and Red List vascular plant species in each vegetation type.

Models for grassland and forest vegetation explained from 25% to 54% of variation in fine-scale species richness. Species richness in both vegetation types responded mainly to annual precititation amount, bedrock type and area of semi-natural habitats in the surroundings of the vegetation plots. When we projected the numbers of species predicted by the models to a grid covering the entire area of the country, spatial diversity patterns of all and native species differed considerably between grasslands and forests, whereas alien and Red List species showed higher congruence between the vegetation types.

Our study demonstrated that vegetation-plot databases are a valuable source of data for high-resolution mapping of plant species richness across large areas. Besides high-resolution, the main advantage of this data source against its alternatives is that it allows for mapping of diversity of individual vegetation types and different species groups. This is important, because different vegetation types can exhibit different diversity patterns. Any such study has to be very careful about biases that are inherent to large vegetation-plot databases, but if they are reduced by careful stratified resampling, the resulting maps can provide meaningful representation of the spatial patterns of fine-scale diversity that can be used for testing the effects of potential underlying factors.

Vegetation of scree, ravine and oak-hornbeam forests of Transcarpathia, Western Ukraine

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Transcarpathia (Transcarpathian Ukraine) is a region in Western Ukraine in a transitional zone between the Pannonian Basin and the Eastern Carpathians. It has a diverse geology including Quaternary sediments, volcanites, limestones and flysch and its climate is relatively warm and humid. Although forests of this region are relatively extensive, local forest vegetation has been poorly studied (with the exception of beech forests) and phytosociological relevés were published only from a few sites. Therefore, we conducted two field surveys in 2016 and 2017 aiming scree, ravine and oak-hornbeam forests, the vegetation traditionally classified within alliances *Tilio platyphylli-Acerion* and *Carpinion betuli* of the class *Carpino-Fagetea*. The former expedition covered almost the whole low-altitudinal part of Transcarpathia including northeastern margin of Pannonian Basin, while the latter expedition aimed mainly middle altitudes of Carpathians.

In the field, we were recording relevés using Braun-Blanquet approach. For each relevé, basic environmental characteristics (altitude, aspect and inclination of slope, cover of rocks) were recorded and heat load index was computed. Mixed soil samples were also taken and soil pH was measured later on. Recorded variables were used in subsequent ordination analyses. Using various classification methods, we classified our relevés to the association level. We distinguished several associations: scree forests occurring mostly on limestone (mainly of the association *Phyllitido-Aceretum*), cooler type of scree and ravine forests (*Arunco dioici-Aceretum pseudoplatani*), lowland slope forests in a transition between ravine and oak-hornbeam forests (*Aceri-Tilietum*), slightly wet Pannonian oak-hornbeam forests occurring in lowland part of the region (*Circaeo-Carpinetum*), mesophilous Carpathian oak-hornbeam forests (*Carici pilosae-Carpinetum*) and xero-mesophilous Carpathian oak-hornbeam forests (drier type of the association *Carici pilosae-Carpinetum* and the association *Primulo veris-Carpinetum*).

The most recent vegetation' anthropic changes of estuarine areas of rivers in Northern Black Sea region (Ukraine)

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The estuarine areas of rivers (EAR) cover an area approximately of 2500 sq.km. They are rich in phytodiversity particular rarity. The vegetation of EAR has vitally important biosphere role in the steppe zone which marks by overly excited and exhausted natural plant resources. The most recent leading anthropic factor of phytodiversity transformation in the 21st century is the construction of the midstream "Danube – the Black Sea" through the Delta Kiliyskyi Danube estuary. With its introduction into exploitation occur the redistribution of channel flow with an appropriate hydrogenous succession of all types of vegetation's organisation. The construction was disturbed a biogenetic channel, including seaside-island of the delta, which provided the exchange of genetic material, especially of representatives of an ammophilo-littoral floral complex between the Western and Eastern Black Sea regions. The Anthropic impact on Delta geocomplexes located in the area of influence of the fairway is the largest and can coincide only with historical global climate change. Those occurring, today primarily will affect the coastal ecosystems through raising the level of the World Ocean and coincide with the transgression of the Black Sea. Therefore, monitoring the changes is relevant. Besides the conclusions on the distant future, it will allow for the prediction of changes taking place and to develop measures to minimize the impact of current anthropic transformations of vegetation. The urgent measures to protect Delta phytodiversity must be implemented. Among them, priority is the transfer of diasporas rare species from areas where they undergo a transformation in favourable habitats. Another effective measure that will have a restrictive effect on current and past Delta transformation is establishing an ecological network in which the present natural history object will serve as a key area the international level. This is consistent with the strategy of forming "Green corridor of the Lower Danube," according to a declaration signed by the Minister of Environmental Protection of the Danube countries. Another recent impact factor on the vegetation of EAR is a large-scale conservation of areas in the region of Northern Black Sea. The conservation has led to changes in vegetation structural differentiation and reduce rare phytodiversity. It is established that the preservation, restoration and maintenance of phytodiversity of EAR under current conditions can be achieved by the removal of a certain amount of plant material by mowing, grazing and winter burning of vegetation. Implemented experimental studies demonstrate the need for intervention in the processes in the territories of protected objects (absolute outside protected areas) to maintain the existing phytodiversity and its enhancement, that must be the paradigm of environmental policy. In the scientific aspect should be continued studies of changes occur due to the impact of new anthropic factors, including large hydrostatic construction, conservation and recreational development of riverine areas and develop preventive measures to minimise negative impacts on phytodiversity.

Structure of moss layer as environmental predictor for vascular plant vegetation in rich fens

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Bryophytes are one of the most important components of fen ecosystems. Vegetation composition in rich fens strongly depends on sufficient supply of mineral-rich groundwater, which has been in contact with base-rich bedrock. Acidification and eutrophication are consider as the major constraints on the conservation and restoration of rich fens. Therefore rich fens are protected as EU priority habitat H7140 – Transition mires and quaking bogs, H7230 Alkaline fens and are part of NATURA 2000. Rich fens harbor a large number of threatened vascular plants species and brown mosses, whose occurrence depends on high pH and low nutrient availability. Ongoing process of succession leads to transformation of species-rich brown-moss communities into species-poor *Sphagnum*-dominated communities. The succession usually starts by changes in the bryophyte layer, with consequent changes in the herb layer. When brown mosses are replaced by *Sphagnum* species, some threatened species of vascular plant species start to disappear although groundwater pH is still high. Empirical experience shows that especially short-lived vascular-plant species, relying on generative reproduction, are suppressed by expanding *Sphagnum* species that may compete effectively with vascular-plant seedlings by effective nutrient uptake and fast growth.

In this study we tested the responses of vascular plant species to the relative cover of brown mosses versus sphagna, independent of pH/calcium level, water level and cover of non-fen bryophytes. We used three different vegetation data sets from temperate Europe, differing in size, geographical and temporal extend and preciseness in measurement of environmental variables. In all three datasets, proportion of brown mosses versus sphagna, significantly accounted for residual variation in vascular-plant data when the effects of pH/calcium level, water table depth and hemeroby were partitioned out. We indeed found that a group of short-lived fen specialists, including endangered species relying on generative reproduction, significantly positively responded to the cover of brown mosses. Nevertheless, most of these species showed such a significant response only in one dataset, making generalization of the results problematic.

Survival and growth of three *Sphagnum* species under experimental conditions. Applicability in Pyrenean mire restoration

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Mires are rare habitats in Catalonia, NE Spain, where they can be found exclusively in the Pyrenees. Mires have high conservation interest, and hold various Habitats of Community Interest (HIC). On some of these HICs, peat mosses (*Sphagnum* spp.) play an engineering role. Thus, they become interesting plants to plan restoration actions on mires. Since there is no precise knowledge on mire restoration ecology within southern European mountains, we addressed an experimental analysis on the response of distinct *Sphagnum* species to contrasting conditions.

We conducted an experiment under chamber controlled conditions using stem fragments and capitula from three species of *Sphagnum* (*S. teres*, *S. magellanicum* and *S. capillifolium*). In natural environments, these three species thrive in different ecological conditions (from flooded areas to raised moss clumps, and from minerotrophic to ombrotrophic). The aim of the study is to test the survival and growth of sphagna depending on water level, type of substrate and species interactions.

The survival of the three species was significantly affected by the type of substrate. Generally, they showed preference for substrates where these species grow in nature, i.e. peat and dead wood. The growth of *S. magellanicum* and *S. capillifolium*, both related to ombrotrophic habitats, was diversely affected by the distinct substrates used. The only species affected by the water level was *S. teres*, which in the wild has preference for minerogenic habitats with high water table. Interaction between species did not cause growth differences in the study cases, although most likely this was due to poor growth of the stem fragments, thus to no effective concurrence between them.

The results partly support the ecological preferences pre-assumed for the species analysed, although their distribution pattern along the water table depth gradient was not consistent for the ombrophilous species (*S. magellanicum* and *S. capillifolium*). So that, the interaction between species would be a reasonable driver in the habitats building, at the fine scale of flooding mires.

Fagus sylvatica-dominated woods of Italy: an updated classification

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Coenological features of European beech forests were recently analyzed in the context of European vegetation classification by Mucina et al. (2016) and Willner & al. (2017). In these studies some areas of Italy were under-represented, especially the Piedmont western Alps and northern Apennines. In order to fill this gap and to test the recent European classification on a national scale, data from the Italian beech-forest dataset (extracted by the main Italian databases VegItaly, BVN/ISPRA and Vegetation Plot Database – La Sapienza University) were integrated with published and unpublished beech wood relevés extracted by the database IPLA spa (a company dealing with environmental issues controlled by the Piedmont Region Administration).

The aim of this study is to present a first contribution to the floristic, ecological and phytogeographical characterization of Italian beech forests.

The data set was formed by 3518 georeferenced relevés and 1248 taxa. It was submitted to agglomerative clustering (Bray-Curtis distance, flexible beta method) and diagnostic species of the resulting groups were established by computing the *phi* coefficients. We distinguished eight groups:

Group 1 - Eutrophic and/or calciphilous beech woods of low altitudes, mainly on calcareous substrata, distributed in the Alps and Northern Apennines. Group 2 - Acidophilous beech woods, mainly on siliceous substrata, distributed in the Western Alps and Northern Apennines. Group 3 - Open beech woods, with heterogeneous floristic components, distributed in the Western Alps and Northern Apennines. Group 4 - Eutrophic beech woods, mainly on calcareous substrata, well characterized from a floristic view point, distributed in the Eastern Alps. Group 5 - Degraded beech woods with a high cover of *Sesleria argentea*, mainly distributed in Northern Apennines. Group 6 - Italian peninsular beech woods of low altitudes, mainly distributed in the Southern Apennines and Sicily. Group 7 - Eutrophic beech woods of the Southern Apennines, mainly distributed in the mountains of Calabria. Several relevés coming from the Tuscan-Romagna Apennines unexpectedly showed some floristic similarity with this group. Group 8 - Eutrophic beech woods of the central Apennines, occurring especially on the Adriatic side of the Italian peninsula.

The syntaxonomical schemes proposed in the recent literature can be partially confirmed, but our analysis additionally identifies more local patterns of vegetation differentiation which are not apparent in coarse-scale international analyses.

Is plant community mycorrhization decreasing along a gradient of anthropogenic pressure?

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Anthropogenic influence has long been recognized as the main cause of biodiversity loss, thus contributing to ecosystem degradation. At the same time, mycorrhizal symbiosis plays a crucial role in multiple ecosystem services and often favours plant diversity. Although it is known that some human impact can decrease mycorrhization at plant individual level, it has not yet been tested how increasing anthropogenic influence translates into changes in plant community mycorrhization at larger scales. In this study, we ask how the anthropogenic impact is related to plant community mycorrhization at a regional scale. To do this, we quantified the overall prevalence of mycorrhizal symbiosis and arbuscular mycorrhizal symbiosis in 158 (semi)terrestrial habitat types in the Netherlands, using the Dutch National Vegetation database - the largest regional vegetation database available. The prevalence of mycorrhizal symbiosis in these habitats was quantified by plant community mycorrhization index using plant mycorrhizal status data. We found that the overall prevalence of mycorrhizal symbiosis is not affected my anthropogenic influence, whereas the prevalence of arbuscular mycorrhizal symbiosis increases with increasing human impact in wetlands and woodlands, indicating the vulnerability of these habitats to anthropogenic impact.

Habitat conservation in Italy: the state of the art in the light of the first European Red List of Habitats

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The assessment of the conservation status of species and habitats is one of the main objectives of the European Union to reduce the global loss of biodiversity and related ecosystem services. For the first time, among the several instruments adopted at European level, the European Commission has implemented to habitats the "red-listing" approach, already well known for animal and plant species. This approach is aimed to produce a general framework for assessing habitat conservation status and future prospects. The first European Red List of Habitats, based on a modified EUNIS habitat classification, was recently published and Italy participated with a group of 15 vegetation experts from several Italian universities and institutions. With more than 67% of all terrestrial habitats surveyed throughout Europe (EU28+), Italy is confirmed as one of the European countries with the highest habitat biodiversity.

In this contribution, an analysis of the threats affecting the terrestrial habitats at national level is performed, paying particular attention to the inconsistencies that may occur when comparing assessments carried out at different spatial scale. The outcomes of this evaluation highlight a rather widespread decline of habitats in Italy, particularly critical for specific habitat types. The trends identified at European level are overall confirmed: amongst the 7 considered habitat macro-types, the most critical ones are grasslands, wetlands and coastal habitats, where most of the threatened habitat types are concentrated.

An emblematic example is given by the Italian endemic habitat E1.1e "Perennial rocky grassland of the Italian Peninsula", including secondary herbaceous plant communities spread in the inner territories of peninsular Italy, especially in the Apennines, traditionally used as extensive pastures. Their conservation status is considered VU (Vulnerable). Among the major pressures and threats that put them at risk of conservation, the main one is represented by the abandonment of traditional pastoral activities. Actually, this is a secondary habitat, maintained by extensive pasture which has drastically decreased all over the mountain areas. Besides E1.1e, Italy hosts another endemic habitat type, G1.Ba "*Alnus cordata* woodland", evaluated as DD (Data Deficient) due to the poor knowledge on past and present trends. Conservation effort for maintaining these exclusive Italian habitats in a good state of conservation is a crucial responsibility at national level. The same could be said for almost exclusive types such as the habitat H6.1 "Mediterranean and Temperate active and recent volcanic features", occurring in Italy for almost 80% of its whole European distribution area (EU28), featured by relic vascular plants with a very restricted range.

Overall, the European Red List of Habitats takes into account a much wider range of habitats than those listed in Annex I to Directive 92/43/EEC, which inexplicably excludes many types of vegetation with conservation relevance. We propose a critical comparison between the results of the 3rd Report on Habitats of Community Interest in Italy and the threat categories attributed to the various habitat types by the European Red List, in order to point out inconsistencies and affinities.

Reciprocal Extrapolation: Woody Species Distribution on Crete and Sicily

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Extrapolation of species distribution models is frequently done for mainland regions, therewith predictions for e.g. inaccessable terrain can be made. We extend the method to isolated regions and use the Mediterranean islands Crete and Sicily as study areas. The islands share a couple of woody species of the widespread vegetation class Quercetalia ilicis. We trained species distribution models in MaxEnt on one island and extrapolate prediction to the other island. As base data precise coordionates are used and additionally bedrock type, topography and macro-climate parameters are used. For the latter environmental parameters we describe a selection process, which helps for extrapolation accounting for common values. Models work well chiefly for substrate specialists, while predictions for several species elude from extrapolation. We discuss reasons for failure and success of the method.

A three level framework for the survey and monitoring of Habitats in the RESECOM LIFE+ project

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The main goal of the RESECOM project is to provide the UE with information to assess the "favourable" or "unfavourable" status of plant species and habitats in the long run, by following some standard and solid protocols. The target species and habitats are those included in the Habitats Directive (HD), and the range of the work extends to the Aragon region. The monitoring techniques are an objective of the project itself. These have to be appropiate to give sound information about long term processes, and to detect changes in the patterns of plant and habitat features by means of a good analytical approach. This aim to detect possible effects of the global change in species and habitats performance is the second important goal of this project. For habitats, the spatial features have not been considered, because there are other projects that do this (habitat mapping). So, the project is focused in the "structure and function" features. The approach to the survey and monitoring of these features is showed in this presentation.

With limited budget, there is a trade-off between the need of extensive surveys (for a better assessment of the conservation status) and the precision of the data gathered in each site (for a good ability to detect slight changes or trends in the long term). Instead of choosing one of both ways, we have intended to build a framework with several levels, so all the different strategies could be included. There are several monitoring programs or proposed methodologies that organize in various levels of intensity. We have found that the entire habitat structure and function surveying methodologies can be well classified in three levels: a) Level 1: Quick assessment. It takes short time (less than half an hour) per location, and attributes are qualitatively evaluated. Coordinates and photographs are taken systematically, and a standard form is filled out. No high expertise is required, but yes some training. b) Level 2: Releves. These are classical inventories, taken in plots, mostly temporary, and semiquantitative measures are taken. A good expertise in species determination is needed. Structural aspects, as well as disturbances inside the plot are also measured. Some extensive survey of presence of other taxa different from plants (birds, butterflies, dragonflies, etc., would be included in this level). c) Level 3: Detailed monitoring. Here we search for quantitative data: precise values of the frequency of plant species in the community, trends in population size or densities of key species, physical and chemical parameters through water samples, precise structural measures.

In the RESECOM, we have applied these concepts to 22 types of Habitat of Comunitary Interest, grouped in five main groups: salt marshes, grasslands, shrubs, wetlands (bogs, fens) and rocky habitats. For each of these groups, we have written a handbook with sampling protocols and developed the proper forms. It has been also designed the structure of a database according to the way that data are taken in the various levels. This DB is still in construction. 70 monitoring sites have been surveyed and constitute the habitat monitoring network, but this number is increasing.

Conservation Status Assessment of Habitats in the RESECOM LIFE+ project

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One important action in the RESECOM LIFE project is to assess the effectiveness of the methods used to achieve the goals set. For the goal of detecting changes on the long run, is still very soon to have results: in most cases (sites) only one survey has been made. The data that will be used for this assessment will be those gathered in levels 2 and 3, and some repetitions and statistical analysis of the data are needed for this. Nevertheless, we have attempted to set a framework for the objective of assessing the conservation status. We search for a method that can work even with the information obtained at the first level (quick assessments). We have learned from literature to set attributes of interest of each habitat type. Then, we have adjusted the indicator features according to the observations in preliminary surveys.

The indicator setting has been inspired in the TREMEDAL LIFE project rules and databases, stated in the document of "Common Indicators for the Monitoring of Habitats". In this phase, we have used an ecological approach. So, a number of attributes (groups of indicators) have been taken in account: physical structure, hydrology, vegetation structure, species composition, and pressures and activities around the monitoring site. We have assessed the structure and function separately from the future prospects. One of the key features of this indicator system is that indicators are relative, so they are assessed in function of "change", more than contrasting the observed values against reference values. Species are incorporated as separate indicators, so there is a very fruitful synergy when using the monitored plant populations in the species level of the RESECOM project as indicators of habitat condition (if those are true indicators of good condition of the habitat, and if the population establishes in one of the target habitats). Having regard to the releves made in the first (preliminary) surveys, a list of typical species has been stated for each site.

The scoring procedure is based in the ECLECTIC index, that has been proposed in the work "Bases Ecologicas Preliminares para la Conservación de los Tipos de Hábitat de Interés Comunitario de España (BEPCTHICE)", to assess the conservation status of standing water habitats. This is a system of weighted values for the indicator parameters, separated in blocks each of which has a fixed percentage for the total value of the index, ranging from 0 to 100. Some threshold values, separate the ranges that mean the different conservation degrees: Favourable, Unfavourable-Inadequate, or Unfavourable-Bad.

As stated in the explanatory notes and guidelines for the assessment and reporting under Article 17 of the Habitats Directive, the assessment result of a site is the "conservation degree" and the joint assessment of all the monitoring sites of a habitat, would be the "conservation status" (based in the structure and function) of the habitat at regional level.

One of the virtues of this framework is that in the scoring tables, an assessment of "unfavourable" degree can be traced, and found the concrete aspect that is failing, so the assessment becomes a diagnosis on which management objectives and actions should be based.

Abrupt changes in the composition and function of fungal communities along an environmental gradient in the High Arctic

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Fungi play a key role in soil-plant interactions, nutrient cycling, and carbon flow and are essential for the functioning of arctic terrestrial ecosystems. Some studies have shown that the composition of fungal communities is highly sensitive to variations in environmental conditions, but little is known about how the conditions control the role of fungal communities (i.e. their ecosystem function). We used DNA metabarcoding to compare taxonomic and functional composition of fungal communities along a gradient of environmental severity in Northeast Greenland. We analysed soil samples from fell fields, heaths, and snowbeds, three habitats with very contrasting abiotic conditions. We also assessed within-habitat differences by comparing three widespread microhabitats (patches with high cover of *Dryas*, *Salix*, or bare soil). The data suggest that, along the sampled mesotopographic gradient, the greatest differences in both fungal richness and community composition are observed among habitats, while the effect of microhabitat is weaker, although still significant.

Furthermore, we found that richness and community composition of fungi are shaped primarily by abiotic factors and to a lesser, though still significant extent, by floristic composition. Along this mesotopographic gradient, environmental severity is strongly correlated with richness in all fungal functional groups: positively in saprotrophic, pathogenic, and lichenised fungi, and negatively in ectomycorrhizal and root-endophytic fungi. Our results suggest complex interactions amongst functional groups, possibly due to nutrient limitation or competitive exclusion, with potential implications on soil carbon stocks. These findings are important in light of the environmental changes predicted for the Arctic.

Ecology or history?
The story of *Nymphaea candida* at its western distribution limit

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In the Netherlands, *Nymphaea candida* is an often overlooked species, which has its centre of distribution in northern, central and eastern parts of Europe, from where its distribution area stretches into Siberia and Central-Asia. It was discovered as late as 1976 in a river-pond in Noord-Brabant. Afterwards, it was demonstrated that *N. candida* was already collected in 1881 in the north of the country, and that the species was still present in several locations, mainly in the northern provinces of Fryslân, Groningen, Drenthe, and Overijssel. The nearest populations are located more than 150 km east of the Dutch border. In the flora, the taxon was never recognised fully, and as a consequence it was never properly recorded in flora or vegetation surveys, and it was chronicled as very rare (occurring in only 18 5 × 5 standard map cells). Separate accidental finds by the first and last author raised the questions 1) whether *N. candida* was really as rare as supposed, 2) in what communities this species grows, and 3) whether the occurrence of *N. candida* in the Netherlands can be considered a relic of a once more extended distribution area, or probably as a more recently established outpost.

To answer these questions, several excursions were made to map *N. candida* in the wider areas where the species was recorded before, and relevés were made of the vegetation in which the species grows. Based on the experience in these excursions, similar landscapes were also surveyed. In total, *N. candida* is known now from 27 map cells. It is almost restricted to the valleys of small lowland rivers with peat soils and former raised bog areas at the edge of the Drenthian boulder clay plateau only a few locations are known from the rivers in the centre of the country. Like in other areas, *N. candida* and *N. alba* are only found together exceptionally, which we believe is a result in the difference in rhizome architecture of both species. From a comparison of the 78 relevés of *N. candida*-vegetation with the Dutch national vegetation classification it follows that in the Netherlands, apart from the *Nymphaeo albo-Nupharetum lutaeae* also the *Nymphaeetum candidae* can be distinguished.

A combination of our vegetation study with literature made clear that *N. candida* has probably reached the Netherlands in the last glacial interstadium, but not later than the early Holocene. Considering the wide variety of vegetation types in which it can grow, we conclude it is very well possible that *N. candida* survived in rivers and lakes in raised bog areas and in river valleys, as long as the sites are isolated from invading *N. alba*. From here it might well have been dispersed locally in the dug reclamation canals where it can be very abundant. Its low dispersion capacity, other than with running water, makes the long distance dispersal from more eastern populations in Germany very unlikely. The difference between the *Nymphaeo-Nupharetum* and the *Nymphaeetum candida* can only be explained on the basis of historical facts, whereas their ecology is broadly overlapping. Therefore, we conclude the populations of *N. candida* in the Netherlands are to be considered of a relic nature, and not as outposts.

The vegetation communities of saltmarshes in Scotland

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To meet Scotland's conservation and legislative requirements to monitor and set management objectives for saltmarsh habitat, a national survey was developed jointly funded by Scottish Natural Heritage and the Scottish Environment Protection Agency. This national survey focussed on developing a fine scale vegetation map of all Scottish saltmarshes over 3 ha, which was digitised using GIS software. The results of the project provided new insights into the vegetation communities found on saltmarshes and associated habitats including communities found in the splash zone of cliff faces and the changing abundance of brackish swamp communities. A total of 7,704 ha of coastal habitat was surveyed as part of the project, which included 5,840 ha of saltmarsh vegetation and 1,864 ha of associated vegetation.

Syntaxonomical classification of mown mountain grasslands of Polygono-Trisetion alliance in Carpathians differs in various countries

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With the aim to create the uniform classification system and to assess the distribution of distinguished vegetation unites there were large data set of relevés obtained from private databases and national phytosociological databases of Slovakia, Poland, Romania and Ukraine containing relevés of grassland vegetation of *Molinio-Arrhenatheretea*, *Mulgedio-Aconitetea* and *Nardetea strictae* classes.

Starting dataset consisted of 20 472 relevés (8 883 Slovakia, 5 074 Poland, 676 Romania, 1 994 Ukraine). The initial data set was analysed using the program JUICE 7.0.127. The relevés of target vegetation were selected based on diagnostic species of *Polygono-Trisetion* alliance and also based on numerical classification using PC-ORD 5.0 software package, with Sorensen (Bray-Curtis) distance as a resemblance measure and Flexible Beta (0.25) with Square Root Transformation, value p = 0.5.Relevés of non-target vegetation units were deleted from the dataset. The Slovak expert system for identification of grassland syntaxa of Polygono-Trisetion alliance was used for selection of typical relevés of clearly delimited associations and these were set as the a priori groups in the semi-supervised classification. The typical relevés of vegetation units delimited in Poland and Romania were selected based on Poland and Romanian syntaxonomical literature and added to *a priori* groups. In total, 115 relevés in 7 *a priori* groups consisting of 6 to 29 typical relevés were selected to represent associations of the target vegetation. Heterogeneity-constrained resampling was performed to remove unbalanced distribution of the relevé plots. The strata were defined based on the geographical position of individual plots. The relevés selected as typical for a priori groups were all included in the final data set without stratification. Semi-supervised classification including 7 *a priori* and 25 newly-generated clusters was used to expand the a priori groups. We performed the K-means analysis with fixed centroids, three pseudo-species cut-off levels (0%, 5% and 25%) and Hellinger transformation. The classification process was repeated in 10 cycles.

Finally, 7 associtions of *Polygono-Trisetion* were determined in dataset: *Campanulo glomeratae-Geranietum sylvatici*, *Geranio sylvatici-Trisetetum flavescentis*, *Crepido mollis-Agrostietum capillaris, Geranio-Alchemilletum crinitae*, *Alchemillo-Deschampsietum caespitosae*, *Phyteumo (orbicularis)-Trifolietum pratensis* and *Astrantio-Trisetetum flavescentis*. The most widespread community in the Carpathians is *Geranio sylvatici-Trisetetum flavescentis*. *Geranio-Alchemilletum crinitae* association occurs only in Slovakia. *Phyteumo (orbicularis)-Trifolietum pratensis* association was found mainly in Poland with few occurrences in Slovakia and *Astrantio-Trisetetum flavescentis* is typical association in Romania.

This contribution was supported by grant VEGA 2/0040/17.

Plot size effect on species richness along an altitudinal transects in the Dolina siedmich prameňov Valley, Belianske Tatry Mts, Slovakia

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Local environmental factors, such as site conditions, biotic interactions, and management, were found to be important controls of fine-scale species richness in different temperate and alpine grasslands. Species richness is largely affected by size of the plot and shape and angle of species-area curves brings a lot of valuable information on the saturation of the plot by species. Species-area curves are also a useful tool for comparison of different vegetation types. The aim of the presented study was to analyse relationship between the increasing plot area, and the number of all plant species found within plots in various vegetation types in the Dolina siedmich prameňov Valley, which is the south-western corner of the ridges Belianske Tatry Mts. Our basic expectation was that larger plots will contain higher number of plant species; nevertheless we also focused our investigation on the course of the species-area curves in various vegetation types.

The sampling nested-plot series were with plots of the sizes of 1, 2, 4 and 16 m^2. Presence of all vascular plants, bryophytes and lichens where recorded. In the largest plot (4 × 4 m) the abundance and cover of plants in accordance to the principles of the standard Zürich-Montpellier school methods was estimated and stored using the TURBOVEG database software. The plots were square-shaped and placed in stands that were visually homogeneous in terms of topography, vegetation structure and total floristic composition. Basic environmental data were recorded or estimated, such as slope orientation and inclination, altitude and geographical coordinates using handheld GPS receiver. The initial data set containing 524 relevés (131 relevés with 16 m^2 plot size) and 509 species was analysed using the program JUICE 7.0.127. Numerical classification of the data set was performed using PC-ORD 5.0 software package, with Jacckard distance as a resemblance measure and Flexible Beta (0.25) with Square Root Transformation, value p = 0.5. The optimal number of the clusters was determined with the OPTIMCLASS Analysis.

According to the syntaxonomical interpretation, the 12 floristically differentiated vegetation units were distinguished – *Salix silesiaca* shrubs, *Rubetum idaei* clearings, *Petasition* tall herb fringes, *Calamagrostis* tall grass communities, *Delphium elatum* tall herb communities, *Festucetum carpaticae* grasslands, *Caricion firmae* swards, *Sesleria* alpine grasslands, *Potentillion* rocky habitats, *Festuca picturata-Calamagrostis villosa* grasslands and *Juncion trifidi* grasslands. The slope of the species-area curves was than compared among habitats using linear mixed models using sites of the nested plots as random factors. The analyses were performed in the R software and the results will be presented in the Conference.

This contribution was supported by grant VEGA 0090/12 and VEGA 0121/09

TurbovegSD, an Android app for collecting vegetation plots

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TurbovegSD is an Android app that can be used to record vegetation plots in the field. It communicates seamlessly with the desktop version of Turboveg through xml files for import and export. To start working with TurbovegSD first a project file needs to prepared using the desktop version. Any database structure and any species list are accepted by TurbovegSD. The export may contain a number of plots, but it's not required. After importing the project xml file in the app superfluous header en species data fields can be hidden. Other projects might also be imported, allowing working on more than one project during a field season. TurbovegSD automatically grabs GPS coordinates, and OpenStreetMap is integrated for orientation. Working offline is possible using the map. Wherever lookup tables are used in de Turboveg desktop version it is the same for TurbovegSD.

Selecting species is very flexible. Any combination of the first few characters of the genus and optionally the first few characters of the species will show a short list of possible species names.

Plots can be selected and organized in a table, making comparison of for example old and new recordings of a permanent plot easy.

The collected data can be exported as xml file and automatically uploaded or send by email to the desktop computer. To import the collected field data in a database the Turboveg desktop version provides in an import function for TurbovegSD xml files.

A German Synopsis of *Montio-Cardaminetea*

Hinterlang D

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Spring habitats in woodland and grassland areas are part of the fresh water system, marking the spots where ground water discharges and becomes surface water. Ecologically they are characterized by water temperatures that are relatively low in the summer and relatively high in the winter, supporting plant species that are tolerant of low temperatures around their roots at all times. Ground water, by nature, is poor in nutrients, so that net primary production is low. For this reason, the typical plant species in spring habitats do not suffer from strong competition. The most widespread communities of spring habitats belong to the *Montio-Cardaminetea* and contain only plant species with low demand on temperature and nutrient supply.

Some 1,800 relevés, of which more than 900 were processed in vegetation tables, were the basis of an investigation into the vegetation of spring habitats in Germany. The comparison of the relevés lead up to a distinction on the high syntaxonomical level of orders, dividing spring vegetation in woodland areas, on one side, from spring vegetation in open (grassland) habitats, on the other side. Spring vegetation in open habitats is subdivided into thee alliances with 11 associations in total, whereas, spring vegetation in woodland areas comprises only one alliance with two associations. The syntaxonomical solution presented is to a high degree conformant with the EVS-accepted check list: Vegetation of Europe: hierarchical floristic classification system of vascular plant, bryophyte, lichen, and algal communities, published by Mucina et al. 2016.

Relevant parts of the syntaxon descriptions of the German synopsis of *Montio-Cardaminetea* are: syntaxonomy and nomenclature, floristic characterization and differentiation. Furthermore, investigations of vegetation structure and ecology are presented to underpin the syntaxonomical differentiation. Further information is added on: vegetation dynamics, distribution, economic importance, zoocenology, and nature conservation. For each alliance and for the class a vegetation table with constancy values is provided. In addition, tables with average ecological parameters describe the ecological conditions for the given syntaxa. An overview of the syntaxa and their diagnostic species simplifies the determination and shows the floristic peculiarities of *Montio-Cardaminetea*.

The North Rhine-Westphalian Vegetation Survey

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North Rhine-Westphalia (NRW), Germany, currently provides some 15,000 vegetation relevés to the German national database VegetWeb. However, most of these datasets derive from a mapping campaign for grassland in the late 1980s and early 1990s which sum up to more than 9,000 data sets. Like in many places in Germany, the community of vegetation scientists and the University institutes specialized in vegetation science have decreased dramatically, so that over the past 15 years only few vegetation relevés were added to the database.

The State Agency for Nature, Environment and Consumer Protection NRW therefore started a new campaign to collect vegetation relevés. Overall target of this campaign is to publish a revised Red List of Vegetation Types for NRW by 2020. This revised Red List of Vegetation Types should be underpinned by data, rather than on expert judgement only.

Using a social media tool to set up a community of experts on flora and vegetation and by providing smartphone apps as online mapping tools, that were already successfully introduced for data collection on flora, we hope to attract more vegetation scientists to add to the database. Furthermore, we extended the classical habitat mapping method of our agency, adding a vegetation relevee, wherever a Red List vegetation type would be found, that could be distinguished at least on the syntaxonomic level of alliance. On this basis, we could already add some 450 vegetation relevés in the past two years, mostly typical of rare and important Habitat Directive habitat types. But we only just started. In addition, we will exploit some 18,000 datasets of a very detailed grassland mapping campaign (2014-2016).

Response of lichen diversity on forest management in the silver fir–beech forests in the western Pyrenees

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The influence of forest management on lichen diversity was studied in the western Pyrenean silver fir-beech forests for the first time in this region. Our specific aims were to determine the main drivers of lichen species richness and turnover and explore which lichens can be used as indicators of management intensity. The effect of management was assessed on the overall lichen diversity as well as on the lichen groups based life growth form and photobiont preference. Lichen diversity was analyzed by generalized linear mixed models and multiple regression analysis on distance matrices.

In the overall survey of 32 plots we identified 66 lichen species. The results suggest that total lichen richness in the Pyrenean forests is decreasing on the steeper slopes where the lichen richness may decrease because they are exposed to higher light levels as well as drought, which have a great negative influence on lichens. In the case of fruticose lichen richness, thermicity index was a significant variable, highly correlated with elevation. On the higher elevations greater humidity may favour the occurrence of this lichen group. Turnover was driven by slope, forest management and geographical distance. Forest management did not play any role in the case of lichen species richness, but it did so in the species turnover. Unmanaged stands contained some rare species such as *Nephroma resupinatum* and greater number cyanoliquens. Surprisingly, *Lobaria pulmonaria* considered the best indicator of forest management is a widespread species in the western Pyrenees and its presence is probably linked with the high humidity hence it cannot be considered as an indicator of forest management.

Thermophilous forest fringe communities in Bulgaria

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Thermophilous forest fringe vegetation has not been studied in the eastern part of the Balkan Peninsula previously. Only scarce data dealing with communities dominated by *Trifolium medium* are available. The aim of our research is to develop a classification scheme of the communities which belong to the class *Trifolio-Geranietea sanguinei* T. Müller 1962 in Bulgaria. A data set of about 230 phytosociological relevés have made during 2015-2017 in various parts of the country was performed and analyzed. The differentiation of the forest edge communities reflects the ecological and geographical features: edaphic factors, regional climatic influence, diversity of main vegetation forest and shrub types, peculiarities of community dynamics, and regional species pool. The classification scheme of the *Trifolio-Geranietea sanguinei* communities in Bulgaria is developed and the characteristics of the distinguished syntaxa are presented.

Shrub encroachment above the treeline in the Pyrenees

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Several studies have provided evidence that shrub communities have increased their area and density in Alpine and Arctic ecosystems as a result of global change, leading to the so-called 'shrub encroachment'. It has been rarely analysed in European temperate environments above the treeline, although there are frequent studies referring to the subalpine belt. In this study, we aim to assess shrub encroachment at high elevations in the Pyrenees, to understand the main factors influencing this process, and to estimate the main changes occurred at ecosystem level.

We selected two widespread shrub species, *Rhododendron ferrugineum* and *Juniperus alpina*, which mostly grow on northern and southern exposures, respectively. We looked for the main grassland types, which coexisted with these two shrubs by inspecting general vegetation cartographies. Then, we established 30 plots that combined each shrub species with the three most representative grassland types coexisting with each shrub. The plots were situated between 2200 and 2500 m a.s.l. and were distributed along the south-eastern part of the Pyrenees. Each plot consisted of a grid of 225 5 × 5 m cells, where we evaluated the change in shrub coverage and the type of habitat structure by comparing the aerial photographs taken in 1997 and 2014. Finally we performed linear models to explore which factors influenced this process, either biotic (shrub species, type of grassland, community structure, initial shrub coverage) or abiotic (altitude, aspect, slope, X-coordinate).

Our results showed that *J. alpina* experienced higher increase rates than *R. ferrugineum*, both through expansion of large clumps and establishment of new individuals. Grassland type did not result into different encroaching rates, whereas former shrub population structure strongly influenced shrub expansion. At ecosystem level, encroachment implied higher community biomass and litter accumulation, together with lower litter decay rates and productivity.

Monitoring snowbed vegetation in the Pyrenees: *FLORAPYR* Interreg project

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The *FLORAPYR* project (European Interreg project for years 2016-2019) is the continuation of a previous European project (2012-2014). One of our main objectives is to develop a unified monitoring protocol for snowbed vegetations within the Pyrenean range in the context of global warming, involving eight conservation and research organisations from three countries.

Among the different plant communities inhabiting snowpatches, we focus on those dominated by *Salix herbacea* L. (*Salicion herbaceae* Br.-Bl. 1948). Our monitoring specifically aims at recording the floristic composition, the phenology and the environmental conditions – microclimate and soil – in the permanent plots. As accessing the different localities can be a challenging and time consuming process, the protocol was developed to ensure that the time invested in monitoring each site is limited to a few hours, thereby maximising the data collected. In addition, the response of *Salix herbacea* L. to warming will be assessed by means of open top chambers, set in four representative localities.

We chose 14 snowbed localities distributed throughout the whole Pyrenees. In each locality, we established three permanent plots of 3 × 1 m, divided into 12 subplots of 0.5 × 0.5 m, following the snowmelt gradient and including the optimum and the margins of the *Salix herbacea* L. populations. Surveys are conducted four times yearly, every three weeks between the first week of July and the second week of September.

We present our first results regarding the ongoing characterisation of Pyrenean *Salix herbacea* L. stands in terms of floristic richness, phenology and microclimatic conditions.

Relationships between vegetation types and physical-chemical soil characteristics in a set of south-west oriented gypsum-clay slopes in central Spain

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Under lower-dry and semiarid ombrotypes with ion-rich soils, natural disturbances generate ecological niches where a variety of natural habitats develop, some of them may adquire wider distribution facilitated by anthropic disturbances. An analysis of vegetation-soil relationships has been carried out in a set of slopes placed in the Mesa de Ocaña south-west edge, in Huerta de Valdecarávanos township (Toledo, Central Spain), among the "Yesares del Valle del Tajo" (ES4250009) gypsum Special Area of Conservation (Natura 2000). The study area is placed in the Manchego-Sagrense subsector, under Mesomediterranean bioclimate, and lower dry-semiarid ombrotype. The stratigraphy of the studied slopes consists in secondary gypsum from glauberites with green lutites on the upperback slope, red and green lutites with gypsum nodules on the lowerback slope, and lutites with red sand levels on the foot slope. Vegetation types described along the slopes are: ruderal communities of *Carthametalia* and *Sisymbrietalia*, non halophile *Lygeum spartum* coummunities of *Dactylo hispanicae-Lygeetum sparti*, communities of *Spergularia diandra,* halophile coummunities of *Lygeum spartum* correspondig to *Limonetalia,* and communities of *Frankenion pulverulentae*. An analysis of physical-chemical soil characteristics has been carried out: soil bulk density, pH, electrical conductivity, organic matter, calcium carbonate, sulphates, available nitrogen and phosphorus. The main conclusion is that topography, stratigraphy, erosion and deposition processes generate salinity, nutrients, and moisture gradients that explain the ecological processes that lead the ocurrence of these communities.

Formal classification, distribution and ecology of rocky grassland alliances *Bromo pannonici-Festucion pallentis* and *Diantho lumnitzeri-Seslerion*

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A database of grassland plots recorded in the Carpathian Mountains and the Pannonian Basin was used to define a concept of the alliances within the order of *Stipo pulcherrimae-Festucetalia pallentis*. In our previous analyses based on supervised and semi-supervised K-means clustering we indicated three clearly separated alliances (*Bromo pannonici-Festucion pallentis*, *Diantho lumnitzeri-Seslerion*, *Seslerion rigidae*) and one broad alliance (*Asplenio-Festucion pallentis*) with a central position within the order. In our recent contribution, the two of the delimited alliances, *Bromo pannonici-Festucion pallentis* and *Diantho lumnitzeri-Seslerion*, together with all subordinate associations were reproduced by formal definitions based on species composition and cover. Ecological differences were evaluated using Ellenberg indicator values. Diagnostic species and distribution maps for particular associations were provided. Our study confirmed differences between the two alliances. Besides distinct floristic composition, these alliances also represent different ecology and different phytogeographical histories (petrophytic variants of a dry continental steppe vs. relatively mesic refugial habitats with dealpine species at low altitudes, probably remnants of the Pleistocene steppe-tundra). The following researchers also contributed to the data set and concept development: Gheorghe Coldea, Claudia Biţa-Nicolae, Zoltán Botta-Dukát, Andraž Čarni, János Csiky, Mirjana Ćuk, Jürgen Dengler, Daniela Dúbravková, Annamaria Fenesi, Ružica Igić, Zygmunt Kącki, Roman Kish, Joanna Korzeniak, Daniel Krstonošić, Ladislav Mucina, Tamás Rédei, Eszter Ruprecht, Zvjezdana Stančić, Iveta Škodová, Lubomír Tichý.

Financial support was provided by the grant VEGA 02/0027/15.

Favourable Reference Values for Natura 2000 habitat types

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Conservation status (CS) is a key concept in European nature conservation laws and policy since the aim of Habitats Directive is to restore or maintain a favourable conservation status (FCS) for all species and habitats included in the Annexes of the Habitats Directive (HD). In order to assess the CS under this Directive, it is necessary to determine Favourable Reference Values (FRVs) for the range of habitat types and species (FRR), for area of habitat types (FRA) and for population size of species (FRP). FRVs are key reference levels to define in specific terms when FCS is being achieved for individual species and habitats.

The 2013 reporting under Article 17 has shown that FRVs are often inconsistently applied across Member States. Unlike for species populations, for habitat types only few scientific publications exist on the amount and range requirements, for example on the minimum distribution or area for the long-term survival of its characteristic species and functioning. Conceptual differences between Member States in defining and setting FRVs lead to very different interpretations about the goals to be achieved under the nature directives.

In order to achieve a more harmonised approach for establishing FRVs, the European Commission DG ENV issued a call for tenders for the service contract 'Defining and applying the concept of Favourable Reference Values for species and habitats under the EU Birds and Habitats Directives' (ENV.B.3/SER/2015/0009). Support the development of methodologies and guidance on how to establish FRVs including testing of these methods.

In the project a step-wise approach is proposed for the assessment of FRVs for habitat types. The approach consists of three steps: (1) gathering information on the ecology, spatial distribution, functioning and a historical perspective of the habitat, (2) analysis of the current distribution and area and the trends in these parameters, (3) assessing Favourable Reference Area, and (4) assessing Favourable Reference Range. The steps differ, depending on the type of habitat (spatial distribution, functioning), the trends (negative, stable, positive) and the availability of data. In general two approaches may be followed. Firstly a reference based approach, in which the FRA is determined based on historical reference data. For this approach guidelines are given on the level of restoration needed under different conditions. The second approach is model based, and may consist of modelling the required minimum area of good functioning, followed by upscaling to national/biogeographic level, or the potential distribution or area that can be reached maximally. Both approaches are illustrated by examples of habitat types from the Netherlands and Italy.

The collection of wild orchids for Salep

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Salep is an ingredient for drinks, ice or traditional medicines that is made of bulbs or tubers of wild orchids. Especially different species of *Orchis*, *Anacamptis, Ophrys* and *Dactylorhiza* are used as salep in countries in the eastern part of the Mediterranean and the Levant (a.o. Turkey, Greece, Syria, Iran) and for that purpose also collected in some adjacent countries (Albania). About 1000 to 4000 bulbs are needed for one kilo of salep. Therefore every year millions of bulbs are dug up during the flowering season of the orchids, bulbs are removed and the remaining plants are thrown away. In cases this lead to the local extinction of species. Also in North-Western Europe increasing cases of orchid "harvesting" for salep have been recorded, likely by immigrants from the East-Mediterranean region.

In 2017 Wageningen University and Research, in collaboration with Naturalis Biodiversity Centre, started a study on providing alternatives for the harvesting of several wild plants, including orchids used for Salep. The study has two focuses: (i) the growing and producing of (hybrid and traceable) orchids which can be used as an alternative food product (in co-operation with commercial orchid growers), and (2) the development of alternative methods of "harvesting" and local awareness raising in a case study area. One part of the second research is an inventory of areas in which orchid harvesting occurs.

We will use the EVS meeting in 2017 to carry out a first inventory of the problem.

For this we invite participants to fill an enquiry form for their country and indicate whether collection of orchids for Salep is known in their region, which species are harvested, and how severe the problem is, in relation to the conservation of biodiversity. Participants are also invited for possible co-operation on the topic in future.

Variability of *Robinia pseudoacacia*-dominated communities in Europe

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Black locust (*Robinia pseudoacacia*) is one of the most widely planted non-native trees in Europe. It is used mainly for timber, afforestation of non-forest habitats and as melliferous plant. At the same time it widely spreads on its own, penetrating wide spectrum of habitats and environmental conditions. During four centuries it was able to spread throughout almost the whole continent forming stable forest communities with characteristic species composition. Still its position in the phytosociological system is widely discussed and during the last decades various authors placed the *Robinia*-dominated stands even to different classes – into shrub communities of *Rhamno-Prunetea*, anthropogenic communities of *Artemisietea* or *Galio-Urticetea*, and forest communities of *Querco-Fagetea*, *Quercetea pubescenti-petraeae*, or *Quercetea robori-petraeae*. Nowadays majority of authors place them in the separate class *Robinietea pseudoacaciae*, however there is a lot of confusion inside the class. Authors in various countries used different concepts and names for alliances and associations, moreover variability and distribution of several associations in different countries is also not fully known. The aim of the presented study was to evaluate the variability and distribution of the *Robinia*-dominated communities in Europe, based on the analysis of the phytosociological relevés from the EVA and Sophy databases and our own published and unpublished data. From the original dataset of 10153 relevés with presence of *Robinia pseudoacacia* we have eliminated relevés i) with the abundance of *Robinia pseudoacacia* lower than 50%, ii) smaller than 100 and larger than 500 m2, iii) with cover of other tree species higher than *Robinia pseudoacacia*. The resulting dataset consisted of 1936 relevés. The dataset was than analysed by set of cluster analyses using various combinations of similarity coefficients and clustering algorithms. The most stable clusters were than used as a base for semi-supervised classification of the remaining relevés in the JUICE software. Diagnostic and differential species for each cluster was obtained using JUICE software and presented in synoptic table. Preliminary results reveal presence of well-known and stable associations, such as *Arrhenathero elatioris-Robinietum pseudoacaciae*, *Anthrisco cerefolii-Robinietum pseudoacaciae*, or *Chelidonio majoris-Robinietum pseudoacaciae*, even though the dataset needs further analyses. Final results will be presented at the conference.

This contribution was supported by grant VEGA 2/0051/15 and long-term research development project no. RVO 67985939.

Methodology for the identification of habitat types in Turkey mirroring descriptions of EUNIS and Natura 2000

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According with the EU regulation, the potential inclusion of new territories in the Natura 2000 network requires submitting a proposal of species and habitat types that require protection. As a first step prior the negotiation with the European Commission, in consultation with the existing member states and with the European Topic Centre on Biological Diversity, it is necessary to create preliminary lists of habitat types following the same principles and criteria used in Europe.

Here, I present the methodological framework that has been used to create habitat lists in Turkey for the project "Technical Assistance for Strengthening the National Nature Protection System for Implementation of Natura 2000 requirements" supported by the European Union and the Republic of Turkey. The underlying principle for this framework was to create a comprehensive list of all habitats occurring in Turkey following the classification of EUNIS as a guidance. Although a comprehensive classification of vegetation in Turkey doesn't exist yet, this approach made use of the phytosociological descriptions that are available for certain habitat types.

The identification of European habitat types in Turkey was developed through three phases: (i) developing preliminary lists and descriptions of EUNIS habitat types for the three biogeographic regions of Turkey; (ii) a critical review of the EUNIS habitat types, proposal of new habitats and crosslinks with the habitats of the Directive described in the Interpretation manual (EUR28); and (iii) description of the habitat types of the Directive (EUR28) recognized in Turkey and proposal of new ones following similar criteria.

The development of these phases was done in coordination with more than 20 Turkish experts that collected botanical data and participated in special seminars to discuss habitat classifications and biogeographical boundaries. A group of Turkish botanists were responsible of generating habitat descriptions that were standardized in a unique format to ensure similar standards for the three biogeographic regions. This documentation resulted in the first comprehensive compilation of EUNIS habitat types for Turkey and also in a preliminary draft of the "Interpretation Manual for Annex I Habitats in Turkey" for further discussions between the Republic of Turkey and the European Union.

New data about the ecology and floristic structure of the communities of *Genista lydia* complex in Bulgaria - vulnerable habitat (F3.1d) from the Red List of European habitats

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The communities of *Genista lydia* complex (incl. *Genista rumelica*) are a part of the sub-endemic Balkan-Anatolian vegetation. They are open low heathlands occupied some volcanic rocky substrates with pronounced Mediterranean climatic influence. They are distributed in Europe exclusively in North-East Greece and South Bulgaria. Their habitat - F3.1d Balkan-Anatolian genistoid scrub, was assessed as "Vulnerable" in the Red List Assessment of European Habitats. But their ecological and floristic features were practically not known until now. The recent study provide detailed information based on more than 115 phytocoenological releves for their chorology, ecology, floristic structure and preliminary data for the classification of these communities in Bulgaria. About 420 species were established to participate in their floristic structure. The main regions of their distribution in Bulgaria are East Rhodope, Thracian Plain, southern slopes of East Balkan Range Mt., Valley of Mesta River, etc., where the phytocoenological material have been collected.

A cocktail of tall emergent vegetation - *Phragmitetalia, Bolboschoenetalia maritimi* and *Magnocaricetalia* (WetVegEurope results)

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During the last years great progress has been achieved towards unifying vegetation classification at the European scale. Thanks to the European Vegetation Archive (EVA), the new database software TURBOVEG 3, and the program for data analysis JUICE 7.0 a huge amount of vegetation plots from all around Europe has become more accessible and relatively easy to manipulate. Several vegetation classification projects have been launched.

Since 2013, the project WetVegEurope is developing a consistent formalized phytosociological classification of European aquatic and marsh vegetation to be used as a tool for nature conservation. The project deals with the *Lemnetea, Potametea* and *Phragmito-Magno-Caricetea* classes. However we present here only a part of the results – the general classification protocol and the resulting formalized phytosociological classification of the orders *Phragmitetalia, Bolboschoenetalia maritimi* and *Magnocaricetalia* up to the association level.

The data were extracted from WetVegEurope (GIVD code EU-00-020), a database created specifically for this project and containing 375 654 vegetation plots from 33 European countries. The data preparation and all the analyses were performed with the program JUICE 7.0. The initial data set used contained plots with the occurrence of at least one diagnostic species of *Phragmito-Magno-Caricetea* (according to the main European literature). The data set was subsequently stratified and resampled according to the country of origin and pre-existent phytosociological classification. The method used for formally classifying the vegetation follows the principles of Cocktail classification using species groups (Bruelheide 1995, 2000), however a specific classification protocol was created for marsh vegetation. Such a protocol includes all the criteria, rules and steps, which led to our final classification. We produced logical formulas for automatic assignment of vegetation plots to phytosociological units – orders, alliances and associations. This study presents different classification solutions with related issues and their potential use. It also provides a model protocol that could be applied for unifying vegetation classification at European scale.

Recruitment of forest plant species (*Fagetalia*) after anthropogenic disturbances in beech forests

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Questions: The main threat to beech forests is the anthropogenic exploitation, due to wide applicability of beech wood. This leads to the depletion of understorey specialists and disturbance in the diversity of beech forests. Here we ask how management affects recruitment of *Fagetalia* understorey species in subsequent stages of beech forest regeneration?

The aims of the study are 1) to investigate relation between diversity of beech forest and the stands' age along environmental gradients, 2) to reveal distribution and diversity patterns of understorey species after anthropogenic disturbances, 3) to study recruitment of beech forest species in relation to history of management, type of neighboring stands and environmental conditions.

Location: Poland, Sudety Mountains

Methods: Sampling area is covered by old forest (at least 300 years). Natural vegetation for this area is acidophilus and basophilous beech forests. Historical forest management is long-term documented (about 100 years). The space-for-time substitution approach was used in this study. The study area was divided into several age forest stands: <20, 20-60, 60-100, >100 years. The reference sampling plots were randomly located in the oldest forest stands. The next plots were located in different age stands adjacent to the reference plots. Vegetation data was collected from plots of a size 10 m^2. Additionally, trees age, tress height and canopy density, renewal type (spontaneous or forced), soil samples for seed bank and pH measurements, humus depth, slope, exposition was collected.

Conclusion: This study will provide recommendations for the future management planning enhancing recruitment of beech forest specialists.

Meadow steppes of the southern Urals in latitude gradient

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Palaearctic steppes, one of the widely distributed and endangered biome in the temperate zone of Eurasia, are traditionally attractive for researchers. The substantial part of these grasslands is represented in Russian Federation. However, studies of Southern Ural steppes are not sufficient at the present. This territory is considered as a boundary between Europe and Asia. Floristic composition of plant communities is influenced by both regions species pool there. So the differentiation of steppe types is complicated and additional numerical methods are needed for syntaxonomical decision. We aimed to (i) reveal the diversity of Pre-Urals meadow steppes, (ii) to study its floristic composition on latitude gradient and (iii) to develop syntaxonomy.

The dataset contained 200 georeferenced plots relevés included in South Ural non-forest vegetation database (GIVD ID 00-RU-006). Plots were located in spatial range (North-South) about 550 km length (from 56.01°N 59.03°E to 51.03°N 52.27°E) within the forest-steppe and steppe zones. There was moisture gradient corresponding with latitude one: annual precipitation ranges from 344 to 592 mm according to worldclim. org data. It was divided in three parts. Analysis of latitude range species distribution with ANOVA-based technique was carried out. As a result moisture factor influence on floristic composition of meadows steppes were determined and indicator species group for different ecological conditions were defined (indifferent or affiliated to any part of moistening gradient). The number of herbage species was determined as indefferent (*Galium verum, Filipendula vulgaris, Festuca pseudovina, Inula hirta, Plantago urvillei, Seseli libanotis, Phlomoides tuberosa)*. They are traditionally included in diagnosis of order ***Festucetalia valesiacae*** Br.-Bl. et Tx. ex Br.-Bl. 1950. At the other hand, a number diagnostic species of order ***Helictotricho-Stipetalia*** Toman 1969 were determined as indifferent too (*Potentilla humifusa, Carex supina, Scorzonera austriaca, Euphorbia subcordata)*.

A number of grasses steppe dominants (*Stipa pennata, Stipa capillata, Poa angustifolia)* and herbs (*Fragaria viridis, Campanula sibirica, Adonis vernalis*) were determined as affiliated to north (most mesic) part of moisture gradient. These are mostly ***Festucetalia valesiacae*** diagnostic species. For south (most xeric) part of gradient mostly ***Helictotricho-Stipetalia*** diagnostic species were determined as affiliated (*Poa transbaicalica, Stipa zalesskii, Artemisia austriaca, Achillea nobilis, Veronica incana)*.

Then all relevés were classified using the TWINSPAN algorithm with JUICE 7.0 software. Proportion of species of different indicator groups was used to determine allocated syntaxa position in high-rank subdivision of class ***Festuco-Brometea*** Br.-Bl. et R. Tx. in Br.-Bl. 1949.

Eight associations were allocated, the tree ones belong to European steppes of ***Festucetalia valesiacae*** and five another - to continental temperate grasslands of Western Siberia and North Kazakhstan of ***Helictotricho-Stipetalia*.**

Joint optimization of cluster number and abundance transformation for obtaining stable vegetation classifications

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The choice of abundance transformation and the number of clusters are among the most important methodological decisions influencing the outcomes of vegetation classifications. The optimal number of clusters is routinely sought for by calculating cluster validity indices (e.g. Optimclass, average silhouette) for classifications of different number of clusters. In contrast, there are very few examples in the literature when the optimal abundance weighting is selected on the basis of evaluating classifications made by systematically changing the data transformation function.

Here we present a protocol for finding the combination of abundance transformation function and cluster number which results in the most stable, that now we deem the 'best', classification. We show how the optimal values of these two variables co-vary, and how different decisions on any of them can change the classification patterns.

We used real data sets representing Hungarian grasslands, European wetlands and Australian kwongan vegetation, as well as simulated data for testing relationships between abundance weighting, number of clusters and stability. We classified the data sets with changing cluster number and exponent of the power transformation in all possible combinations using the partitioning around medoids non-hierarchical method. The stability of classifications was assessed by mean Goodman & Kruskal's lambda. The stability values are plotted on a heat map where the horizontal and the vertical axes are defined by the exponent and the cluster number, respectively, and the color intensity of the cells reflect the stability obtained by the actual combination of parameter values. Thus, the most stable classification can be found at the most intensively colored cell.

The relationship between optimal values for the exponent and the number of clusters varied significantly among data sets. In cases of data sets with uneven abundance distribution of species within plots, very different numbers of clusters proved optimal when low and high weight were given to the most dominant species. In contrast, when species abundances varied less, the optimal number of clusters changed little along different values of the exponent. Nevertheless, classifications with the same number of clusters but different abundance transformation can reflect significantly different biological processes. The mean Goodman & Kruskal's lambda successfully identified the optimal number of clusters for the most simulated data sets.

The vegetation of the North of the Iberian Peninsula: history, general trends and human influence

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The northern fringe of the Iberian Peninsula is crossed by a high number of mountain ranges which gather into two great mountain systems: the Cantabrian Range in the west and the Pyrenees in the east, both in a mainly east-west oriented position and connected by means of the Basque alignments. The connection of this peninsula to the European continent is made by a wide isthmus of over 450 km width, which is crossed by the Pyrenees, forming a formidable natural division. The Pyrenees also provide a connection with the rest of the main mountain systems of the Alpine system in Europe. The geographic position of this area, spanning between the 42 and 44º N of latitude, causes the coincidence of the sharp transitional band between the summer dry southern part of the continent, i.e. the Mediterranean climatic and biogeographic area, and the temperate climatic area (Eurosiberian region). This frontier has been moving back and forth along the Pleistocene driven by the climatic changes, in the same way as happened with the altitudinal vegetation belts of the mountains. This has been responsible of many episodes of migration, extinction and speciation in the flora both in the high elevations and in the lowlands. North of this Eurosiberian-Mediterranean boundary the vegetation is dominated by deciduous forests of *Quercus robur* and *Fagus sylvatica* with other typically temperate species such as *Fraxinus excelsior*, *Acer pseudoplatanus, A. campestre*, *Tilia platyphyllos* and *Corylus avellana*, while south of it the forests are formed basically by sclerophyllous evergreen species such as *Quercus rotundifolia, Q. faginea* or *Q. coccifera*. Other vegetation types typical of the temperate dominion are the hay meadows of *Arrhenatheretalia*, the heathlands of *Calluno-Ulicetea*, the hedges of *Prunetalia spinosae*, etc. In the Mediterranean dominion will appear the scrub of *Rosmarinetalia*, the garrigue of *Festuco hystricis-Poetalia ligulatae* and other units adapted to the summer drought.

As a result of the sways of this frontier along the Pleistocene, there are very conspicuous examples of remnant vegetation types in both sides of the border. This means that there are temperate types south of the current frontier, such as beech forests patches or meadows areas, always in north-facing slopes in mountains, and Mediterranean types in the northern side, such as *Quercus ilex* forests with *Arbutus unedo, Phillyrea latifolia* and *Smilax aspera*, thriving in the warmest and driest lowlands of the coastal areas.

The northern Iberian Peninsula shows a large set of examples of living vegetation which current distribution can only be explained by the shifts in plant areas caused by past climate changes. This provides valuable information as clues to estimate the future changes of vegetation driven by the climate change now in motion.

Predicting potential shifts in urban plant communities under climate change

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Urban land-use provides new habitats by creating new combinations of abiotic factors and bringing together species that otherwise would live in different regions of the world or in different habitats within the same region. Current urban plant communities are thus composed of species of different origin and belonging to various life forms. It is likely that different species will respond to current climate change in different ways. The aims of our study were to identify factors which shape composition of European urban plant communities, and to predict their future change under climate scenarios for the 21st century.

The studied 60 cities are distributed across southern, central and north-western parts of Europe. They cover a large macroclimatic gradient with mean annual temperatures from 7.9 to 18.6 °C and annual precipitation from 229 to 1289 mm. In spite of the differences in species composition between these cities, in each of them native species prevail over aliens, and annual and perennial herbs prevail over woody species. According to the considered climate-change scenarios, mean annual temperature in studied European cities can rise by 1.5 to 3.3 °C until 2070, while total annual precipitation is expected to slightly decrease. Our study shows that these changes may lead to changes in urban species composition.

Surprisingly, even under the most severe climate-change scenario no differences were found between future distributions of native and alien species. However it is likely that due to progressing naturalization processes some of already established alien species can enter the invasive stage and spread quickly to new localities. Our results suggest that mainly annual species of Mediterranean origin will increase their occurrence frequency in European urban floras by 2070. In contrast, perennial herbs, woody species as well as most species of the cool-temperate zone will represent smaller proportion of future European urban plant communities in comparison with the present.

Horizontal and vertical structure and its effect on the level of invasion of forest stands

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Even though temperate forests have lower species richness and cover of non-native plants in comparison to some other habitats, such as anthropogenic habitats, wetlands or some grassland habitats, several recent studies from the Central Europe suggest increase in the numbers and proportions of non-native species in the forests. Many studies have already focused on the main factors affecting level of invasions of habitats, however, only very few focused on forests. Forests have more complex structure than majority of other habitats and therefore we aimed to analyze the effect of various vertical structural characteristics (cover of various layers), together with other relevant factors (e.g. elevation, aspect, slope, forest management type, native species, diversity and environmental characteristics of each locality described using Ellenberg indicator values (EIV)) on the level of invasion of forest stands.

For the purpose of this analysis we have used database of forest relevés, included in the Central database of phytosociological relevés of Slovakia together with newly collected relevés that consisted of 10,602 relevés. From the original dataset we have omitted relevés of extreme sizes and relevés collected before 1960. Resulting database consisted of 5,940 relevés. Vascular taxa were classified as either native or non-native (archaeophytes, neophytes), based on the publication Inventory of alien flora of Slovakia. Number and cover of archaeophytes, neophytes and native species were calculated for each relevé using Juice software.

Set of GLMs (R-software) was used to evaluate role of various variables on the number and cover of non-native plant species. According to preliminary results from the structural characteristics, the cover of shrub and herb layer had significant positive association with the non-native species richness and cover of tree layer had significant negative association. At the same time elevation and EIV for moisture were negatively associated with non-native species richness and EIV for nutrients and light were positively associated with the non-native species richness. The results will serve as valuable scientific base for the qualified forest management.

This contribution was supported by grant VEGA 2/0051/15.

Mesophilous mixed deciduous forests (*Carpinion* alliance) in the context of the southwestern Europe

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The mesophilous mixed deciduous forests (*Carpinion betuli* s.l.) play an important role in the vegetation landscape of continental Europe, especially in its central region. Towards southern Mediterranean areas, these forests are increasingly scarce and remain secluded in islands of favorable microclimate, occupying particular phytotopographic situations. In these marginal territories these forests have been classed in vicariant alliances with respect to the Central European Carpinion (*Pulmonario-Quercion* in the Iberian Peninsula), with several plant association described.

Due to their southern location, away from their climatic optimum, these forests occupy topographic positions next to other deciduous forests, with which they share an important floristic pool, which. This is especially relevant with respect to riparian or ravine forests (*Alnion incanae, Tilio-Acerion*). This situation raises two main questions, i.e. (i) the actual entity of these mixed forests in a marginal area, and (ii) their effective floristic differentiation. To evaluate this, we performed a classification of deciduous mixed forests within the framework of all the deciduous forests of the Iberian Peninsula and French Pyrenees. A dataset of 13,600 vegetation plots stored in the SIVIM data bank were used, on which resampling techniques were applied to avoid uneven geographical and floristic bias. To assess the diagnostic species of the vegetation types we applied indicator species analysis. To explain the main patterns of variation in species composition we used projected climatic, biogeographic and Ellenberg variables on a PCA.

At their southwestern European limit, the mixed deciduous forests had a clear floristic entity, although they showed obvious affinities with other ecologically-related forests, due to the important pool of species that is shared. Within this territory, their diversification is primarily related to a biogeographic pattern, which clearly separates the Pyrenean forests from those of the Cantabrian-Atlantic area. Secondary drivers of species composition were altitude, Ellenberg's soil reaction, mean summer maximum temperatures, and Ellenberg's soil humidity.

Syntaxonomically, our results weakly supported the association level, and mainly revealed two group classification at the sub-alliance level. These are the *Polysticho-Corylenion*, closely related to *Carpinion betuli* both ecologically and floristically; and *Corylo-Populenion*, linked to abrupt and mountainous areas. Moreover, our results do not gave support to the alliance *Tilio-Acerion*, which does not appear well defined among other mixed deciduous forests.

Invasive species in riparian tall herb fringe communities of *Convolvuletalia sepium* Tx. 1950 in Poland

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High vulnerability of riparian ecosystems to plant invasions has been documented, as well as negative impact of alien plants on vegetation structure and composition has been stated. Tall herb fringe communities growing along lowland rivers are natural component of riparian landscape and are protected by the Habitat Directive (6430). Due to their specific conditions they are very prone to invasion. For successful protection of this valuable habitat type, it is essential to find main promotors of invasion process. The aims of this study were: (1) to identify invasive plant species present in riparian tall herb fringe communities in Poland; (2) to indicate invasive neophytes which achieved the dominance in invaded patches; (3) to determine factors promoting alien plant species dominance in patches; (4) to evaluate which plant communities are the most susceptible to invasion.

The study material consists of 387 phytosociological relevés containing at least one species considered in Poland as invasive neophyte. The relevés were obtained in 2008-2013 from homogenous vegetation patches covering 4-30 m^2 along randomly chosen parts of Polish river valleys. All the vascular plant and bryophyte species were recorded and their covers (%) estimated. Ancillary data recorded for each plot included: geographical coordinates, slope angle, river size, flow rate, soil moisture content, distance between the vegetation patch studied and the river bed, patch altitude above the river water level, degree of patch shading, plant community, adjacent vegetation type, natural potential vegetation type, dominant form of land use, main anthropogenic factors, number of species, number of aliens, total vegetation cover, relative cover of aliens.

The total pool of vascular plant species was 322, including 21 invasive neophytes. Seven invasive plants were found only in one relevé and achieved a small coverage, with the exception for *Reynoutria sachalinensis*. Following invasive alien plants were the most often recorded: *Echinocystis lobata* (191 relevés), *Solidago gigantea* (101), *Bidens frondosa* (95). For farther analyses 81 relevés with *S. gigantea* were included. The non-parametric Kruskal-Wallis test with the median test proved statistically significant differences in evenness among groups of relevés with different cover-abundance of *S. gigantea*, but differences in species richness and Shannon's diversity were insignificant. Spearman rank correlation analysis revealed significant correlations between the abundance of examined neophyte and the river size, as well as Shannon's and evenness indexes. Discriminant analysis CVA, performed with the CANOCO 4.5 software, showed the variables that best divide the dataset into groups with increasing coverage of *S. gigantea*: the plant community, alien species richness, Evenness, meadow land use type and latitude. *Senecionetum fluviatilis* Müller ex Straka in Mucina 1993 and *Convolvulo sepium-Asperuletum rivalis* Tx. ex Faliński 1966 proved to be the most susceptible to *S. gigantea* invasion.

The study was financially supported by the grants of National Science Centre in Poland, No. N N305231935, N N305018940.

Vegetation of low-altitudinal mesophilous forests in south-western Georgia (Colchic Region)

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The aim of our research is to describe and phytosociologically classify unique mesophilous forest vegetation developed on the slopes of the Lesser Caucasus (80-990 m) belonging to the Colchic Region in SW Georgia. This region is characterized by humid and warm-temperate climate and it is supposed to be an important refugium of forest biota during Pleistocene. Local forests harbour many relict species including evergreen shrubs. This vegetation has not been studied using Braun-Blanquet approach so far.

Chestnut-hornbeam and ravine forests of the study region were documented by phytosociological relevés in 2015 and 2016. Basic environmental characteristics (altitude, aspect and inclination of slope, cover of rocks, potential heat load of site and soil pH) were available for each relevé as well. Subsequently, data were analysed using modified TWINSPAN and ordination analyses (DCA, CCA). Numerical comparison of the distinguished clusters with previously published syntaxa from northern Turkey was performed as well.

The dataset of 53 relevés was divided into three clusters by modified TWINSPAN. Concerning the alliance of Euxinian chestnut-hornbeam forests *Castaneo-Carpinion* two communities were recognized. *Digitalis ferruginea subsp. schischkinii-Carpinus betulus* community were forests of drier sites with low cover of evergreen shrubs, species tolerating dry soils (e.g. *Asplenium adiantum-nigrum*, *Viola alba*) were characteristic for this vegetation. The second type was *Ruscus colchicus-Castanea sativa* community which comprised chestnut-hornbeam forests with well-developed evergreen shrub layer (e.g. *Ilex colchica*, *Prunus laurocerasus* and *Rhododendron ponticum*) and often poor herb layer with frequent occurrence of ferns. Euxinian ravine forests of the alliance *Alnion barbatae* were represented by a community *Polystichum woronowii-Ulmus glabra* containing forests with occurrence of noble hardwood trees and specialists of ravine forests in their herb layer (e.g. *Asplenium scolopendrium*, *Polystichum woronowii*). Numerical comparison with previously distinguished associations in northern Turkey highlighted specificity of recorded communities in the broader context of the Euxinian mesophilous forest vegetation. Thus all three clusters were described as new associations (*Digitali schischkinii-Carpinetum betuli*, *Rusco colchicae-Castaneetum sativae* and *Polysticho woronowii-Ulmetum glabrae*). Ordination analyses indicated that major turnover in species composition is bounded on variables altitude, potential heat load of site and soil pH.

Biomes as a strong fundamental basis for the study of biodiversity geography, conservation of biota and plant communities in Russia

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Biogeographic map "Biome of Russia" (M., 1:7 500 000) developed at the faculty of geography of Lomonosov Moscow State University and is published in the group of nature maps for teaching at Russian universities in the fields of biogeography and ecology. Differentiations of the territory of the country at the regional level on the composition of ecosystems and the diversity of biota for the first time are displayed on the map. The content of the map developed on the basis of the scientific concept of the geography of biodiversity and ecosystems. Species and community of populations of species adapted to the complex conditions of existence, i.e. to the habitat (biotope). The concept of biomes is selected among the possible ways of regional analyses of biodiversity. The biome is considered as a combination of ecosystems of different levels, biota which most effectively uses the abiotic components of the environment as a result of a specific, historically conditioned adaptation to them. The idea of biomes is also based on the concept of geographic dimension of geosystems at the global – regional – local levels.

The map is based on the classification of terrestrial ecosystems-biomes (Walter and Breckle, 1991), which includes three major categories: zonobiome, orobiome (altitudinal belt spectra in the mountains) and pedobiome, where there are large edaphic variants of zonal types. Zonobiome is a large ecosystem that includes a number of interconnected smaller ecosystems that reflects the interaction of climate with regional biota and substrate. Climax communities which are used most effectively of the abiotic components of the environment as a result of a specific, historically conditioned adaptation to them combined in zonobiome. Zonobiomes are divided into regional variants. Orobiomes are still the least developed category in the ecosystem concept. Orobime I-order includes historically complex ecosystems as a single high-belt spectrum, correspond to the current climatic and landscape conditions. It, in turn, is divided into units at the regional level– orobiome II-order, which includes all altitudinal belts that are part of the high-belt range. Special attention was given to the characteristics of vegetation macrostructures and the description of their floristic and faunal components. The regional biomes are central to the study and the units of mapping. The map, which has been compiled at a scale of 1: 7,5 million, contains 94 mapping units, including 35 units of lowland biomes (43 units with geographic variants), related to 6 zonobiomes, and 31 orobiomes (51 units with geographic variants), related to 5 orobiomes- I order. Biome has received a geographical name, the bioclimatic characteristics (in the form of climadiagramm) and number of species of the main groups of terrestrial organisms: of vascular plants, bryophytes (mosses and liverworts) and lichens; of terrestrial vertebrates: mammals, birds, reptiles and amphibians. For orobiomes altitudinal belt spectrum of ecosystems are shown in separate columns. The use of biome as a natural unit for account of biodiversity gives an opportunity of integrated analysis of botanical and zoogeographical information on the biota, as well as a paired study of biotic and abiotic components of ecosystems.

A syntaxonomical survey of the endemic *Astracantha aitosensis* communities in Bulgaria

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*Astracantha arnacantha ssp. aitosensis (*syn. *Astracantha aitosensis)* is a small thorny shrub and endemic subspecies to Bulgaria. It forms specific structural type of communities belonging to the so called thorn-cushion tragacanth vegetation which is differentiated in several locally distributed and floristically autonomous classes in Europe. The communities of *Astracantha aitosensis* are distributed in Eastern Bulgaria and have not been classified according to the Braun-Blanquet approach. They are listed in the Red Data Book of the Republic of Bulgaria and assessed as critically endangered. They occupy hilly rocky or eroded terrains on andesite bedrock and take totally 1220 ha area on the southern slopes of the Eastern Balkan Range in the xerothermic oak belt. In the EUNIS habitats they are designated as Northern Thracian tragacanth hedgehog-heath (F7.4I1) and also affiliated to the Endemic oro-Mediterranean heaths with gorse (4090) in the Habitats Directive. In the Red list of European habitats *Astracantha aitosensis* communities are considered as Eastern Mediterranean mountain hedgehog-heath (F7.4c), assessed as least concern.

The aim of the present study is to determine the syntaxonomical position of *Astracantha aitosensis* communities on the basis of their floristic, phytogeographic and ecological features. A data set consisting of about 50 relevés and almost 200 species was built on the basis of literature data and unpublished ones. Standard hierarchical clustering (UPGMA method) was performed and produced dendrogram with most of the relevés unified in a homogeneous group. The syntaxonomical analysis shows floristic except for physiognomic and ecological relations to the Anatolian class *Astragalo microcephali-Brometea tomentelli* Quézel 1973 not reported for Europe. The present study gives preliminary suggestions on the northwestern extensions and spotted distribution of *Astragalo-Brometea* in Eastern Bulgaria. The analysis is supported by detailed climatic, orographic, floristic and chorological information.

Habitats between land and sea – classification of salt meadow patterns along the southern and eastern Baltic Sea coast

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Along the southern and eastern Baltic Sea, salt meadows form a habitat connecting land and sea. Influenced by more or less saline water with narrow tidal range and shaped through non-intensive land use, this diverse vegetation can be explained through a complex interacting geomorphological and ecological dynamic.

From an international perspective a classification and survey of these salt meadows was conducted, highlighting gradients in species composition. On a dataset of 839 relevés a crispness analysis was conducted searching for optimal clustering method and suitable numbers of clusters. With one global peak at 3 and further local peaks at 6, 9, 11 and 13 clusters k-means analysis, performed with pseudo-species cut levels 0 5 25, showed highest corrected crispness values. Best outcomes could be achieved with 11 clusters whereby additionally further 3 clusters were divided in 2 respectively 4 further clusters manually without rearranging plots through beforehand grouped clusters. Additional a three dimensional NMDS was performed by which explanatory climatic variables and Ellenberg values where fitted *post-hoc*.

Results of non-hierarchical k-means method showed best outcomes with diverse patterns of differentiated vegetation clusters, linked by the occurrence of *Phragmites australis*, *Plantago maritima*, *Glaux maritima*, *Juncus gerardi*, *Triglochin maritima* and *Argentina anserina*. Next to *Therosalicornietea*, *Phragmito-Magnocaricetea* or *Juncetea maritimi*, entire species composition belongs to poly- to euhaline or glycophilous contact communities. 16 vegetation types could be distinguished; some occur along the whole gradient but most of them were obtained on a local level respectively in an eastern or western distribution.

Detailed Habitat Mapping at the Airforce Training Camp of Bardenas (Navarra, NE Spain)

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Bardenas Reales are in Navarra, in the upper part of Ebro Valley (NE Spain) and cover an area of 41.845 ha of common land. Most of the landscape is steppe-like, treeless or with scattered trees, with wide open spaces. The main land uses are sheep grazing and crops. Since 1950 there is an Airforce Training Camp with an area of 2.244 ha where grazing is very limited and there are not crops.

The objective is to know the habitat types, especially those considered of European interest under the Habitat Directive, in the Airforce Training Camp and the area comprised by the road that surrounds this Camp, 2.725 ha in total.

The field work consisted of walking tours previously digitized on-screen and transferred to a GPS unit. The tracks where designed in order to cover the whole territory, taking into account geomorphology and vegetation patches as shown in orthoimages. Observation of habitats as well as indicator species where recorded and photographs taken. These observation and photographs were projected on orthoimages to be the basis of the on-screen digitizing of the map polygons; the map has been projected at 1:25.000 scale. Each polygon is related with a database where habitat types, percentage cover and conservation status are recorded. Conservation status was assessed taking into account habitat structure, plant species and signs of degradation.

There are 47 map units or habitat types, 41 are natural or seminatural habitats and 6 are crops and other artificial habitats. The main habitat types according to the area that they cover are *Lygeum spartum* steppes (Habitats Directive 1550, 1510*), *Artemisia herba-alba* and *Salsola vermiculata* halo-nitrophilous scrubs (1430), and bare ground. Bare ground, called locally "blanquizales" (literally the white places) are a very singular feature of the landscape related with the erosive processes that shape the mesa (terrace) hills.

Other frequent habitats are *Suaeda vera* halophilous scrubs, *Stipa sp. pl.* grasslands and *Dorycnium gracile* scrubs, common in gullies and land depressions. Among the artificial habitats, those related with the military use and crops are the most extended. In the craters generated by the impact of projectiles, colonization by different plant communities take place, from submerged beds of *Ruppia maritima* and *Potamogeton sp.* to common reed (*Phragmites australis*) or *Typha sp.* beds, sometimes with scattered tamarisk thickets in their edges.

Potential Natural Vegetation Map of Navarra (NE Spain), 1:25,000 scale

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The Potential Natural Vegetation Map of Navarra covers an area of 10.391 square kilometres of a territory placed in NE Spain, from the Eastern Cantabrian Mountains and Western Pyrenees to the upper Ebro Basin. Vegetation is very diverse, related with the strong climatic gradient that draws the borderline between the Eurosiberian biogeographical region northwards and the Mediterranean region southwards; altitude ranges from 15 m to circa 2,500 m. Along this gradient of 150 km vegetation types change from alpine grasslands, subalpine coniferous forests and eurosiberian collinar and montane forests (*Pinus sylvestris, Fagus sylvatica, Quercus robur*) to submediterranean marcescent forests (*Q. pubescens, Q. faginea*), mediterranean broadleaved evergreen forests (*Quercus ilex*), Aleppo pine forests (*Pinus halepensis*) and high maquis (*Q. coccifera, Pistacia lentiscus*).

The method of integrated phytosociology (Rivas-Martínez) has been used to describe and map vegetation and the Braun-Blanquet approach to sample and classify plant communities. Mapping units have been defined taking into account the dynamic relationships of the main plant communities and their spatial distribution.

Field work has been done through stratified sampling, taking into account actual vegetation, geology, geomorphology, soils and climate. 2.981 phytosociological relevés have been done, including 62.813 records of 1.364 taxa. The relevés were classified by tabular comparison and multivariate analysis (Twinspan, DCA, CCA) identifying 137 associations and plant communities and 236 subassociations or subtypes. In addition to our own data, maps of actual vegetation as well as previous potential natural vegetation maps have been used to establish the limits of the mapping units; for selected taxa species distribution modelling (Maxent) has been performed, when field data were not enough to infer their potential distribution. Map digitalitation has been done on-screen on digital orthoimages, and the map has been projected at 1:25.000 scale.

The Potential Natural Vegetation Map of Navarra consists of 142 mapping units (vegetation subseries) grouped in 48 vegetation series and geoseries. Subseries are intended to show the internal variability of series, and are distinguished by their substitution stages or floristic composition of the mature stage. The variability within a series can be related with climate (thermotypes, ombrotypes), soil or lithology (pH, bedrock resistance, etc,) and sometimes by historical factors (vegetation relicts).

The mapping units are closely related to climate, geomorphology, phytogeography and land-use of the territory, and therefore are a good proxy of landscape features; they can be used as a basis to land evaluation models and climatic classifications.

This map can be downloaded at http://idena.navarra.es; further information is available at: http://www.cfnavarra.es/agricultura/informacion_agraria/MapaCultivos/htm/index.htm

Classification and biogeography of Iberian mires

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Mires of the vegetation classes *Oxycocco-Sphagnetea* (ombrotrophic bogs) and *Scheuchzerio-Caricetea fuscae* (minerotrophic fens) have one of their southern distribution limits in the Iberian Peninsula, where they thrive exclusively in mountain ridges and along the Atlantic coast. Despite some impoverishment in plant specialists in comparison with temperate and boreal regions, several plant associations have been described on the basis of floristic differences. However, we are lacking a comprehensive synthesis of the main vegetation groups of Iberian mires, while the climatic basis of their distribution remains obscure.

Here, we aim to unveil the main biogeographic patterns of mire vegetation by means of a numerical classification of vegetation plots and the environmental drivers of their distribution. We gathered the Iberian and French Pyrenean mire vegetation plots stored in SIVIM (EU-00-004) and BIOVEG (EU-00-011), as well as unpublished data. We performed a heterogeneity-constrained random (HCR) resampling for each 10 × 10 km UTM. We then computed the Twinspan classification and calculated species indicator values for each group. We performed a PCoA ordination and projected climate data and Ellenberg indicator values on it. Rarefaction curves were finally used to compare species diversity between groups.

We obtained a seven-group classification following the Silhouette Weighted Average as a cluster level stopping criterion. Iberian mires were first split into mountain and Atlantic mires. Among mountain mires, alkaline fens were separated from acidic fens. Atlantic bogs and fens were both split into low mountain and relict coastal communities. All groups could be identified by a combination of indicator species. Macroclimatic variables were the first drivers of species composition, whereas local variables, namely Ellenberg's fertility and soil reaction were secondary. When mountain and Atlantic mires were considered separately, the first ones were mainly determined by local drivers and the second ones by climate. As for species richness, the poorest community-types were the Atlantic mires and the richest the mountain ones.

Iberian mire vegetation proved to be diverse. At coarse-scale, it mirrors the contrasting climatic conditions of the Iberian Peninsula, despite mire vegetation is often regarded as azonal. Nutrient input mode (ombro- vs. minerotrophic conditions), that allows splitting mire into bogs and fens, is a secondary driver of vegetation composition likely due to impoverishment of bogs in specialist species.

New insights to the bioclimatic map of Italy

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The Worldwide Bioclimatic Classification System of Rivas-Martínez, is a bioclimatic classification widely used in the vegetation science, geobotany and landscape ecology. It is known that the macrobioclimates for Italy are two: i) the 'Mediterranean' characterized by at least two arid consecutive summer months; ii) and the 'Temperate' without any summer aridity. Between the two macrobioclimates there is an ecotonal and transitional area: the Submediterranean bioclimatic variant of the temperate macrobioclimate classifiable into six levels according to the latest WBCS.

This submediterranean area has been recently highlighted for the original phytocoenotic, syntaxonomic and habitat (sensu 92/43/ECC Habitats Directive) diversity that is hosted. In fact, there are many submediterranean syntaxa described as part of the Italian Vegetation Prodrome and adopted at the continental level in the European vegetation checklist.

Until now, for Italy, only one complete bioclimatic WBCS map at the national scale was produced. This map, however, shows two critical aspects: i) as it is based on global climate surfaces of WorlClim inherits its spatial accuracy limits; ii) the submediterraneity levels were mapped in a simplified form.

Therefore, the present work aims to update the bioclimatic WBCS map of Italy: improving the spatial accuracy of the climate surfaces (especially the precipitation) through the calibration (regression-kriging - RK) of the 'WorldClim' surfaces with a dense point dataset of local meteorological observations; and mapping in detail the ecotonal subMediterranean area with its distinct levels.

The RK as the calibration process was effective on a national scale: much of the climate surfaces have a satisfactory global spatial accuracy and then ensured for proper mapping of all WBCS bioclimatic units of Italy (scale 1:2,500,000).

The Mediterranean macrobioclimate occurs in 39.4% of the Italian territory while the Temperate macrobioclimate 60.6%. The Temperate macrobioclimate is divided into: Eutemperate, Submediterranean and Steppic.

The Italian subMediterranean area, as well as important for its original and high phytocoenotic, syntaxonomic diversity, was of considerable extent: it occupies 57% of the Temperate Macrobioclimate and 34.8% of the entire Italian territory with the levels as follows: Extremely weak (4 %); Highly weak (6%); Weak (9.5%); Strong (10%); Highly strong (5.2%). Furthermore 8 bioclimates (considering the bioclimatic variants); 7 Continentality types, 11 ombrothermic horizons and 19 termotypic horizons were mapped.

All maps here produced allowing accurate bioclimatic diagnosis for entire Italian territory and will be useful to support the analysis of the vegetation-environment relationships, ecological modelling, biodiversity conservation and for applied studies of climate change at the national scale.

Richness in bryophytes communities of petrifying springs (*Cratoneurion*) in the Cascata delle Marmore (Umbria, Italy) EEC Special Area of Conservation (Central Italy)

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Petrifying springs with tufa formation (*Cratoneurion*) constitute a priority habitat (7220*) under Annex I of the European Union Habitats Directive (92/43/EEC) due to their ecological significance, vulnerability and small dimensions nevertheless is mostly an under known habitat in the monitoring activities and in the definition of Special Area of Conservation (SACs) of the Habitats Directive (92/43/EEC).

The aim of the work is to show results on the characterization of all the Bryophytes communities present in the Marmore Waterfall (SACs IT5220017). Marmore falls is located in the province of Terni, south-east of the Umbria Region; due to its natural conformation offers lots of environments studied to be studied: waterfall, running water, riverbanks, pools and ponds, dripping rock walls, gorges and caves.

Many of the Bryocommunities found belong to the alliance of *Cratoneurion* Koch 1928 but others, with dominating liverworts and mosses, belong also to different sintaxonomic units e.g. Adiantetea capilli-veneris Br.-Bl. in Br.-Bl., Roussine & Nègre 1952 (see below).

A high biodiversity of mosses and liverworts colonize these sites. The alliance of *Cratoneurion* is being studied for the first time in this region.

Statistical analysis of the 130 brio-vegetational surveys made describe at least 12 associations, which can be included into 9 alliances: *Cratoneurion commutati* Koch 1928, *Pellion endiviifoliae* Bardat 1988, *Adiantion* Br.-Bl. 1931, *Cinclidotion fontinaloidis* Philippi 1956, *Brachythecienion velutini*, *Eurhynchion striati* Waldh. 1944, *Grimaldion fragrantis Smarda* & Hadàc 1944, *Mannion androgynae* Ros & Guerra 1987, *Ctenidion mollusci* Stefureac 1941.

Classification of coastal vegetation of the Rybachy and Sredny peninsulas (Northwestern Russia)

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The only vegetation survey made at this territory was published by A. Kalela in 1939 and did not include the whole territory of the peninsulas. The aim of the study is to find out the coastal plant communities diversity and investigate ecological and floristic features of the vegetation types. The Rybachy and Sredny peninsulas are situated at the 69th latitude and bounded by the Barents Sea; their territories belong to the subarctic tundra. Coastal plant communities are an azonal vegetation, which is regularly disturbed by a sea.

The classification was based on 99 original relevés using TWINSPAN algorithm and following analytical revision. It was carried out with Braun-Blanquet approach. The plant communities were classified into 6 associations and one without-rank group. These syntaxa belong to 4 alliances, 4 orders, and 3 classes (*Cakiletea maritimae* R. Tüxen et Preising in R. Tüxen 1950, *Honckenyo peploidis-Leymetea arenarii* R. Tüxen 1966, *Juncetea maritimi* Br.-Bl. in Br. - Bl., Roussine et Negre 1952).

There is a special change in coastal vegetation while moving away from a sea. Therefore, it is a case of zonation.

Atriplicetum lapponicae communities are common for the low-level beaches. These communities are halo-nitrophilous vegetation growing on sandy and shingle wash margins with seaweed debris. Further from the sea, they are changing by *Mertensio maritimae-Honckenyon diffusae* communities. The sea influence decreases, but amount of seaweed debris is still high on the coastal sand dunes. It is a common place for *Honckenyo diffusae-Leymetum arenarii* communities. *Tripleurospermo–Festucetum arenariae* communities cover the higher-level beaches. The nitrophilous species are common for low-level beaches but they are almost absent in high-level phytocenoses.

Silty and sandy low-level salt marshes are devoted to ass. *Puccinellietum phryganodis*. *Puccinellietum coarctatae* communities are found on the shingle low and middle level salt marshes. The further decreasing of salt seawater influence results in *Junco gerardii-Caricetum glareosae* communities' formation. They take middle and high level of salt marshes.

The Rybachy and Sredny peninsulas saeshore vegetation seems to be typical but having similarities with more western coasts. Communities growing on low and middle salt marsh levels of *Puccinellietum phryganodis* and *Puccinellietum coarctatae* are widespread in arctic and subarctic zones. There is an interesting notice that communities of one more widespread association *Caricetum subspathaceae* were not found on the studied area. The reason of such phenomenon could be a little area taking by salt marsh communities on the peninsulas, which turns out that all vegetation types cannot completely evolve.

Preliminary research on compositional differences between old-growth and secondary coppiced thermophilous oak forests

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The aim of our research was to find out whether (1) the continuity of habitat may influence contemporary species composition of coppiced oak forests; (2) there is a group of species which distinguishes oak forests of different origin from each other; (3) we can select the group of old-growth forest species within thermophilous oak forests.

We focused on thermophilous, coppiced oak forests in SW Poland. Based on archival maps dating back to 1750, 1825-1840 and 1930-1944 we selected two types of patches within studied communities: patches which in 1750 already existed as forests and have remained in this form till now (old-growth forests) and those which were marked on archival maps from 1750 as open areas (fields, pastures) and were converted into forests after this period (secondary forests). Within each type of patches we collected 30 relevés. Compositional differences between old-growth and secondary forests were analysed using the indicator species analysis and ordination techniques (PCoA), whereas their statistical significance was assessed using PERMANOVA and Wilcoxon test. Habitat conditions within two types of patches were specified using Ellenberg indicator values (EIVs).

Based on PCoA and EIVs analysis investigated communities seem to be homogenous. However, more detailed methods suggest that the continuity of habitat may influence contemporary species composition of oak forests, resulting in significant differences, in this aspect, between old-growth and secondary forests (PERMANOVA $F=2.15$, $p=0.018$). The old-growth forests are marked by the occurrence of species typical of both thermophilous oak forests (e.g. *Clinopodium vulgare, Serratula tinctoria, Melittis melissophyllum*) and eutrophic forests (e.g. *Hepatica nobilis*, *Asarum europaeum*, *Sanicula europaea)*. In the secondary forests more important appear to be species of open areas (e.g. *Viscaria vulgaris, Rosa canina, Crataegus monogyna*).

The obtained results suggest that in spite of seeming species and ecological homogeneity, thermophilous, coppiced oak forests significantly differ among each other depending on their age. These preliminary research gives some premises to form the group of species which indicate the continuity of habitats currently occupied by thermophilous oakwoods. This is the more interesting that in this group species commonly considered typical of wet meadows or thermophilous hedges are included. On the other hand, species which have been considered typical of ancient forests, so far, such as *Hieracium sabaudum* or *Poa nemoralis* have higher fidelity in secondary thermophilous oak forests than in the old-growth stands. This raises questions about original range and habitat preferences of these taxa.

Sierra de Guadarrama National Park: Biogeograhic and Bioclimatic Maps

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Biogeographic and bioclimatic maps for the Sierra de Guadarrama National Park are shown in the present study. The biogeographical proposal is up to the country level.

All the biogeographic units recognized in the study area belong to the Mediterranean region and to the following provinces, subprovinces, sectors, districts and countries:

— Central Iberian Mediterranean Province (Provincia Mediterránea Ibérica Central)
Castilian Subprovince (Subprovincia Castellana)

- *Castilian Duero Sector (Sector Castellano Duriense)*

  Tierra de Pinares District (Distrito Terrapinariego)
  Arévalo and La Moraña District (Distrito Arevalense-Morañés)

- *Celtiberia and Alcarria Sector (Sector Celtibérico-Alcarreño)*

  Segovia District (Distrito Segoviano) (two countries)
  High Alcarria District (Distrito Altoalcarreño) (one country)

— West Iberian Mediterranean Province (Provincia Mediterránea Ibérica Occidental)
Carpetanian and León Subprovince (Subprovincia Carpetana Leonesa)

- *Guadarrama Sierran Sector (Sector Guadarrámico)*

  Ayllón Sierran District (Distrito Serrano Ayllonense) (one country)
  Riaza District (Distrito Riazano) (one country)
  High Guadarrama Sierran District (Distrito Serrano Altoguadarrámico) (eight countries)

From a bioclimatical point of view, the territory belongs to two macrobioclimates: Mediterranean and Temperate with submediterranen bioclimatic variant. The thermotypes recognized in the study area are: mesomediterranean, supramediterranean, supratemperate and orotemperate (submediterranean).

Diagnostic species of european habitats of semi-natural grasslands in the Iberian Peninsula

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European Directive habitats of semi-natural grasslands are widely represented in the Iberian Peninsula by the dry and semi-dry calcareous grasslands of the *Festuco-Brometea*, *Nardus* grasslands, hay meadows and *Molinia* meadows. The identification of their characteristic species is needed to evaluate and monitoring the conservation status of these habitat types, and to establish restoration programs.

The aims of this study are (1) to identify syntaxonomical associations that correspond to the Habitats 6210, 6230, 6410, 6510, 6520; (2) to analyze the diagnostic species that can represent a good conservation status; and (3) to analyze those species that indicate a bad representation of the habitat.

A data set was composed of vegetation plots of the previous habitat types and also those on other grassland types that tend to occur in contact with them. The vegetation plots correspond to perennial grasslands (*Festuco-Brometea, Molinietalia, Nardetea, Arrhenatheretalia, Plantaginetalia, Mulgedio-Aconietetea, Trifolio-Geranietea, Agrostietalia*) and perennial anthropogenic vegetation (*Artemisetea, Galio-Urtietea*). We have compiled almost 10,000 plots from the Iberian and Macaronesian Vegetation Information System (SIVIM). A stratified resampling by alliance and 10 × 10 km UTM grid was carried out. The resampled data set was submitted to a k-means classification. Diagnostic species were identified by calculating the fidelity measured by the phi (Φ) coefficient of the species to the resulting cluster.

The number of k-means clusters was selected with the purpose to separate clusters that correspond to European habitats and to extract their diagnostic species. Ordination analysis were used to identify species that were negatively correlated with the diagnostic species for each habitat type. Furthermore, the numerical classification was compared with the traditional classification system at the alliance level.

Beyond the European Red List: How can we improve assessment of habitat condition and endangerment?

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The European Red List of Habitats presents the first comprehensive and systematic assessment of the threat level of all terrestrial and freshwater habitats across Europe. Using a typology based on the EUNIS habitat classification at level 3 and a modified version of the IUCN Red List of Ecosystems assessment methodology, it relies mostly on data for extent, range, and changes in extent and quality over the past 50 years to assign each habitat to the categories Critically Endangered, Endangered, Vulnerable, Near Threatened and Least Concern.

The project also offered an opportunity for a brief critique of current approaches to Red Listing but, looking forward to likely needs for assessments of habitat condition and endangerment, this paper will review some key questions that still face us. The aim is to stimulate an ongoing discussion about how to improve the methodology for scientific understanding and the administration of environmental protection policy, across Europe and in particular countries.

What difference does the typology of habitats make to the end results of assessment? What exactly is 'habitat quality' and how can it be categorised and quantified? What are the feasible time scales (50 years? 250 years?) across which past changes in extent and quality might be assessed? What other criteria might be included: habitat dispersion, recoverability after damage, cultural values? Should the criteria be applied sequentially, in parallel or in some kind of algorithm when calculating endangerment? How best can data from separate countries be combined into a single European assessment? Are the existing categories of threat and their thresholds adequate to summarise endangerment?

Combining vegetation and pollen data to improve palaeoecological interpretations

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Fossil pollen analysis is one of the classical tools of the palaeoecological reconstruction of vegetation history. Although it has been used for more than a century, its methodological limitations are not often sufficiently reflected in palaeoecological interpretations. In this respect, a quantitative modelling approach (such as the Landscape Reconstruction Algorithm of S. Sugita) can be helpful. It involves not only evaluation on fossil pollen data, but also the quantification of the relationship between the composition of recent pollen spectra and recent vegetation in the study area and also some assumptions regarding pollen dispersal. While working on a palaeoecological project focused on the modelling of past vegetation in a forest-steppe landscape of southern Moravia (Czech Republic), we were able to compare the composition of local pollen assemblages and local vegetation. Our results provided pollen picture of this characteristic landscape and challenged traditional palaeoecological interpretation of several pollen taxa.

Implementation of landscape ecological planning principles in forest management

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With 3.8 million ha of forests or 57 % 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.

The vegetation of Northern Europe, including Latvia, is about 10 000 years young and formed in Holocene after the last glaciation. Species composition/plant communities have changed along with changes of the climate and quarter-geological processes. However, during the last millennia human impact on natural vegetation has increased significantly till the stage where most forests are artificial while looking natural.

Functional management of forests covers various aspects, the basis of longterm sustainable development is to balance interests of nature conservation and economics, including timber production. Since 2010, great attention has been dedicated to implement these - towards nature, aims.

Existing data - 1.62 million ha of forests, 220 000 ha other lands, shows quite high diversity of the European Union importance habitats. Until now, data on the European Union importance forest habitats are based on concrete mapping records. On the basis of mapped habitat structural quality and distribution data it is possible to analyse the distribution pattern according landscape regions and ecological requirements of certain forest habitat ecological groups. We divided all mapped European Union importance habitats into three ecological groups according to natural disturbance theory of Boreal, Hemi-Boreal region forests: different age group or cohort group, succession group and inner gap dynamic group. Afterwards, significant criteria of the habitats, as dominant tree species and age, were calculated applying discriminant method and reference area for each ecological group were set. So, it was possible to develop landscape ecological network, from stable core areas, ecological corridors and dynamic stepping stones.

Specific nature values will require special management measures, such as either non-intervention or active management, which in turn may consists on maintenance, improvement or restoration, or – in landscape – ecological approach, even facilitation of certain habitat types in certain forest massif or landscape region to support ecological network alive.

The voluntary initiative for nature conservation of the LVM, additional to the existing legal requirements, represents a step towards implementation of green infrastructure and improving connectivity of terrestrial *Natura*2000 network, while integrative approaches are considered to be an opportunity for nature conservation of forest biodiversity nowadays.

Potential distribution of minority forest habitat types (Natura 2000) in Slovenia

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The distribution patterns of many minority forest habitat types in Slovenia are not well known. The reason may be that these vegetation types are commonly found in remote or hard to access forest areas where they cover small patches or belts with specific climate, geomorphological or soil conditions accompanied. We focused on the following minority forest habitat types of Natura 2000 in Slovenia: 9180* *Tilio-Acerion* forests of slopes, screes and ravines, 91E0* Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*), 9530* (Sub) Mediterranean pine forests with endemic black pines, 91R0 Dinaric dolomite Scots pine forests (*Genisto januensis-Pinetum*), 9420 Alpine *Larix decidua* forests. The aim of this study is to estimate habitat suitability for selected minority forest habitat types in Slovenia based on climatic, geomorphological and lithological variables.

The data set about habitat types distribution in this study consists of existing vegetation maps and geocoded vegetation data as well as forest inventory data (Slovenia forest service). A stratified resampling of presence/absence points on 5 × 5 km grid was carried out. Climate data were obtained from detailed raster model data (50 × 50 m grid) provided by Slovenian meteorology service. Due to multicollinearity among various climatic variables four of them were chosen: mean temperature, cumulative precipitation, mean air moisture and cumulative solar radiation during the vegetation period. Two bioclimatic indices, temperature seasonality and precipitation seasonality, were calculated in addition. Relief characteristic were evaluated by digital elevation model (DEM) with 12,5 × 12,5 m raster cell where slope, northness, topographic position index (TPI) have been used in the modeling process. We calculated the distance of each point from the nearest watercourse. The data regarding lithology were also used.

Several statistical models (Generalized linear models – GLM, Generalized additive models – GAM) and machine learning methods (MaxEnt, Random forest - RF, Boosted regression trees – BRT, Support vector machines - SVM) were used. In order to ensure the most credible predictions we repeated stratified resampling of presence/absence points several times and cross-validation technique was performed on each data subset. The final ensemble model was calculated by weighted averaging of the most appropriate models according to ROC curve (Area Under the Curve - AUC criterium).

The final models for each habitat type were applied on the 50 × 50 m grid of the forested area in Slovenia. Based on results we can predict locations of these minority habitats with higher probability, therefore we can check these locations with lower time and resource investment and perform monitoring of habitats conservation status. The habitat suitability models will serve also as basis for prediction of selected minority habitat types development regarding climate changes in the future.

New syntaxonomical approach on *Salicornietea fruticosae* vegetation throughout Western Mediterranean territories

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The recent data on taxonomy of *Sarcocornia* genus (perennial *Salicornia* taxa) in western European countries using a combination of morphological, karyological and phylogenetic analyses have led to the recognition of several new taxa in both Mediterranean and Atlantic territories.

An updated review of the current syntaxonomy of the *Sarcocornia* plant communities for both coastal and inland saline territories in West Mediterranean Europe is discussed. More than 700 phytosociological relevés selected from our unpublished field notes and from many bibliographical sources of vegetation studies are compiled and processed using a multivariate statistical analysis (K-means and correspondence analysis).

Biotopes of Dzharylgach Island (northern Black Sea region): classification and conservation

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The island Dzharylgach represents level coastal habitats which are sozological valuable. Coastal ecosystems are among the most vulnerable to anthropic pressure. To preserve these unique coastal systems is necessary to maintain the conditions in which they were formed. Sandbanks which are slightly covered by sea water all the time. Sandy shores whith elongated wavy shapes constantly immersed in water. Vegetation is represented by *Zosterion marinae*. Coastal lagoons. The complex of numerous salt lakes, which form a lake-lagoon landscape with *Zosteretea*. In the summer lake's complex become shallow.

• Salicornia and other annuals colonizing mud and sand. Sludge sediments of coastal wetlands and periodically flooded inland salt lakes mostly inhabit by annual plant. • Inland salt meadows. The lowered flooded areas which occupied by *Festuco-Puccinellietea* vegetation. • Mediterranean salt meadows. Briefly flood coastal areas of brackish water lakes with sandy-silty soils whith communities *Juncetalia maritimi*. • Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*). Plains of loamy salt marshes inhabited perennial shrub (*Salicornietea fruticosae*). • Pannonic salt steppes and salt marshes. Depression, in which salt water seeps in spring stagnates (flat areas with lowered saline meadow and damp salt soils). The vegetation is represented by classes *Festuco-Puccinellietea* and *Thero-Salicornietea*. • Embryonic shifting dunes. The accumulation of sand on top of the beach and near the formed dunes. Vegetation is very tenuous. • Shifting dunes along the shoreline with *Ammophila arenaria*. Coastal shafts along the northern coast of the island with vegetation Elymetalia gigantei. Vegetation is tenuous. Typical plant species for habitats are *Leymus sabulosus* and *Carex colchica*. • Fixed coastal dunes with herbaceous vegetation. Stable dunes with formed vegetation cover with grassy communities of *Centaureo odessanae-Caricetum colchicae*. • Humid dune slacks.Deep wet depression in the dune system with a predominance of *Schoeno nigricantis-Plantaginetum maritimae*. • Pannonic sand steppes. The stable flat sandy areas with a predominance of *Dauco guttati-Chrysopogonetum grylli*. • Mediterranean tall humid grasslands of the *Molinio-Holoschoenion*. Wet slightly saline grasslands are rich by endemic species, including: *Molinia euxina*, *Trachomitum venetum* subsp. *russanovii*. • Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*. Flooded depression in the central part of the island is one of the biggest area relict and rare species *Cladium mariscus*.

It is necessary to neutralize the impact of over-grazing, recreation and consequences of afforestation through regulation of these processes: reducing amount of visitors, the regulation of wild ungulates, restoration of disturbed areas.

Vegetation of Ljubljana

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Urban areas are known for their high plant biodiversity, which correlates with the settlements size as well as reflects a rich habitat mosaic. Territory of the city of Ljubljana includes a wide range of habitats - beside common ruderal and trampled areas, fields, park lawns and fragments of woodland, it comprises also two larger hilly forested areas, a river with some smaller channelled streams and remnants of bog vegetation.

So far we have compiled a set of about 600 relevés, partly obtained by our own recording and partly from the literature, dating back to the year 1942. The most numerously documented are classes of weed, ruderal and trampled vegetation on more or less highly disturbed places; following are the communities of lawns, weakly trampled vegetation and woodland fringes. The remaining are relevés of two larger hilly forested areas on more acidic substrate and reed and sedge beds near streams or other wet places. Vegetation of some classes is only sporadic or very locally present. Still left to be researched are vegetation types of free-floating (*Lemnetea*) and rooted water plant communities (*Potametea*) and the small remnants of a bog (*Oxycocco-Sphagnetea*).

So far we have sampled 87 different syntaxa, included in 16 classes: *Stellarietea mediae* s.l. (25), *Galio-Urticetea* (20), *Artemisietea vulgaris* (10), *Molinio-Arrhenatheretea* (9), *Polygono-Poetea* (5), *Asplenietea trichomanis* (2), *Thlaspietea rotundifoliae* (2), *Koelerio-Corynephoretea* (2), *Bidentetea* (2), *Phragmito-Magnocaricetea* (2), *Rhamno-Prunetea* (2), *Isoeto-Nanojuncetea* (2), *Helianthemetea guttati* (1), *Carpino-Fagetea* (1), *Vaccinio-Piceetea* (1), *Calluno-Ulicetea* (1). Among more than 600 recorded plant taxa, the three most frequent are *Taraxacum officinale* agg. (291 records), *Plantago major* (196) and an invasive alien species *Erigeron annuus* (190).

The problem when classifying synanthropic vegetation is the high frequency of depauperate stands, lacking a good number of characteristic species therefore the use of deductive method for the assignement of relevés is appropriate. On one hand the problem is frequent disturbance of different scales and degrees and on the other hand the groups of plant communities most frequently found in urbanized areas are themselves of more or less transient character.

In comparison to other European cities, Ljubljana seems to be relatively rich in plant communities, which could be due to the high research input and the high abiotic diversity – a geographical position of the city in the temperate climate zone with more exposed thermophilic places, the vicinity of wetter areas of Ljubljana marshes and varying soil types – acidic and base rich.

Vegetation of »baumscheiben« in the Balkans

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So called »baumscheiben« or the area around tree bases enclosed by pavement or stones represent a unique urban habitat. Floristic composition of these areas have been studied by Wittig R. & Becker U. (2010, The spontaneous flora around street trees in cities...), comparing them among Central and Western European cities and a North American one. The results showed a great deal of floristic homogenization.

In May 2016 we have made phytosociological records of this habitat in the capital cities of former Yugoslavian Republics (Ljubljana, Zagreb, Sarajevo, Belgrade, Podgorica and Skopje), adopting the same method as in the previously mentioned study: in every of the 5 chosen city's districts we have made 5 records on »baumscheiben« with no horticultural planting, with at least 30 % plant coverage in the plot and minimum of 5 plant species present.

The number of recorded plant taxa was quite similar across different cities (mean being 98 taxa), with the total number rising to 319 plant taxa. 17 taxa were recorded in all of the cities, including only one neophyte species – *Veronica persica*.

Although the assessed cities are closer to eachother than the Central and Western European capitals, there is a considerable north-south gradient and some other climatic differences between them which make some cities to stand out of the majority. Podgorica is the city with most expressed Meditteranean climatic influence and Sarajevo with it's location in the hilly continental area is the coolest and wettest.

Vegetation changes of a peat bog after unsuccessful restoration

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Mali plac peat bog on Ljubljansko Barje plain (near Ljubljana) is a rare remnant of high/transitional peat bogs in lowlands of southern Europe and one of the southernmost bogs.

Successional changes and drying of peat lead to first restoration attempt by raising water table level and reversing succession. But the raise of water level was too drastic and this resulted in strong changes of plant communities and disappearance of rare and endangered species. With consequently lowering the water level primary plant communities are being established again.

Vegetation was sampled and mapped in three periods: in 1987 (prior the intervention), in 1999 (after the increase of water level) and in 2015 (after gradual lowering of water level). We will present changes of vegetation between these three periods. In recent years bog communities are appearing once again, but with changed species composition.

Primary plant community *Calluno-Sphagnetum* has almost disappeared during intermediate period with high water and was substituted by open water surface and marsh plant communities, common in neighbouring areas (channels, water reservoirs, streams...). In 1987 only 5 peat bog plant communities were present and were replaced by numerous (15) plant communities, mostly from *Phragmito-Magno-Caricetea* class. In recent years, bog communities are developing again, but species composition i altered and impoverished. Ombrotrophic and minerotrophic species are rarer and plant communities appear only in depauperate forms.

Nature conservation efforts show different attitude towards this peatland, but certain plant species are probably permanently lost from Mali plac. For example species *Eriophorum vaginatum* is now extinct in Ljubljansko barje with closest population in Alpine region of Slovenia.

Tracking temporal changes in Italian coastal dunes: first results from a 12-years resurvey of a small area near Rome (Italy)

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Introduction and aims: Revisitation studies are invaluable tools for monitoring temporal changes in biodiversity and assessing the conservation status of particular habitats. In 2017, we resurveyed 56 quasi-permanent random plots originally performed in 2005 along a representative coastal stretch located approximately 100 km south of Rome, Italy. Plots represent the first portion of coastal zonation, ranging from EUNIS cat. "B1.1" to "B1.4". In this study we asked ourselves: 1) Have coastal dune habitats of our study area experienced a floristic change during the last 12 years? 2) Can we attribute this change to a proper "species turnover effect" or rather to a "nestedness effect"?

Methods: A Detrended Correspondence Analysis (DCA) was carried out to describe trends of change along identified gradients, while compositional changes were specifically explored through a beta diversity analysis, performed using Sørensen pair-wise dissimilarity index by comparing presence/absence data of historical and resurveyed plots.

Results and discussion: After 12 years, we observed major changes in the study area: 8% of the historical plots actually disappeared (i.e. showed no plant cover at all). Moreover, we registered a significant change in the floristic composition with high ß-diversity values characterizing all analyzed communities. Partitioning ß-diversity values allowed identifying species turnover (i.e. species replacement through time) as driving the change in most cases (68% of the plots), while a nestedness effect (i.e. species gain/loss through time) was found to characterize 12,5% of the plots. In conclusion, our analyses reveal important changes at habitat level and raise concerns over the fate of coastal dune ecosystems.

The German Red List of Habitats 2017 – adapted methods of assessment and results

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Germany has a long tradition in Red lists of Habitats. Usually approximately every ten years the Red Lists are updated and revised. The 3rd edition of the National Red List of Biotopes finally was published in spring 2017. The German Red List is based on a complete list of all types of habitats occurring in Germany including those types which are actually not threatened. The classification of the marine habitats has been thoroughly revised to account for much more detailed scientific knowledge and to comply with international marine conventions. Compared to the European classification, the German habitat catalogue has a much finer level of detail. The assessment covers a total number of 863 types of habitats in Germany (not considering so called 'technical habitats').

For the first time we introduced a matrix-based assessment which combines the 'National long-term threat'(nTH, including itself both loss of area and quality), the 'Current trend' (T) and 'Rarity' (R) to the Red List-status (RLD). The main motivation for the current revision was the strong request of nature conservation practitioners to establish the Red List as a basis for habitat management decisions. Current needs for action and also conservation success should be clearly reflected by changes in the Red List-status. For this purpose, the 'Current trend', which correlates to the 10-year-cycle of Red List assessment in Germany and a forecast of the near future, was integrated into the assessment procedure. The German approach requests a full assessment of all criteria. Thus it differs from the IUCN procedure wherein the highest risk category obtained by any of the assessed criteria represents the overall risk status. Nevertheless, the basic concept of 'ecosystem collapse' is similar and an approximate translation to IUCN-categories is possible.

About two thirds of the assessed habitat types were assigned with different degrees of 'risk of loss' (RLD). Thirteen marine types of habitats (1.5 %; *Ostrea edulis*/ *Sabellaria spec*.) had to be classified as 'Collapsed'. The proportion of threatened coastal habitats is the highest (82.8 %). Alpine (58.8%) and marine (52.5 %) habitat types represent the least threatened habitat groups. Inland Waters (76.4 %), open terrestrial habitats (68.8 %) and shrubs, trees & forests (69.5 %) show proportions of threatened habitat types above the average (65.1%). However, open terrestrial habitats represent a significant proportion of habitat types classified in the highest threat category '1!' (16.3 %). Whereas negative trends for coastal, marine and freshwater habitats were reduced, negative trends for open terrestrial habitats considerably increased. The ongoing negative trend is mainly caused by the intensification of agriculture accompanied by grassland loss and levelling of site conditions.

The periodically revised Red List functions as a pre-warning system of additional deterioration and of positive developments in nature conservation ("monitoring of successes and failures"). The poster will illustrate the results of the 3rd edition and point out the major enhancements of habitat red-listing methodology in Germany.

Scale dependent results - the experience of EU Red Listing of forest habitats

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The European Red List of Habitats by Janssen et al. in 2016 was the first comprehensive work at EU-level and European level to assess the status of all natural and semi- natural habitats in a highly modified region of the world where cultural developments and human alteration of habitats date back several thousand years. In total 233 freshwater and terrestrial habitats, of which 42 were forest habitats, were assessed on the basis of national territorial data by the Forest Working Group. Experiences from this work revealed a number of critical methodological issues, partially due to incomplete availability of national data, partially inherent to the specific IUCN Red listing methodology.

The following points highlight major issues which can significantly influence the results of the assessment and therefore merit consideration for organizing future Red Lists, or even necessary adaptations in methodology or additional rules for application of the criteria.

1. Incomplete (historical) data in a specific situation, where losses in area, range and also quality often occurred already centuries ago, can lead to a underestimation of the threat category (adequate time-scales for assessment and continuity of occupancy).
2. Forest habitats in Europe occur at different hemerobic levels (mostly different levels of silvicultural use). Pristine forests are almost extinct, while some cultural forms or secondary forest habitats are relatively widespread in particular regions of Europe. Within the red-lists only the type as such but not different hemerobic levels are assessed.
3. The results are scale-dependent spatially (size of assessment area, geographical scope, especially criterion B geographical restriction).
4. The results are scale dependent in terms of the ecological and compositional coarseness or level of detail of the defined habitat types: the smaller the habitat types are split, the higher is likely to be the proportion of habitat types that are assessed as threatened. Also threatened “subtypes” with naturally local or regional distribution have no influence in the IUCN red-listing assessment.

Examples will be given to illustrate these methodological weaknesses and proposals will be made to enhance the red-listing process.

New features of expert systems for vegetation classification

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Classification and standardized documentation of vegetation diversity at the continental scale are extremely important for nature conservation planning, environmental monitoring and ecological research. One of the alternative approaches for vegetation classification of huge data collected from many different vegetation databases across Europe is the development of formalized vegetation classification using expert systems. Our first expert system for assignment of vegetation plots to vegetation units was used to define some associations of Czech vegetation in 2001. Since that time it has been improved significantly. A new generation of expert system tools is efficient in identifying vegetation types across several hierarchical levels of vegetation classification. It can also use some external criteria of vegetation classification such as distribution range, macroclimatic characteristics and bedrock, which supports a broader range of applications not only in phytosociological classification but also in habitat classification. Although most of the new functions were introduced for easier definition of broader vegetation units such as alliances, classes or habitat types, the expert system still remains useful for the classification at fine resolution (association level), at the local scale and with limited amount of vegetation-plot data.

Alien species in nature reserves' flora of the old-cultivated territories in European Russia

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Comparative evaluation of the alien species amount in flora of two reserves of the old cultivated territories of European Russia was done using «Alien plant Species» Data Base, created in the Institute of Geography, RAS (Moscow). The National park "Valdaiskiy" (Novgorodskaya oblast) (NPV) is founded in 1990. It is situated in the northern part of the Valdaiskiy upland on the border of the mixed coniferous-deciduous and southern taiga forest zones. On its area of 150 000 ha coniferous fur and pine forest plant communities dominate.

The State Nature Reserve "Privolgskaya lesostep" (Penzenskaya oblast) (PV) is founded in 1989. It occupies the territory of 8370 ha in the south-western part of the Privolgskaya upland in the forest-steppe zone. The main plant communities are mixed pine and oak forests and meadow steppes. NPV vascular plants flora includes 746 species of 107. In PL the whole amount of vascular plants species is 852 species of 98 families. The spectrum of ten main families in two reserves is similar: *Asteraceae*, *Poaceae*, *Rosaceae*, *Caryophyllaceae*, *Fabaceae*, *Ranunculaceae*, *Lamiaceae, Scrophulariaceae*, *Apiaceae*. But the number of *Cyperaceae* species considerably diminishes in PL.

The share of alien species is 18% (133 species of 42 families) in NPV and 11% (97 species of 29 families) in PL. *Rosaceae* (20 species), *Poaceae* (13), *Asteraceae* (10), *Brassicaceae* (10), *Pinaceae* (9) lead alien species spectrum in NPV. *Asteraceae* (18), *Brassicaceae* (14), *Poaceae* (11), *Chenopodiaceae* (7), *Caryophyllaceae* (6) are in the top of alien flora spectrum in PL. Most of families consist of 1-2 alien species. *Cyperaceae* is absent in alien flora spectrum of both reserves. Therophytes from various regions of Asia, Eurasia and Northern America prevail. Ergasiophytes dominate in NPV (53 species, 78% of alien species). This group includes decorative, food and forage plants, which run to wild. Xenophytes prevail in PL (68% of alien species). Species of this group is introduced to the new habitats by roads and railways. Efemerotophytous (species incapable to naturalize) prevail in NPV whereas in PL the number of epekophytous (species naturalized in secondary habitats) increases.

Species with high invasive ability can become permanent component of nature and semi-nature communities. Among them there are species common for both reserves (*Acer negundo, Lepidotheca suaveolens, Solidago canadensis, Impatiens parviflora, Populus alba, et al.*). Some species are met only in NPV (*Aster salignus, Lupinus polyphyllus, Elodea canadensis, Impatiens glandulifera*), and some species are typical for PL (*Amaranthus albus, Amaranthus retroflexus, Ambrosia artemisiifolia, Bidens frondosa, Conyza canadensis, Cyclachaena xanthiifolia*).

Thus, we can consider that in the forest zone alien species maintain its status longer due to conservativeness of local nature ecosystems. While in the forest-steppe zone naturalization of adventive species takes place comparably quickly. As a result alien species obtain status of local flora species.

Are there any common distribution patterns between different levels of biodiversity? Comparing haplotypes, species and plant communities in a beech glacial refugium

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Understanding the relationships between genetic, species and ecosystems diversity is crucial towards conserving all these three basic levels of biodiversity. So far, very few studies have checked for common patterns of the above-mentioned levels of biodiversity, focusing mostly on measures of diversity and not in the co-occurrence of certain entities (e.g. alleles, species and ecosystems). Here we searched for any common spatial patterns between beech cpDNA haplotypes, vascular species and plant communities of beech forests. Beech has been much influenced by glacial and interglacial climate fluctuations during the Quaternary, while the Balkan Peninsula hosts many of its glacial refugia. Apart from the distribution of beech lineages, the flora of beech forests has also been influenced by the glacial history of the temperate zone. Our study has focused on Mt. Menikio (northeast Greece) which is a putative refugium of beech on the basis of its topographical features, its flora and vegetation types as well as genetic data. Sixty vegetation plots and three beech individuals from each plot were sampled for DNA analysis. Vegetation data have been analysed by means of classification and ordination. cpDNA haplotypes were deduced based on the combination of three chloroplast microsatellites (cpSSRs). A probabilistic species co-occurrence analysis was run to test co-occurrence between beech haplotypes and the taxa recorded in the vegetation plots. AMOVA analysis was performed to describe the genetic structure of the studied populations in the beech forest communities. Five communities were distinguished through cluster analysis. One of them is transitional to the ravine forests of Tilio-Acerion, a vegetation type hosting relict species, which have possibly served as refugium during glacial periods. Both ecological and geographical gradients of vegetation differentiation have been found in the study area. Chloroplast haplotypes showed spatial patterns of diversity that fits to populations derived from adjacent glacial refugia. Significant associations of co-occurrence between haplotypes and vascular taxa were found, but not common distribution patterns between haplotypes and plant communities. Our study shows that the combined study of plant species, their communities and cpDNA haplotypes may reveal more thoroughly historical factors, such as migration routes and refugia of species and populations and thus help in the understanding of the evolutionary processes that have shaped specific spatial patterns of biodiversity.

Classification of the relict forest communities of Palla's Black Pine (*Pinus nigra* subsp. *pallasiana*) in Bulgaria

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New approach for the classification of the Black Pine forest communities in Bulgaria was made in this study. The analysis of forest pytocoenoses from Vlahina, East and West Rhodopi and Balkan Range Mountains confirmed their separation into two classes - *Quercetea pubescentis* (low-altitudinal) and *Erico-Pinetea* (high-altitudinal). The second class is represented from one polymorphic association *Seslerio latifoliae-Pinetum nigrae* whereas the other group is represented from two new associations. The association *Junipero deltoidi-Pineteum pallasianae* is more related to the surrounding thermophilous oak forests as well as the association *Lathyro laxiflori-Pinetum pallasianae* is more similar to the hornbeam and beech forests.

Ecology, variability and dynamics of bog woodlands in the Western Carpathians

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Our research activities have been focused on the most important localities with well-preserved relict fragments of the unique raised bogs complexes of the Western Carpathians situated in the northern part of Slovakia (the Upper Orava region near Slovak-Polish border and the Podtatranská brázda Furrow). Mentioned sites represent hot spots of specific mires communities which are valuable not only floristically – by the presence of many relict species, but also from the geo-historic, biogeographic and landscape point of view. Studied raised bogs complexes create mosaic of various ecological successional stages covering whole gradient of environmental conditions. There are very close syngenetic relationships between raised bogs communities of the class *Oxycocco-Sphagnetea*, extrazonal *Pinus mugo* scrubs on peaty soils and slightly wooded bogs dominated by *Pinus sylvestris* and/or *Picea abies*, belonging to the class *Vaccinio uliginosi-Pinetea sylvestris*. Our main goal was to find a satisfactory syntaxonomical solution for the unique stands with a different presence of *Pinus* ×*celakovskiorum* – hybrid, originating from the parental combination of *Pinus mugo* s. str. and *P. sylvestris*. We distinguished 5 associations within the class *Vaccinio uliginosi-Pinetea sylvestris* that represent woodland bog vegetation. Our syntaxonomical scheme reflects not only floristic criteria of individual plant communities but also the evolution of studied hybrid complexes (derived from the parents *Pinus mugo* s. str. and *P. sylvestris*) and the sites' history. Individual vegetation units create mosaic pattern with neighboring communities based on groundwater level as well as degradation of the sites.

Montane beech forests of *Aremonio-Fagion* alliance in the Western Carpathians

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Classification of montane beech dominated forests on the base-rich bedrock in the Western Carpathians is still unclear. Eutrophic communities of high altitudes used to be classified within the *Acerenion* suballiance, and calciphilous communities within the *Cephalanthero-Fagenion* suballiance of the *Fagion* alliance. Recent broad-European vegetation synthesis of Willner et al. (2017) revealed a similarity of Western-Carpathian montane calciphilous communities to those of the *Lonicero alpigenae-Fagenion* Borhidi ex Soó 1964 suballiance subordered to the *Aremonio-Fagion* (Horvat 1950) Borhidi in Török et al. 1989 alliance (*Lonicero alpigenae-Fagion* Dierschke 1998 syntax. syn.; Mucina et al. 2016). Both last-mentioned units were not recognized in national lists of vegetation units in Western-Carpathian countries (Czech Republic, Slovakia, Hungary and Poland) yet.

Here we present species differentiation of this newly recognized alliance in the Western Carpathians from the other alliances of beech dominated forests of the region using complete data from the Slovak national vegetation database. Species with the highest fidelity are *Cirsium erisithales*, *Valeriana tripteris*, *Daphne mezereum*, *Rosa pendulina*, *Calamagrostis varia* and *Rubus saxatilis*. Finally, inner syntaxonomic structure of the alliance, including *Corthuso-Fagetum* (Klika 1927) Fajmonová 1982 and *Clematido alpinae-Fagetum* (Sillinger 1933) Fajmonová et Šimeková 1973 associations is provided.

Optimizing the land cover mapping process in Norway

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Land cover maps give information about what types of vegetation we have and where these types are found. This information is crucial in management of natural resources, for example when building roads or creating new national parks. The systems for land cover classification, as well as mapping methods vary greatly. The classification system used will also affect what methods are suitable, from vegetation survey to human interpretation of aerial photos. A new system for land cover classification, Nature in Norway (NiN), has recently been created in Norway. Currently all maps made by this system are made by vegetation survey. However, vegetation survey is expensive and slow. An estimate, with the current mapping rate of 20 ha per day, shows that 100 fieldworkers need to work all summer for almost 200 years before maps exist for all of Norway.

In this study three different mapping methods (interpretation, vegetation survey and a combination) were used for mapping a total of six sites at Hvaler in south, eastern Norway. Interpretation was done using infra-red aerial photos in stereo. Vegetation survey was carried out in field using aerial photos to aid delineation. A separate dataset was collected in field to create a measure of the quality of the maps. This measure allowed for comparing quality as well as mapping rates across the three methods.

The results of the study shows that maps made by interpretation can have quality that is comparable to that of maps made by vegetation survey. The land cover in the mapped area seems to be more important for map quality than the method used. At the same time, the mapping rate following interpretation was more than twice as high as the mapping rate of vegetation survey. In conclusion, including interpretation in the land cover mapping process might increase the current rate of mapping, without reducing the map quality.

Consistency in vegetation survey in Norway

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Vegetation survey is the basis for maps used for example by authorities when planning new infrastructure and conservation areas. However, the map quality will affect both the relevance of the planning, as well as the amount of available information in the maps. Measuring map quality is therefore important, and one possible measure for quality is the consistency among vegetation survey maps covering the same area. In our study, parallel mapping was performed with three mappers for two Norwegian systems for vegetation classification, both based on vegetation survey. The aims of the study were to: 1) Estimate the consistency between the maps. 2) Find the causes of inconsistencies. 3) Compare consistency at different spatial scales and in different systems for vegetation classification.

The study area was situated in Valdres, in south-central Norway. The vegetation in the study area ranged from north boreal forest at lower altitudes, to alpine vegetation at higher altitudes. An area of 754 ha was mapped in scale 1:25 000 using a vegetation type system. Within this area, a smaller area of 99 ha was mapped in scale 1:5 000 using a nature type system. The spatial consistency between the three maps made by each system was calculated both at type and group levels.

The maps made by the same system, for the same area, included different types, and the types were located differently within the maps. The average spatial consistency at group level was 88% for both systems. At the more detailed type level, the average spatial consistency was 58.9% for the vegetation type system and 40.8% for the nature type system. Higher system complexity was followed by lower consistency. Attention to map quality is needed in vegetation survey, both while vegetation survey is performed, and subsequently when the maps are used.

Diversity of Lithuanian vegetation classes in the context of European vegetation

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Syntaxonomic structure of Lithuanian vegetation was conceptualized more than a quarter of a century ago, later revised review of grassland vegetation diversity was published, studies of several separate classes were performed. The vegetation survey published at the time indicated the presence of 32 vegetation classes, 42 orders, 74 alliances and 221 associations in Lithuania. The main objective of the study was to assess the diversity of Lithuanian vegetation in the context of European vegetation, using the European vegetation review to the alliance level and the created semi-automatic vegetation classification to the class level, that had appeared in 2016.

Data set used for reclassification contained 12 935 relevés and 2198 taxa. Relevés have been made by various authors from 1925 to 2015, their area being 4–500 m^2. The vegetation classification was performed using the EuroVegChecklist Expert System tool through Juice software.

The classification procedures showed that 37 vegetation classes could be found in Lithuania, 1% of the relevés were not classified, and 12.87% were assigned to more than one vegetation class. Comparison of the vegetation survey used in Lithuania and the obtained classification results revealed that 26 classes of vegetation coincide; it accounts for about 84% of all relevés. Eight vegetation classes: *Alno glutinosae-Populetea albae, Brachypodio pinnati-Betuletea pendulae, Calluno-Ulicetea, Sisymbrietea, Digitario sanguinalis-Eragrostietea minoris, Helichryso-Crucianelletea, Poetea bulbosae*, *Robinietea*, not previously mentioned in Lithuanian vegetation survey, were ascertained. Incorporation of the last 4 phytosociological classes into syntaxonomic system of Lithuanian vegetation is still questionable. Not a single relevé was ascribed to 3 other vegetation classes present in Lithuania (*Cakiletea maritimae, Salicetea purpurea* ir *Zosteretea*).

Relationships between *Tamarix boveana* Bunge communities and physical-chemical characteristics of soils in a microbasin in central Spain

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The study area is located in a microbasin where vegetation constitutes natural habitats that are scarce, limited, vulnerable and important for biodiversity. It is located in municipal district of Borox (Toledo, Central Spain) nearby of Special Area of Conservation "Yesares del Tajo" (ES4250009). The study site belongs to the subsector Manchego-Sagrense, under a mesomediterranean bioclimate with lower dry ombrotype.

The presence of a stream and surface runoff of stormwater from the adjacent gypsum slopes causes seasonal flooding and salt accumulation, providing habitat for a variety of halophilous and halonitrophilous plants communities.

As a consequence of these characteristics, the vegetation present in this area is very particular, highlighting the only one community of *Tamarix boveana* Bunge in the province of Toledo (*Tamaricion boveano-canariensis* Izco, Fernández-González & A. Molina 1984; Habitat 92D0 of Annex I of the Habitats Directive). In addition, in this site are present communities such as almarjales (*Suaeda vera*), orzagales (*Atriplex halimus*), juncales (*Juncus* spp.), and grasslands of *Elymus curvifolius*.

The objective of this work is to analyze the physical-chemical properties of the soil where the *Tamarix boveana* community develops.

To relate the distribution of *Tamarix boveana* formations in the study area with the type of soils where it is developed, analysis of the physical-chemical properties of the soils have been carried out. Main physical-chemical properties analyzed were: soil bulk density, pH, electrical conductivity, sulfates, soil organic matter, calcium carbonate, easily available nitrogen and phosphorus.

After analyzing the physical-chemical characteristics of the soils where *Tamarix boveana* develops, it is observed that it lives on light soils (low bulk density) with pHs from slightly acid to slightly basic, with a high content of organic matter and carbonates. The most important conclusion is that the presence of this species depends mainly on the mixed salinity and soil moisture gradient. The salinity of these soils is between 2 (very slightly saline) and 30 dS/m (strongly saline), with the highest frequency between 4 and 8 dS/m (slightly saline). Therefore, the permanent humidity throughout the year and deposition of salts are the essential factors for *Tamarix boveana* establishment.

The dynamism of vegetation on abandoned terraces in the Ligurian Apennines (N-Italy)

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Terraced areas are a distinctive feature of Ligurian landscape, that have been recognised at international level for their historical and cultural importance, however, if not properly maintained, may represent a major hydrogeological risk factor. In order to implement the proper maintenance and recovery strategies of this landscape and to prevent hydrogeological risks, an accurate knowledge of vegetation dynamics is fundamental. This research aims to: 1- study the vegetation with phytosociological method and to attribute it to a syntaxonomical classification. 2- investigate the relation between vegetation and other characteristics, such as the time of abandonment, former cultivation, main morphological features (altitude, exposure, terrace size), pedological and climatic characteristics of the terracing. 3 – evaluate which phytocenoses are more related to hydrogeological risk.

In this study, the first results of the hilly belt of the Ligurian Apennines in the East of Genoa are presented. This is an area belonging to the submediterranean variant of temperate macrobioclimate, according to the classification of Rivas-Martinez (2011), with terraces mainly used for olive cultivation. According to the map of the Series of the Vegetation of Italy (Blasi 2010), the area belongs to the climatophylous vegetation series of *Rubio-Querco pubescentis* sigmetum.

The study of the plant communities has been carried out following the phytosociological method of the Zurich-Montpellier Sigmatist School, as successively integrated. Together with vegetational survey, soil samples have been analysed with a filed portable X-ray Fluorescence Spectrometry for the geochemical analyses. Samples and surveys have been localised with a GPS for subsequent spatial analysis in GIS (Geographic Information System).

First results show that secondary succession of abandoned terraces differs from climatophylous vegetation, especially at the initial stages (e.g. lack of herbaceous species, colonization by shrubs and vines) and that tall shrubs and trees vegetation is more closely related to hydrogeological risk.

Patterns of plant diversity in European grasslands

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Grassland communities hold an important part of Europe's plant diversity. In most cases, their evolution, current state and species richness have been strongly affected by human activities in the landscape. The traditional management through extensive grazing or mowing lasting thousands of years since the Neolithic era well simulated the natural processes maintaining grasslands and thus kept their species pools or even enlarge the suitable environments for grassland species. However, the environmental and land use changes over the last hundred years (N deposition, fertilizing, draining, land abandonment etc.) have caused either a transformation of grasslands into monodominant species poor communities or their complete disappearance from the landscape which in both cases means serious biodiversity losses. Therefore, we decided to investigate various aspects of plant diversity in European grasslands in order to understand processes which shape the current patterns and to know their importance and spatial character.

In our studies, we (1.) examined vascular plant species-richness patterns and drivers in grassland vegetation across the European continent. Furthermore, we (2.) focused on underlying filtering processes of grassland communities via the systematic differences in functional characteristics between potentially present and established species. For analyses of species richness, we used a large set of georeferenced relevés from the European Vegetation Archive recorded in grasslands linked with environmental and other data in GIS. Our aims were to examine factors which potentially cause the observed species-richness patterns, to compare human-related and environmental drivers, and to create maps of grassland species richness for Europe based on the results of predictive modelling. The study on underlying filtering processes (in progress) aims to find differences in trait composition and functional diversity between the realized and the dark diversities of the grassland relevés which would be related to environmental sorting, limiting similarity, dispersal ability etc.

Our preliminary results suggest the richest grasslands occur in sub-montane to lower montane areas, with base-rich bedrock and stable environments, historically less impacted by agricultural intensification – e.g. hilly landscapes on the periphery of the Pannonian Basin. Regarding human impact on grasslands, it seems there is a gradient of degree of negative human influence from south towards north, with the strongest negative effects within intensively used landscapes in northern/north-western Europe.

Floristic patterns at different scales in broadleaved oak forests from northern Iberia

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We have analysed 273 relevés representing Northern Iberia forests dominated by *Quercus pyrenaica*, previously divided in twelve groups. By using a variant of indicator species analysis that generates indicators for each group of sites but also for different combinations of them, we searched for those floristic affinities that best define the inner structure of *Quercus pyrenaica* forests. We took the order of a site group combination indicated by a species, as an indication of the geographical scale of that floristic pattern, and we used the traits of the indicator species to understand the nature of potential drivers.

The compositional patterns of *Quercus pyrenaica* forests in North Iberian Peninsula are varied and have complex relationships. Through indicator species we could identify different ecological traits driving compositional variation among scales of analysis: Local to regional species assemblages and substrate type or disturbance indicators were shown at low and intermediate levels (i.e. involving a one or a small number of groups), whereas those indicators representing the temperate climate that prevails in most of this territory emerged at higher levels (i.e. involving a large number of groups). Based on the chorology of co-occurring species, we can observe two major gradients that determine the floristic composition of our groups, Mediterranean / temperate and oceanity / continentality and more locally silicicolous / calcicolous (due to a peninsular east-west differentiation by substrate). The set of species selected by indicator species analyses at a given order of sitegroup combinations reflects the ecological drivers that filter different species traits at that scale of analysis. Niche assembly exerts a recognizable effect at small scale (i.e., for combinations involving few groups), but the prevalent floristic patterns observed at larger scales of work seem to be driven by historical assemblages closely related to broader climatic variables.

The SUN LIFE+ Project: a strategy for monitoring species and habitats of the 92/43/EEC Directive in Umbria Region (central Italy)

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The SUN LIFE 2013 NAT /IT/000371 project aims at the implementation of a strategy for the management of the Natura 2000 network in Umbria, as a model for an organic management of the network even at national and international level. Umbria is one of the few Italian Regions that completed the conversion of the Sites of Community Importance (SCIs) in Special Areas of Conservation (SACs) that complement the Special Protection Areas (SPAs). In Umbria the network is composed by 102 sites (96 SACs and 6 SPAs), distributed in the Mediterranean and in the Continental Biogeographic Regions, covering a surface of 130,094 hectares, i.e. 15.37% of the Regional territory. In the Natura 2000 sites, 41 habitat types of Habitats Directive (92/43/EEC) Annex I (including 11 priority habitat types), and about 100 species of Annexes II, IV and V (8 of which are vascular plant species) are recorded. The detailed knowledge on species and habitats distributions (maps 1:10,000), together with their trends and conservation status in Umbria, played an essential role in the definition of the management strategy in this Region. In addition, a database of phytosociological relevés carried out in the different habitat types, georeferentiated and archived in the National Database VegItaly, constituted a fundamental pre-condition for the correct development of a management and monitoring strategy for species and habitats.

The SUN LIFE project will end in 2017. The activities scheduled under action D1, which has the goal to formulate and start the implementation of the monitoring program of the Natura 2000 network, tend to the elaboration of monitoring and management protocols, aimed at giving the administrations a feedback for the necessary conservation actions related to the effective conservation requirements of each species and habitat. During the SUN LIFE activities, some indicators for the evaluation of the conservation status of species and habitats were provided. The indicators were classified in two categories: quantitative (H1 – habitat surface; H2 – habitat fragmentation; S1 – species distribution; S2 – population size) and qualitative (S3 – occurrence of alien species; H3 – coherence of floristic composition with the habitat type; H4 - structure/ physiognomy of the habitat; H5 – successional unit of the series). This indicators have represented the starting point for the experimentation of a still ongoing monitoring protocol, preliminary tested on some species and habitats, selected considering the i) rapidity of the dynamical processes, ii) conservation status and anthropic pressure, iii) restricted/fragmented distribution.

A "Diagnostic Manual for Natura 2000 Habitats and Species in Umbria" was compiled, including all the knowledge on habitats and species, collected during the monitoring programs carried out in the last 13 years (bibliographic and unpublished cartographic and phytosociological data). Last but not least, the funding opportunities available both at national and regional level for the conservation and management of biodiversity inside the Natura 2000 network were identified, in this way assuring the long-term efficiency of the network.

Broad-scale syntaxonomic revisions using large plot datasets: experiences, lessons and recommendations

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The development of large plot databases has greatly enhanced the possibility of doing broad-scale syntaxonomic revisions. Still, there are many methodological challenges involved in any such exercise. Based on experiences with recent supra-national classification efforts I will give a review of some critical methodological points: (1) data selection from large plot databases such as the European Vegetation Archive (EVA); (2) taxonomic harmonisation of the species list; (3) classification algorithms; (4) determination of diagnostic species; (5) formal definition of vegetation units; (6) evaluation of alternative classifications.

To facilitate data selection for syntaxonomic revisions, all relevés stored in the European Vegetation Archive should be classified at least at the class level. However, a pan-European revision of the delimitation of classes, based on data analysis and using a broad variety of methods, would be desirable. Even more urgently needed is a standard European species list. The matching of national and regional species lists to this European one has to be carefully revised. Uncritical application of synonyms, like those given in the Euro+Med PlantBase, can lead to disastrous errors (as will be shown by some examples). Harmonisation of different taxonomic resolutions (subspecies, narrowly and broadly defined species, species aggregates, sections) is extremely laborious and should be facilitated by including taxonomic information in the European species list.

Semi-supervised classification algorithms are still in an early stage of development. In particular, the lack of semi-supervised variants of divisive methods (such as TWINSPAN) strongly limits their application in broad-scale syntaxonomic revisions. Moreover, information on the original assignment and subsequent syntaxonomic revisions of the data is mostly lacking in plot databases, which makes it difficult to define reliable a-priori groups.

For determining diagnostic species, a consensus approach using several fidelity measures is recommended. Fidelity thresholds should take into account the geographical distribution of species, because otherwise the diagnostic value of species with restricted ranges may be neglected. On the other hand, widely distributed species may be diagnostic only in a part of their distribution range. Diagnostic species can be used to establish formal definitions of vegetation units (examples from beech forests and grasslands will be given). An important but largely unexplored field is the evaluation of alternative syntaxonomic solutions. Number, frequency and specificity of diagnostic species are recommended as important evaluation criteria. Finally, a step-wise approach to syntaxonomic revisions is recommended, i.e., individual classification exercises should focus on one or two hierarchical levels rather than on all levels at once.

Invasive species of class of *Artemisietea vulgaris* Lohmeyer et al. in Tx. ex von Rochow 1951 in Kryvyi Rih iron ore basin (Ukraine)

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Phytoinvasion is topical issues in Ukraine because of alien species plot to 14 % of flora. The largest negative impact of invasive species on biodiversity is where natural vegetation is too high transformed. One of the regions with intensive flora adventization is Kryvyi Rih iron ore basin with square approx. 300 sq. km.

In Kryvyi Rih iron-ore basin vegetation is transformed due to long-term development of iron ore deposits. The main forms of anthropic landscapes are industrial and mining which includes dumps, quarries, and also residential areas, waste lots, garbage dumps.

The feature of coenoflora of *Artemisietea vulgaris* is a high proportion of adventitious species – archaeophytes and neophytes and their continued involvement in coenosis. Among them, significant part are invasive species. This contributes to the occurrence of communities of class on railways, along roadsides, which are known pathways of invasive species. Quite often they are considered as diagnostic for syntaxa different levels. Communities with their participation by authors are emphasized as variants of associations formed by indigenous species also. The adventization's degree of vegetation *Artemisietea vulgaris* is investigated. There are 45 species of alien plants (21.6% of coeflora). 12 invasive species are found in coenoflora – *Acalypha australis* L., *Ambrosia artemisiifolia* L., *Anisantha tectorum* (L.) Nevski, *Centaurea diffusa* Lam., *Cardaria draba* (L.) Desv., *Conyza canadensis* (L.) Cronq., *Erigeron annuus* (L.) Pers., *Grindelia squarrosa* (Pursh) Dunal., *Helianthus tuberosus* Pers., *Iva xanthiifolia* Nutt., *Solidago canadensis* L., *Xanthium albinum* (Widder) H. Scholz. Among them are dominated: by life forms – annuals (66.7%); by hygro morph – xero mesophytes (50.0 %) and mesophytes (41.6 %); by the date of arrival– neophytes (100 %); by origin – North American species (58.3%); by the degree of naturalization – agrioepekophytes (50.0%) and epekophytes (41.6%). Invasive species in the region show significant coenotic activity and are the dominant of associations of class – *Anisantho-Artemisietum austriacae* Kostylev 1985, *Cardarietum drabae* Timár 1950, *Dauco-Centauretum diffusae* Bagrikova 2002, *Erigeretum canadensi-acris* Smetana 2002, *Achilleo millefoliae-Grindelietum squarrosae* Kostylev in V. Solomakha *et al*. 1992, *Ambrosio artemisiifoliae-Xanthietum strumariae* Kostylev in V. Solomakha *et al*. 1992 and form relative stable derivate communities. The analysis of their role in coenoses educes several are transformers – *Conyza canadensis*, *Grindelia squarrosa*, *Solidago canadensis* (25% of invasive in the region). Their cenotic activity and participation in vegetation indicate strengthening its synanthropization process and improving the degree of communities' invasiveness. The topical is a problem of effective management communities formed by invasive species. The mechanical methods of their deterring (mowing, plowing) can be effective only in the early stages of the invasive process and on the relatively small areas. Also, the primary assignment is to determine the potentially invasive species among new alien species for the region and forecast their further distribution.

Landscape pattern within riparian forests in aero-photo images since 1940 - ties

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Topographic maps or forest area studies in Latvian case – also forest stand and dominant tree species maps often are used in research studies of land cover changes. However, such maps come with a specific time view and interpretation of the land cover, as well with different land cover definitions. For example, in the case of forest, in topographical maps of 1930 – ties, there are not included all areas, which at this point of view and, according to the international criteria should be defined as forests as we understand it nowadays. So, the best solution for land use research is to use aerial imageries, if available.

In this study the German Army aerial photographs from 1940-ties are used. The maps can be accessed in the US National Archives. The scale of aerial photographs varies from 1:5400 to 1:24 000. As supporting information or field control information, for example, for dominant tree species classification in aerial imagery we use old forest stand maps. Meanwhile, the distribution of deciduous and coniferous trees is recognizable just from aerial imagery – looking on crown structure of tree cover.

The initial results of the study show that over the past 70 years the area of riparian forests has changed considerably, as well as riparian zone land use structure, and area and complexity of patches. Land use types of riparian forests with more mosaic structure vary outspoken. There is different height of trees, so, canopy cover of forest is heterogenous with large number of openings in various sizes. Some water stream and river banks are more open with a neglectable linear shrub area which indicates primary succession, in general. Some wetland and mire areas often lie by agricultural areas without any forest buffer zone, questioning about meaning of ecotones and management. As well, there are small patches of agricultural land of irregular shape which indicates existing of former natural borders and some aspects of micro – compliance.

Thus, early indications show more intensive use of riparian areas for agriculture compared to nowadays.

ANNEX WITH LAST ABSTRACTS

Conifer Siberian Taiga Decline: The Sinergy of Water Stress Impact and Bark-Beetle Attacks

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Climate warming in Siberia leads to increasing activity of the aggressive pests in Siberian taiga forests. Here we considered climate impact on the activity and range of two most dangerous species: Siberian silkmoth (*Dendrolimus sibiricus*) and *Polygraphus proximus*. Siberian silkmoth is the primary pests that feeds primary by needles of Siberian pine (Pinus sibirica), fir (Abies sibirica). Polygraphus proximus is a secondary bark-beetle species which attacks weakened fir trees. At present air temperature and climate aridity increase caused northward migration of the Siberian silkmoth outbreak range. The current outbreak located >50 km from its northern historical boundary (up to 60°+NL). This outbreak started in 2015 within "black taiga" (or "dark needle conifer", DNC, composed by Siberian pine and fir mainly) within Yenisei plain, and covered the area about 800 thousands ha.

The analysis of ecological and climate variables (air temperature, precipitation, drought index, on-ground cover moisture, vapor pressure deficit) before and during the current and historical silkmoth outbreaks was performed. Based on that, the variables thresholds that ignite pest outbreak estimated. Along that, outbreak ignition and dependence on elevation, exposure and slope steepness was analyzed.

The observed climate change open an opportunities for the Siberian silkmoth migration to the northern taiga. The potential southward big-scale silkmoth outbreaks now limited by stands fragmentation.

The other aggressive pest *Polygraphus proximus*, the species similar to bark-beetle *Dendroctonus ponderosae* in North America, was not found in Siberian earlier. Observing climate aridity and droughts increase weakened fir trees and provided a "food base" for that bark-beetle massive outbreak. This pest also attacks stands weakened Siberian silkmoth. Now the majority of Central Siberian south taiga is within the range of *Polygraphus proximus* with fir stands loss about 30-50%. The DNC stands spatial and temporal mortality dynamics and its relationship with climate variables was analyzed.

European Endemism in Vascular Plants from a Global Perspective

Hobohm C, Janišová M, Landi S, Vanderplank S, Beierkuhnlein C, Grytnes JA, Steinbauer M, Veetas OR, Fildelis A, De Nascimento L, Clark VR, Fernández-Palacios JM, Field R, Franklin S, Guarino R, Jihong H, Krestov P, Ma K, Onipchenko V, Palmer M, Simon MF, Stolz C & Chiarucci A

Based on a new sampling design (Nested Circle Design, NCD), we estimated numbers of endemic vascular plants related to circular plots across the globe. Sixty geographical points were chosen by generating equal probability coordinates. Each point was used as the center of a series of five nested circular plots, with grain ranging from 10,000 to 100,000,000 km^2.

Since detailed distributional data are not available for all vascular plants and circular plots, the estimates were based on expert knowledge (authors). Specifically, the number of endemic vascular plants in each circular plot was independently estimated by five experts who provided a minimum and maximum value for each circle.

We did not exclude any marine, glaciated or other region even if it was clear that certain circles would represent regions without vegetation or endemics. This is a model to resolve analytical problems caused by sampling biases.

The resulting regressions can be used for biogeographical comparisons. Europe is often characterized as poor in endemics. However, it can be shown that especially European Atlantic islands and Mediterranean regions of Europe are relatively rich in endemics compared to other regions in the world that formerly have been classified as rich.

In Europe Madeira and Canary Islands represent very high plant endemism, followed by continental islands of the Mediterranean (Sicily, Crete) and mainland regions bordering the Mediterranean such as the Iberian Peninsula or Turkey.

E.g. Hawaii (Big Island) and New Zealand which are often characterized as extremely rich in endemics have lower vascular plant endemism than e.g. Madeira or Tenerife.

However, e.g. the Juan Fernandez Islands, especially Masatierra, are much richer than any region of Europe, and Ecuador and the Cape Floristic Region, as expected, are much richer than any mainland region in Europe.

The GrassPlot database: new opportunities for characterising grassland biodiversity patterns across taxa and scales and along ecological and biogeographic gradients

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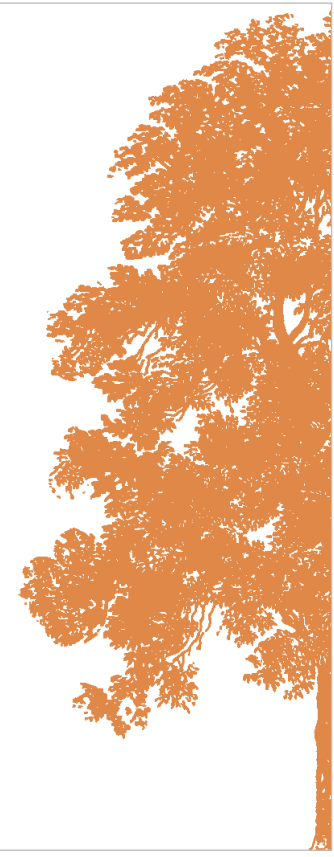
The Database of Scale-Dependent Phytodiversity Patterns in Palaearctic Grasslands GrassPlot (GrassPlot; EU-00-003; http://bit.ly/2qKTQt2) is a collaborative project within the Eurasian Dry Grassland Group (EDGG; http://www.edgg.org/). It was initiated with an international workshop in Bayreuth in spring 2017 and aims at complementing the European Vegetation Archive (EVA) with a multi-scale and multi-taxon plot database that is specialised and selective. GrassPlot collects high-quality plot observations (relevés) of eight standard grain sizes (0.0001; 0.001 … 1000 m²) as well as nested-plot series with at least four different grain sizes. The scope of GrassPlot are the grasslands as well as other herb- or cryptogam-dominated terrestrial and semi-terrestrial vegetation types from the whole Palaearctic biogeographic realm (Europe, North Africa, West, Central and North Asia). The plot observations in GrassPlot typically contain extensive environmental data determined in the field as well as in about 35% of all cases records of terricolous bryophytes and lichens in addition to those of vascular plants.

GrassPlot contains all the data from the annual EDGG Research Expeditions/Field Workshops since 2009, but meanwhile also many other dataset from Morocco in the West to Japan in the East and from Sicily in the South to Spitsbergen in the North. In early September 2017, GrassPlot comprised 40,601 vegetation plots of all sizes and 1,277 nested-plot series. They originated from 143 contributors (who became members of the GrassPlot Consortium), 108 datasets and 35 countries, but many more datasets were in the preparatory "pipeline".

The presentation will present some preliminary analyses with the overarching Palaearctic dataset and results from published studies of regional datasets sampled with the EDGG sampling methodology (Dengler et al. 2016). For benchmarking the richness in Palaearctic grasslands, we produced mean richness values of grasslands of different regions and types. It turns out that diversity patterns strongly depend on grain size and taxonomic group. In terms of phytosociological classes, average vascular plant species richness values across all considered scales are particularly low in coastal grasslands (dunes and salt marshes) and particularly high in alpine grasslands (*Elyno-Seslerietea*, *Juncetea trifidi*). Basiphilous dry grasslands (*Festuco-Brometea*, *Cleistogenetea squarrosae*) have outstanding high average richness at intermediate scales (0.01−10 m²), while the highest averages at 100 m² are found in one Mediterranean (*Lygeo-Stipetea*: 59.4 species) and one alpine class (*Elyno-Seslerietea*: 57.5). Analysing species-area relationships demonstrates that the power function, contrary to various claims in the literature, by far outperforms the logarithmic ("Gleason") and saturation function at these scales, with the average slopes (*z*-values) of vascular plants (0.21) and bryophytes (0.19) being significantly lower than those of lichens (0.29). Regional studies in Transylvania (Turtureanu et al. 2014), Ukraine (Kuzemko et al. 2016) and Siberia (Polyakova et al. 2016) show that the relative importance of drivers of biodiversity vary strongly between grain sizes and among the considered taxonomic groups.

Although GrassPlot already has mobilized many high-quality data, owners of untapped sources are welcome to join our Consortium.

AUTHORS



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