35th Meeting of Eastern Alpine and Dinaric Society for Vegetation Ecology

BOOK OF ABSTRACTS

Ohrid, 2013, July 3-6

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ORAL PRESENTATIONS

The Alpine Vegetation of Elmacik Mountain (Duzce) in North West Black Sea Region of Turkey

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Turkey is located in the Alpine-Himalayan orogenic belt is the mountainous country, two main orogenic belts extend on the northern and southern part of the Anatolian peninsula. The northern Anatolian mountains are the continuation of Carpathian-Dinaric-Balkan mountain chains, and Taurus Mountains lying in the southern part of Anatolia form the southern chains of the Alpine mountain branches. The Northern Anatolian Mountain chain extending on the northern part of Anatolia forms three main orobiomes: humid-temperate broad-leaved deciduous forest belt, humid-cold coniferous forest belt and alpine grassland belt in Euro-Siberian Flora Region. The subalpine and alpine vegetation of North Anatolian Mountain chains have investigated a few local regions (Ida and Olympus Mountains) and those important to understand the subalpine and alpine vegetation types actually present. This contribution focuses on the present research on the (oreal) subalpine to alpine mountain vegetation of Elmacik Mountain (Duzce) in North West Black Sea Region of Turkey. In this study, subalpine and alpine vegetation of north west Black Sea Region from Elmacik Mountain is investigated and some new plant groups are identified in addition to know ones. The study area exhibits distinct vegetation types. Out of these, rock vegetation is in the class of *Aspelinatae trichomanis*. Its class is represented by *Potentilletalia specosae* order and *Aubretion olmpicae* alliance in Elmacik Mountain. Excoriated meadows and subalpine shrubs are in upper class of *Daphno-Festucetales* and they are included in orders, class of *Daphno oleoidis-Festucetalia (ea) variae* and *Bruchentilion spiculifoliae* alliance in Elmacik Mountain. So that, it is understand to subalpine and alpine vegetation and flora links between Elmacik Mountain and other Mountains in North West Black Sea Region of Turkey.

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Diversity of moss flora in forest communities of Papuk Mt (Eastern Croatia)

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Papuk Mt is situated in North-eastern Croatia, in Slavonia, within a basically lowland area. In this lowland area the Papuk is the largest and the highest mountain; the peaks are between 800 and 900 m a.s.l. Since the great majority of Croatian mountains are built up of Mesozoic limestone, this system has a high geological diversity dominated by metamorphic rocks, granites and different types of schists. The climate is temperate but moderately warm without an explicit dry period. Papuk Mt is protected as Nature Park. Ninety-five per cent of the area is covered with beech forests. Among them dominant are acidophylous communities of suballiance *Luzulo luzuloidis-Fagenion* and ass. *Festuco drymeiae-Abietetum*. However, above patches of carbonate and dolomite rocks basiphylous beach forests of ass. *Vicio oroboidi-Fagetum* are developed. Similar, oak forests are also acidophylous (ass. *Festuco drymeiae-Carpinetum betuli*) or basiphylous (*Quercion pubescenti petraeae*). The open and exposed rocky habitats, although rather small in extent, are of great importance for biodiversity. Bryophytes were recorded in all forests types in period 2009-2011. It was

recorded 176 species, 32 liverworts and 144 bryophytes. Among them seven are new for bryophyte flora of Croatia. The richest moss flora have basiphilous beech forests with averagely 23 species per plot. They are followed by oak forests, which are very similar in average number of moss species regarding pH of bedrock (19 species in basiphylous and 18 in acidophylous stands) but with different species compositions. Acidophylous beach forests have the poorest moss flora with averagely 15 species. However, in this group belongs one of the most peculiar communities with *Sphagnum quinquefarium*, which is unique in Croatia and characterised by many boreal elements. It can be concluded that Papuk Mt has rich moss flora reflecting geological diversity followed by diverse forest communities.

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Relict vegetation of gorge-like parts of Mountain Leskovik in south-east Serbia

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The Mountain Leskovik with its pick 1174 m high belongs to group of Carpathian-Balkan Mountains. It is situated at further south-east of Sokobanja's mountain chain made by Rtanj, Devica, Ozren and Leskovik. It is constructed by Mesozoic limestones like the whole mountain chain, and in the geomorphologic sense, it is very rugged with specified gorge-like parts nearby Lipovac and Resnik. The gorge-like parts are habitats where the specific vegetations of gorges, canyons, rocks and dunes are developed, and where the series of relict forest associations are situated.

The series starts with polydominant forest association *Querco-Colurnetum mixtum* situated in Lipovac cirque at the lowest heights just above the Monastery St. Stevan. The various species of oaks dominate in the association: *Quercus sp., Quercus frainetto, Quercus cerris, Quercus petraea* and Turkish hazel (*Corylus colurna*), followed by the next species: *Acer campestre, Carpinus betulus, Carpinus orientalis, Fraxinus ornus* and other trees. There are 38 representatives in the ground flora and *Cyclamen hederifolium* distinguishes at the autumn aspect of vegetation.

In the dips above this association the polydominant forest association *Fraxino-Colurnetum mixtum* is developed where Manna Ash (*Fraxinus ornus*) and Turkish hazel (*Corylus colurna*) dominate, and there can be found also: *Acer campestre, Quercus cerris, Quercus frainetto, Quercus petraea* and the other trees species. Ground level is rich with greenish plants (38) and the more numerous are: *Glechoma hirsuta, Cyclamen hederifolium* and *Melica uniflora*.

The peak of this series is polydominant forest association *Syringo-Aceri monspessulani-Coryletum colurnae* where dominate: lilac (*Syringa vulgaris*), Montpellier Maple (*Acer monspessulanum*) and Turkish hazel (*Corylus colurna*). Among tree representatives, there are: *Cornus mas, Carpinus orientalis, Fraxinus ornus, Prunus mahaleb, Quercus pubescens* etc. Among greenish representatives, (34) the most numerous are: *Arabis turrita, Digitalis lanata, Helleborus odorus* and *Silene coronaria*.

At the edge of this series, on the rocks and boulders of Lipovac cirque, the association *Syrigo-Prunetum mahalebi* is situated, dominated by: lilac (*Syringa vulgaris*) and mahaleb cherry (*Prunus mahaleb*). The association is pure with species (24) and among them we can find *Fraxinus ornus, Galium aparine, Helleborus odorus* etc.

The series of relict polydominant forest species ends with association *Carpinio orientalis-Aceri monspessulani-Coryletum colurnae* which is situated at the exit of Lipovac cirque, and it is dominated by: Oriental Hornbeam (*Carpinus orientalis*), Montpellier Maple (*Acer*

monspessulanum) and Turkish hazel (*Corylus colurna*), followed by: *Dactylis glomerata*, *Geranium lucidum*, *Tamus communis* and *Lunaria annua*.
The spectrums of flora elements, life forms and some other ecologic characteristics of relict polydominant forest associations will be represented by verbal presentation.

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The interplay between flowering timing and environmental constraints affects the functional strategies in central Apennine grasslands

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The timing of flowering is an important component of community assembly. Indeed flowering phenology affects the composition of plant communities through its effect on species interactions. Moreover, flower production is resource-intensive, which might tend to favour reproduction during times of low environmental stress. Nevertheless, if flowering time is critical to competition for resources or avoidance of stress, it could be considered a part of a larger plant strategy that incorporates other functional traits.
Actually it was stated that in grasslands of central Apennines, dominant species tend to bloom in the central phases of the growing season, when no stress acts in the system, day-length and light intensity allow a high rate of photosynthesis, and a long time is available for seed maturation. These species do not need functional strategies allowing fast pre-emption of the canopy or tolerance to stresses. Instead, subordinate and accidental species have functional strategies that allow them to flower before or after the dominant ones or to share the same period through a different type of space occupation. Moreover the functional set underlying the flowering pattern of subordinate and accidental species has a dual ecological meaning. It limits competition with dominant species and enables tolerance to environmental stresses, which change throughout the growing season (i.e. low soil temperature in spring and water shortage in summer). Also invasion of pastures by tall grasses owing to the management cessation affects the flowering-related functional pattern in that during the central and late phases of the growing season (when invasive tall grasses are growing and blooming), flowering species of abandoned meadows are marked by a set of traits devoted to stress tolerance or underlying a long reproductive cycle. It is possible to argue that the comprehension of the changes in the flowering-related functional pattern in abandoned pastures may help to explain the ecosystem functional response to the cessation of anthropogenic disturbance.

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Geographical and ecological differentiation of mesophilous *Fagus* forest vegetation in the Southeast Europe

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Beech forests have a remarkable proportion in European forest landscape. In the Central Europe beech forest occupy different sites and have a wide altitudinal range, while in the South Europe, in their range limit, they could be found only on humid mountain areas.
Our analysis deals with forets in SE Europe. The main divison into two major clusters. Beech

forests can therefore be classified into two alliances, *Aremonio-Fagion* and *Doronico orientalis-Fagion moesiacae*. Further division revealed seven different beech and beech-fir forest types, which we interpreted geographically and ecologically.
A significant increase of the proportion of chamaephytes, hemicryptophytes and therophytes was detected along the main macroecological gradient towards the south and east. At the same time, the proportion of geophytes and phanerophytes significantly decreases in the same direction. There is also a significant increase in the proportion of Stenomediterranean, Eurimediterranean, Mediterranean-Montane, and Eurasian species, while Boreal species, as expected, decrease toward the southeast. The main differentiation of beech forests in south-eastern Europe is due to macroecological factors (macro-climatic, development of vegetation in the past period), whereas ecological factors (temperature and moisture as the most important) are reflected in the differentiation of sub-alliances.

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Phytosociological features of the amphi-Adriatic *Sesleria juncifolia* s.l. grasslands

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Sesleria Scop. is one of the grass genera playing a major role in the montane grasslands landscape of south-eastern Europe. Within the genus, *Sesleria juncifolia* aggr. represents an amphi-Adriatic group of taxa which exhibits a typically disjunct range including the western Balkans and the Apenninian Peninsula, where neither systematics nor the syntaxonomical scheme of *S. juncifolia* agg. are entirely clear. Based on recent taxonomical papers, the following species are more or less considered to belong to *S. juncifolia* agg.: *S. apennina* Ujhelyi, *S. calabrica* (Deyl) Di Pietro, *S. kalnikensis* Ják., *S. juncifolia* Suffren,. *S. interrupta* Vis., *S. uhjelyi* Strgar and *S. albanica* Uhjelyi. Due to the ecological plasticity of the taxa belonging to *S. juncifolia* aggregate, a plethora of plant communities, classified into various higher ranked syntaxa occur throughout its distribution range. Probably the most common vegetation type dominated by one of the taxa from the *S. juncifolia* agg. are the amphi-Adriatic subalpine grasslands classified within the order *Seslerietalia tenuifoliae* (*Elyno-Seslerietea*). These grasslands host a number of circum-Adriatic (e.g., *Edraianthus graminifolius*, *Carex kitaibeliana*, *Scabiosa silenifolia*, *Trinia dalechampii*, *Anthylllis montana* subsp. *jacquinii*, *Gentiana dinarica* etc.) as well as circum-boreal taxa (e.g., *Silene acaulis*, *Dryas octopetala*, *Gentiana verna*, *Oxytropis campestris* aggr., *Erigeron epiroticus*, *Juncus monanthos* etc.) both on the Apennines and the Balkans. However, the presence of some vicariant and endemic taxa led some phytosociologists to propose syntaxonomic schemes aimed to emphasize the biogeographic characteristics of the Apennines and the Balkans respectively more than to highlight the amphi-Adriatic links. During our recent research on the taxonomy of *S. juncifolia* aggr. and its phytosociological characteristics, several problems re-emerged, while some others were uncovered for the first time. Hence our research aims at stabilization and a better circumscription of the syntaxa of various ranks characterized by the presence of different taxa within the *S. junciolia* aggr.

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Restoration of the lowland moors in the Federal Province of Salzburg (Austria)

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The successful restoration of lowland moors in Salzburg will be shown by the example of the Adneter Moos and the Fuschlseemoor.
The Adneter Moos, a protected landscape since 1983 was lowland moor of about 40 hectares near Hallein (District of Tennengau), abandoned for more than thirty years. Larger parts of the former lowland moor were destroyed in the sixties of the 20th century by afforestation with spruce (*Picea abies*).
First investigations showed the high biodiversity of the protected landscape with its adjacent area (100 hectares): More than 450 different plant species were found, that are more than 25 % of the flora of the whole Federal Province of Salzburg. Despite of the progressive shrub invasion more than 45 species of the Red List of Salzburg could still be found in rests of open litter meadows. Especially remarkable are threatened and nearly distinct species like *Juncus subnodulosus*, *Dianthus superbus* ssp. *superbus*, *Gentiana pneumonanthe* or *Liparis loeselii*, which can still be found only in a few other localities of the Tennengau. Six amphibian and four reptile species, some of them mentioned in the fauna-flora-habitat-directive of the European Union could be distinguished too. The Adneter Moos is also very attractive for birds (e.g. *Anthus pratensis*, *Saxicola rubetra*, *Saxicola torquata*) and day-flying Lepidoptera (e.g. *Coenonympha tullia*, *Maculinea nausithous*, *Maculinea teleius* or *Melitaea diamina*).
Between 2004 and 2005 a landscape management plan was worked out to give the aims and suitable methods a concrete form (Arming & Eichberger 2005). Since 2005 13.5 hectares of abandoned litter meadows and 1.15 hectares of shrub invasion were restored. A big goal was the conversion of more than 5.7 hectares of former spruce afforestation into litter meadows.
By investigating several permanent plots an annual vegetation monitoring evaluates the measures and documents the vegetation shift.

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Vegetation pattern on the western slope of the Devínska Kobyla Mts – Southern Slovakia

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The Devínska Kobyla Mts is the most southern section of the Malé Karpaty Mts, in Slovakia. The unique geographical position is resulting in an extraordinary physical-geographical condition, such as topography, climate and mainly vegetation. The Devínska Kobyla Mts is situated on the border of two phytogeographical regions: the region of Pannonian flora and the region of West Carpathian flora. Finally it belongs to the region Eupannonicum with close phytogeographic relationship to the nearby Hundsheimer Berge Hills in Austria. In Devínska Kobyla Mts we can find Western Carpathian, Pannonian and Mediterranean species growing together, and reaching the most western or northern boundaries of their natural occurrence

(*Peucedanum arenarium*, *Chrysopogon gryllus*, *Conryngia austriaca*, *Rhamnus saxatilis* subsp. *saxatilis*). The xero-thermophilous and calciphilous elements dominate in the species composition of vegetation. The recent vegetation data of dry grasslands and successive shrub vegetation in the Devínska Kobyla Mts mainly belonging to the *Festuco-Brometea*, *Trifolio-Geranietea sanguinei*, and *Rhamno-Prunetea* classes are present here. The 70 phytosociological relevés were sampled mostly during 2009 and 2010. The expert system for identification of grassland vegetation of Slovakia, numerical classification and ordination methods were applied to determine the 9 main vegetation types (associations) and to find the responsible environmental drivers related to their distribution patterns, respectively. Results of DCA support our assumption, that the major environmental gradients in species composition of vegetation were associated with moisture, nutrient content, light and temperature following the average Ellenberg indicator values.

Survey of vegetation units:

Festuco-Brometea Br.-Bl. et Tüxen ex Soó 1947
- Festucion valesiacae Klika 1931
  - Festuco valesiacae-Stipetum capillatae Sillinger 1930
- Bromo pannonici-Festucion pallentis Zólyomi 1966
  - Poo badensis-Festucetum pallentis Klika 1931 corr. Zólyomi 1966
    - Festuco pallentis-Caricetum humilis Sillinger 1930 corr. Guterman et Mucina 1993
- Cirsio-Brachypodion pinnati Hadač et Klika ex Klika 1951
  - Polygalo majoris-Brachypodietum pinnati Wagner 1941

Trifolio-Geranietea sanguinei Th. Müller 1962
- Geranion sanguinei R. Tx. In Th. Müller 1962
  - Geranio sanguinei-Dictamnetum albae Wendelberger ex Th. Müller 1962

Rhamno-Prunetea Rivas Goday et Borja Carbonell ex R. Tx. 1962
- Prunion fruticosae R. Tx. 1952
  - Prunetum fruticosae Dziubaltowski 1926
  - Rosetum pimpinellifoliae Kaiser 1926
- Berberidion vulgaris Br.-Bl. 1950
  - Ligustro-Prunetum R. Tx. 1952
  - Balloto-Syringetum vulgaris Exner 2004

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Diversity and Gradients of Forest Vegetation in Çakırlar Basin (Antalya – Türkiye)

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This study was carried out in Çakırlar Basin in Antalya (Turkey). The altitude in the basin ranges from sea level to about 2600 m causing a high ecological and floristic diversity in a short distance. In the work, forest vegetation was sampled, assessed and classified. Total 61 relevés were sampled in 2011 and 2012 in accordance with Braun-Blanquet approach. The classification and ordination of the relevés with the passive projections of topographical factors (altitude, inclination and aspect) were realized by using the numerical analysis techniques which are widely used in vegetation ecology studies. According to the analysis, it was defined that forest vegetation in the basin is formed by 7 different forest communities representing different ecological and floristic characteristics. The riverine forest is dominated

by *Platanus orientalis* forests accompanied by *Nerium oleander* (1), The lowest part of the basin is covered by *Quercus cocciferae – Olea europea* dominated sclerephyllous forest which was converted to scrublands due to the human induced degradation (2). Another sclerephyllous forest in the basin appearing at the higher elevation zone is dominated by also *Quercus coccifera* with the dense appearance of *Spartium junceum* (3). Coniferous forests in the basin are formed by *Pinus brutia, Cedrus libani* and *Pinus nigra*. The lowest part of those forests is formed by *Pinus brutia* with the dense occurrence of *Stipa bromoides* (4). Along the altitudinal gradient, it was followed by *Quercus coccifera-Pinus brutia* dominated forest (5), *Pinus nigra-Cedrus libani* dominated forest (6) and *Cedrus libani* dominated forest with the dense occurrence of *Anthemis rosea* at the herb layer (7). All topographical factors showed significant correlations with relevés but altitude appeared the most significant and explanatory variables effecting the floristic differentiation in the basin.

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Floristic composition of the order *Halacsyetalia sendtneri* H. Ritter-Studnička 1970 in the Republic of Kosovo

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In this paper we present the research data from flora and vegetation of the order *Halacsyetalia sendtneri* H. Ritter-Studnička 1970 in Kosovo analyzed by Braun-Blanquet methodology. This order represented the alliance *Centaureo-Bromion fibrosi* Bleč. et al. 1969 that includes the following associations: *Cynancho-Saponarietum intermediate* Bleč. et al. 1969, *Polygalo-Genistetum hassertianae* Bleč. et al. 1969, *Sedo-Bornmullerietum dieckii* Bleč. et al. 1969, *Hyperico-Euphorbietum glabriflorae* Rexhepi 1978, *Onosmo-Scabiosetum fumaroides* Rexhepi 1978, *Potentillo-Fumanetum bonapartei* Rexhepi 1979 and *Stipeto-Convolvuletum compacti* Millaku et al. 2011. All of the above associations developed in serpentine terrains at an altitude of about 600-1000 m. Although serpentine terrains are difficult to plant growth and development, the presence of species is quite large. Ecological characteristics will be reflected through the analysis of life forms, while analysis of floristic elements appears across the areal spectrum.

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Gradient of plant species diversity in EU Natura 2000 forest habitats – case Illyrian *Fagus sylvatica* forests

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Natura 2000 is a coherent ecological network of special areas, designated under the EU Habitat Directive (1992) and EU Bird Directive (1979), to preserve biodiversity and habitats in a favourable conservation status. Within the Natura 2000 network in Slovenia, managed forests dominate, and conflicts between nature conservation and timber productive roles are possible.
Forest management is a robust driver of diversity and, according to the applied options, may act as a factor of enhancement or depletion of biodiversity. In the framework of the Life+ ManFor C.BD project, within the Dinaric fir-beech forest in Slovenia, the impacts of three key factors (forest management, dominant tree species, and location) on plant species

diversity have been studied. Besides their significant forest-management and timber productive role of these forests, their ecological and nature-conservation aspects are also important. These forests are the central parts of the habitats of three large European predators, the brown bear, lynx and wolf, and of many other species of nature-conservation interest, and the major part of these forests has been designated as part of the Natura 2000 network (mostly habitat type of Illyrian *Fagus sylvatica* forests). According to climate change predictions, they might be also among the most threatened forests in Slovenia in the future. To mitigate the effects of climate change on these forests and to preserve the present biodiversity, appropriate forest management measures need to be applied.
The plant species diversity has been tested before and will be assessed after implementation of forest management measures of three intensities. In this article, the status of plant species diversity before the implementation of forest management measures is presented. In three selected sites, 27 plots were set in the bottom of the karst terrain depressions (sinkholes). Among three groups of plots with different planned forest management measures and among three groups with different dominant tree species, there are no significant differences in the plant species diversity parameters. However, there are significant differences among groups of plots from different locations of Dinaric fir-beech forests. The number of species per 400 m² sized plots varies between 29 and 68 (mean: 48.8), and the value of the Shannon diversity index H' is between 1.23 and 3.30 (mean: 2.41). After the implementation of forest management measures, the plant species diversity will be assessed in order to optimize forest management system in these sensitive forests.

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Effects of environmental variability and disturbance regime on the floristic composition and the ecosystem functioning of the dry Puna (south Peruvian Andes)

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Alpine environments lining within tropics represent as much as 10% of the total surface area of the alpine ecosystems worldwide, still their ecology has been studied much less thoroughly than outside the tropics. The dry Puna is the widest ecosystem of high tropical Andes, one of the leading biodiversity hotspots worldwide. In this alpine environment, the main stress factors are represented by the long period of water shortage, the high degree of potential evapotranspiration, the wind erosion of soil and its low nutrient content, and the extreme thermal variation. The aim of this study was to deepen our understanding of the dry Puna species composition, ecosystem functioning and community diversity connected with the environmental/anthropogenic variables. To this end, a stratified sampling method was applied for the data collection: the cover percentage values of species were evaluated and soil samples were collected in 121 plots. For the statistical elaboration of the data a Multivariate Regression Tree, Indicator Species Analysis and Redundancy Analysis were executed. Our results demonstrate that the dry Puna landscape is anything but homogeneous from a floristic point of view. As a matter of fact, disturbance intensity, land form and soil features shape the specific composition of pastures, leading to a quite complex mosaic of plant communities. The main sources of this variability are disturbance intensity, altitude, percentage of outcropping rocks, slope, aspect and, with a lower degree, soil features (organic matter, pH, and potassium). In particular, high grazing intensities cause the spread of species with avoidance strategies as thorny dwarf shrubs (*Tetraglochin cristatum*), annual and prostrate plants. Harsh conditions promote the spread of cushion plants (*Pycnophyllum sp.* pl.). The

Festuca orthophylla tall grassland, whose species composition emerged as shaped by aspect and soil features, is the dominant plant community in the dry Puna.

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Flora of the Galičica Mt (Macedonian Part)

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The natural characteristics of Galičica Mt, location, geological history, relief and geological substrate have contributed for the development of a exceptionally rich floral diversity, with over 1700 higher plant species, among which the endemic and relict species are of special importance. Galičica Mt is a region with numerous species, representatives of various geo elements – Mediterranean, Sub-Mediterranean, Oro-Mediterranean, Balkan, Scardo-Pindic, Central-European, European, Alpine, and other. Some plant species here reach the northern, southern, eastern or western boundary of their distribution. A large number of plant elements from the southernmost parts of the Balkan Peninsula and Asia Minor on Galičica Mt reached their northernmost boundary or one of their northernmost points, among which are the *Rindera graeca*, *Acantholimon androsaeum*, *Sideritis raeseri*, *Morina persica*, and others. At the same time, some alpine species have reached their southernmost boundary here (*Sibbaldia procumbens*).The plant species discovered for the first time on Galičica Mt are of special importance. Galičica Mt is a locus classicus to over 30 plant taxa, most of which have a valid taxonomic status. The majority of species described are for the time being known only within the boundaries of the mountain and are its local endemic species. Such is the case with the following species: *Bupleurum mayeri* Micev., *Centaurea galicicae* Micev., *Centaurea tomorosii* Micev., *Dianthus galicicae* Micev., *Dianthus ochridanus* Micev., *Edraianthus horvatii* Lakušić, *Festuca galicicae* Mgf-*Dbg*, *Helichrysum zivojinii* Černjavski & Soška, *Laserpitium ochridanum* Micev., *Micromeria kosaninii* Šilić, *Nepeta ernesti-mayeri* Diklić & Nikolić, *Sempervivum galicicum* Micev., *Jurinea micevskii* Stevananović, Tan & Matevski. There are 19 taxa on Mount Galičica from IUCN World's Red List of Threatened Plants which have the status of „rare" (R) and which are found in all parts of the mountain, from the lowest parts to the highest subalpine parts.

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New records for the Flora of the Republic of Macedonia

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In this occasion a contribution to the knowledge of distribution ranges of several plant species will be presented. The records represent enlargement of the range of restricted range species; or they represent the shift of the southern border of the species range; or simply fills the gaps in the distribution range for other species.

The following plant species were recorded in course of the botanical research during last several years and they represent new findings for the flora of the Republic of Macedonia: *Polypodium cambricum* L., *P. interjectum* Shivas, *Clematis recta* L., *Salix rosmarinifolia* L., *Lathraea rhodopea* Dingler, *Cirsium grecescui* Rouy and *Eleocharis austriaca* Hayek.
Polypodium cambricum (Matka canyon near Skopje) and *P. interjectum* (several dales and ravines in Macedonia) grow in deep and humid dales. *Cleamtis recta* was found only on one locality close to v. Mrezhichko in Mariovo region. Only one cluster of *Salix rosmarinifolia* was discovered on Lukovo Pole peat land which vas partly burned at the end of 2011. *Lthraea rhodopea* was found on Belasica Mt., which actually represent a continuation of Rhodope massif in Macedonia. *Cirsium grecescui* was found on the border between Shara Mountain and Bistra next to the wetland at the Bunec resort. *Eleocharis austriaca* grows on Shar Planina next to the alpine lake Bogovinsko Ezero.

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Content of Ni, Zn, Cu in some species of the genus *Alyssum* L. in Macedonia

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Heavy metals are important natural and anthropogenic pollutants in the environment, and their toxicity is an issue of great importance from an environmental, evolutionary, taxonomic and nutritional aspect. Excessive presence and accumulation of heavy metals in the soil causes a change in its composition and homeostasis in many plant species. The distribution of heavy metals in the root system and shoot of the plant depends on the species, availability and features of the heavy metals.
The objective of this survey is to determine the content and the potential for accumulation of Ni, Zn and Cu in plant species of the genus *Alyssum* in Macedonia. For realization of this objective an analysis of the presence of these metals in plant material (root, stem, leaf) from multiple locations in Macedonia: Mariovo, Veles, Makedonska Kamenica, Pelagonia, Tikvesh, Ohrid, Mavrovo, Shar Planina and other regions, have been conducted.
The plant material was collected from different substrates (limestone, dolomites, serpentine soils, different silicates etc.). From the so far completed analysis, the highest content of Ni was recorded in the leaves of *Alyssum corymbosoides* (384.7 mg•kg-1), as well in the species from Tikvesh region (due to the impact of the smelter FENI and natural presence of heavy metals in the soil). The highest content of Cu was recorded in plant species from Makedonska Kamenica, which indicates the primary influence of its soil availability. The highest content of Zn was found in the species from Veles, Makedonska Kamenica, while the lowest among plant species that grow on carbonate substrate (*Alyssum doerfleri* - Mariovo, *Alyssum saxatile*). Future research will be focused on the Macedonian endemic species of the genus *Alyssum* that grow on serpentine soils.

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Vegetation of limestone rocks and scree of the Moesian phytogeographic province

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The northeastern (Carpatian) and eastern (Balcan) Serbia are abundant in calcareous geological substrate and hence in calciphyle flora and vegetation. The vegetation of limestone rocks belongs to the class *Asplenietea rupestris* Meir. et Br.-Bl. 1934, order *Potentillletalia caulescentis* Br.-Bl.1926. and alliances *Micromerion cristatae* V. et N. Ranđ. 2012 and *Ramondion nathaliae* Ht. 1935.
Within the alliance *Micromerion cristatae* V. et N. Ranđ. 2012 only the association of *Micromerio-Parietarietum serbicae* Miljk.,M., Ranđ., N., 2012 has been described so far, while there are three associations which belong to the alliance *Ramondion nathaliae* Ht. 1935 – *Cetero - Ramondietum serbicae* R. Jov. 1953, *Erysimo-Ramondietum nathaliae* R. Jov. 1953 and *Inulo-Stachyetum horvaticii* Ranđ. N. et. al. 2001.
The vegetation of limestone screes belong to the classes *Thlaspietea rotundifolii* Br.-Bl. et al. 1947 and *Dripetea spinosae* Quencel 1967.
The first class is represented by the order *Achnateretalia calamagrostis* Oberd. et Siebert 1977 and alliance *Achnatherion calamogrostis* Jeni-Lips 1930.
The second class is represented by the order *Dripetalia spinosae* Quencel 1967 and alliance *Peltarion alliaceae* H-ic (1956) 1958.
The screes of eastern Serbia have not been thoroughly investigated yet. An investigation of this type of vegetation is being carried out and on these screes the autors have noticed the presence of the following species: *Cephalaria uralensis, Jurinea mollis, Centaurea atropurpurea, Acanthus balcanicus, Aethionema saxatile, Alyssum* etc.

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Some new plant species in serpentine of the Republic of Kosovo and their conservation status

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Based on different researches made from different authors, in the Republic of Kosovo there are about 3000 vascular plant species, majority of them distributed in the Sharri Mountains and Albanian Alps of Kosovo. Although in terms of flora and vegetation Kosovo is explored by various authors, in serpentines of Kosovo we have found some new plant species for flora of Kosovo. These species found in the Republic of Kosovo have very limited distribution area and are threatened by different factors that affect directly in the degradation of their habitat and this way reduce population of these species. During 2011-2013 in serpentines of Kosovo we have found these new plant species: *Epimedium alpinum* L., *Crocus flavus* (L.) Weston and *Cyanus lingulatus* (Lag.) Holub (syn. *Centaurea lingulata* Lag.). Species *Epimedium alpinum* L. that is distributed in European Alps, Northern Italy and in parts of Balkans is found in a place known as: Bokat e Morinës (near to the border with Albania), in a serpentine substrate on the altitude from 500 up to 1100 m, within the three plant associations (*Quercetum frainetto cerris, Polygalo-Forsythietum europaea* and *Fagetum montanum*). The species *Crocus flavus* (L.) Weston is found in serpentines of Gurana, near to the border with Republic of Macedonia in a very narrow locality, within the plant association *Quercetum frainetto cerris*. The species *Cyanus lingulatus* (Lag.) Holub. is found in Mushtishti mountains in serpentine substrate on the dry subalpine pasture vegetation and has very limited distribution area.

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The vegetation of siliceous rocks and screes of the Moesian phytogeographic province

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The siliceous rocks comprise 95% of the mountains of southeast or Rhodopean Serbia where a specific rock and scree vegetation develops. This vegetation belongs to the classes *Asplenietea rupestris* Meir. et Br.-Bl. 1934 (rocks) and *Thlaspietea rotundifolii* Br.-Bl. et al. 1947 (screes).
The class *Asplenietea rupestris* Meier et Br.-Bl. 1934 is represented by the order *Asplenietalia septentrionalis* Lakušić 1968 within which the alliances *Silenion lerchenfeldianae* Simon 1958 and *Genistion sericeae* Ranđ. 2008 have been discovered so far.
Within the alliance *Silenion lerchenfeldianae* two associations have been described: *Sempervivo-Minuartietum bulgaricae* N. Ranđ. 1980 and *Seseli rigidae-Dianthetum noeani* Milos.V. 2010, while within the alliance *Genistion sericeae* Ranđ. 2008 a single association has been described: *Achilleo-Genistetum sericeae* N. Ranđ. 1981.
On the other hand, within the class *Thlaspietea rotundifolii* Br.-Bl. et al. 1947, order *Polygonetalia alpine* Lakušić 1968 and alliance *Polygonion alpine* Lakušić 1968 one community has been described: *Linario-Polygonetum alpini* N. Ranđ. 1995.
The rock community *Sempervivo-Minuartietum bulgaricae* N. Ranđ. 1980 grows on micaschiste and grandiorite and represents the endemic siliceous rock community of Besna kobila and neighbouring mountains. The name of the community is derived from the characteristic species *Sempervivum heuffelii* and *Minuartia bulgarica*. The community *Seseli rigidae-Dianthetum noeani* Milos.V. 2010 grows on andensite and beside the caracteristic species that the community was named after, it is caracterised by the presence of some rare plants, such as *Saxifraga paniculata, Silene waldsteinii, Lamium garganicum, Thymus jankae, Campanula sparsa* etc.
Beside the characteristic species *Achillea chrysocoma* and *Genista sericea*, the community *Achilleo chrysocomae-Genistetum sericeae* N. Ranđ. 1981 which grows on rocky grounds of Besna kobila also includes *Phleum michelii, Hypericum barbatum, Sempervivum heuffelii, Plantago subulata* etc.
The scree community *Linario-Polygonetum alpini* N. Ranđ. 1995 beside the species it was named after, is caracterised by the presence of *Digitalis viridiflora, Knautia magnifica, Thymus balcanus, Peucedanum sequiradium* and other species that come to the habitats of this community from the neigbouring pastures.

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New contributions to chorology and composition of the association *Astragalo-Morinetum Micevski* 1971 in east Macedonia

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Association *Astragalo-Morinetum* Micevski 1971 belongs to the alliance *Saturejo-Thymion* Micevski 1970, order *Astragalo-Potentilletalia* Micevski 1971 and class *Festuco-Brometea* Br.-Bl. et Tx.1943. According to the first investigations by Macedonian botanists, this

association is widespread in east Macedonia on the north up to the Veles-Delesinci line. However, a three-year investigation (2009-2012) suggests the presence of this community on the hills surrounding Štip, near the crossroads by St. Nicola (Đurinac, Oral, Đuđanci), and south from Kumanovo (Bislim, the river Pčinja gorge, Orašec village), which moves the border of distribution of ass. *Astragalo-Morinetum* Micevski 1971 to the north up to Kumanovo. The presence of species *Astragalus parnasii*, *Morina persica*, *Scutellaria orientalis*, *Centaurea orphanidea*, *Polygala rhodopaea*, *Jurinea arachnoidea*, *Thymus pseudoatticus*, *Genista trifoliata*, *Convolvulus holosericeus* shows the floristic similarities of these stands described earlier by Micevski, but the presence of species *Salvia jurisucii*, *Artemisia maritima*, *Echinaria capitata*, *Coronilla scorpioides*, *Stipa pennata*, *Haplophyllum suaveolens*, *Astragalus wilmottianus*, *Trigonella gladiata*, *Scabiosa silaifolia*, *Trifolium echinatum*, *Salvia horminum*, *Trifolium hirtum*, *Crocus pallasii*, and *Crocus cancellatus* ssp. *mazziaricus*, according to the authors of this paper, shows that these communities actually grow on marly substrate in somewhat different environmental conditions.

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Ecological and floristical changes in sand grasslands along Danube River

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The examined area located in Carpathian Basin is semi-arid, extreme dry where open grassland is the typical vegetation. The soil is dry and sandy with xerotherm characteristics vegetation types and with dominant endemic species such as *Festuca vaginata*. Experiment based on determination of dominant species in vegetation (*Festuca vaginata* and *F. pseudovaginata*, identified as new taxa). Soil characteristics examination based on average soil samples and their laboratory examinations. Physiognomy of the vegetation remained the same with some changes in species composition: in *Festuca pseudovaginata* plots the weed and disturbance resistant species amount increased and *Cynodon dactylon* became dominant on grasslands. In plots where *F. pseudovaginata* was dominant the field was degraded and contained shallow and sandy soils. Urbanization caused growth of nitrate content in this area. Result suggests that this taxa adapted well to the new environment which changed because of human activity. Background of condition of plant nutrition, furthermore to outline pedological differences between different vegetation.
This project supported by a grant from Switzerland through the Swiss Contribution: „Sustainable Nature conversation on Hungarian Natura 2000 sites".

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Ecological aspects of *Pycnophyllum molle* Remy and *P. weberbaueri* Muschl. in the high Andean dry Puna

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The dry Puna is the widest ecosystem of the tropical Alpine Andes, mainly composed of shrubs, grass tussocks, cushion, and mat-forming species. It is subjected to long and intense drought and cold stress periods and to disturbance, mostly due to grazing of domestic

camelids (*Lama glama* and *Vicugna pacos*) and fires. In these environmental constraints, facilitation among plants (a plant interaction by which "nurse" species ameliorate micro-scale harsh conditions and provide refuge to other plants), is key in the conservation of plant diversity. The research aims were to understand which ecological variables affect the distribution of the potential nurse cushion species *Pycnophyllum molle* and *P. weberbaueri*; and if these species are differently affected by disturbance.
The study area (3900-4900 m a.s.l.) was located in the "Salinas and Aguada Blanca National Reserve" in the southern Peruvian Andes. Data on species cover, topographic and soil features, and type of disturbance were collected along transects. We used canonical redundancy analysis to understand the relations between the cover of the two *Pycnophyllum* species and the above mentioned variables.
Our results indicate that both the *Pycnophyllum* species avoid high disturbance intensities (large herds of domestic camelids and fires) and grow on soils very similar in texture, pH, $CaCO_3$, and potassium content. *P. molle* is linked to relatively undisturbed conditions (absence of grazing and fires), on the most fertile soils (with the greatest phosphorus and organic matter content, and the lowest C/N ratio), at the highest altitudes, and on the steepest slopes characterized by greater rockiness. *P. weberbaueri* is related to intermediate disturbance intensities (herds of wild camelids and sporadic herds of domestic camelids or large herds of domestic camelids), less fertile soils, lower altitudes, and less steep slopes.

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Formation Specifics of the Alpine Flora of the Russian Far East

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According to the published scientific sources the conditions of the development and distribution of alpine species in the mountains of the Pacific coast could have appeared in the Neogene, especially in the Pliocene, when the intense tectonic activity took place within the entire eastern edge of the Mongol-Okhotsk volcanic belt and beyond it. Some peaks and ridges not covered with forests may have already existed in the Paleogene in the coastal mountain areas, where the upper boundary is lowed in comparison with continental mountains and where the winds get the greatest force (Yurtsev, 1968, 1974, and others).
According to the spore and pollen analysis the cedar pine, the ancestor of mountain pines and Japanese *Pinus parviflora* Siebold et Zucc, grew in this period on the rocky slopes of the coastal mountain ranges. Types of the section *Dryas* L. inhabited stone and debris streams of the forest belt. Modern barrens of Hokkaido and Sikhote-Alin can give a rough idea of the possible nature of ancient alpine tundra vegetation, but its species composition was significantly poorer. Plants such as *Dryopteris fragrans* (L.) Schott, *Cryptogramma raddeana* Fomin, *Chosenia arbutifolia* (Pall.) A. Skvortsov, *Populus suaveolens* Fisch., *Woodsia ilvensis* (L.) R. Br., *W. glabella* R. Br. and others could inhabit this territory.
According to A.I. Tolmachev (1956) the following barren bushes and shrubs may be of the Pliocene age: *Cassiope ericoides* (Pall.) D. Don, *Phyllodoce coerulea* (L.) Bab., *Novosieversia glacialis* (Adams) F. Bolle, *Rhododendron aureum* Georgi. The level of systematic isolation of these genera suggests very long development of their parental types in the standing alone mountain ridges.
Earlier rising of individual volcanic massifs, abundance of open stony surfaces, and coastal location of mountains created the preconditions for the development of the already high in the Neogene alpine and mountain elements.

The basic composition of modern alpine species is likely of the Early and Middle Pleistocene age. They were formed in the atmosphere of longer and more severe winters and short summers. These species include: *Larix cajanderi* Mayr, *Betula exilis* Sukacz., *Duschekia fruticosa* (Rupr.) Pouzar, *Dryas ajanensis* Juz. and others. The ancestors of these species already existed on the territory of Angarida in the Neogene. B.A. Yurtsev (1974) proposed to call these groups of plants, genetically related to Early Quaternary landscapes, as neoangarida, unlike paleoangarida, which are of a more ancient age. The Badzhal alpine flora, as well as the North-Eastern flora, is also neoangarida. Climate changes due to the general cooling of the Arctic basin contributed to the development of the neoangarida complex as such changes caused intense winter cooling of the continent and the appearance of permafrost landscapes.
A broad contact between the floras of different Angarida mountain massifs was formed right at the beginning of the Pleistocene. The dramatic change in the general character of the climatic conditions gave a powerful impetus for the formation of species of cold-resistant flora elements of the Far East and for their wide dispersal.

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Macro, Micro and Molecular changes of sheep ingestive apparatus related to dry grassland vegetative cycle: a key tool for rangeland management

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Hofmann's studies stated that Ruminant digestive apparatus shows a high degree of structural and functional variability, reached by means of evolutionary steps. In addition, he demonstrated the occurrence of seasonal adaptations of the digestive system in relation to forage availability and climatic conditions. From an ecological viewpoint, the Apennine grasslands show an annual productive trend, with the highest production corresponding to the flowering peak at the end of June. In the summer, the quantity of phytomass available for flock feeding decreases; in addition, a forage biochemical alteration occurs, due to the increase in the percentage of lignin, with a consequent reduction of forage digestibility and nutritional supply. Anatomical research, supporting eco-vegetational investigations focused on the maintenance of pastoral ecosystem biodiversity, performed during two consecutive years, demonstrated molecular, micro- and macroscopic modifications of the sheep ingestive apparatus, related to the vegetative cycle of pasture and to interannual climatic differences. From a molecular viewpoint we observed a different expression of AQP5, a water channel protein, in sheep parotid glands according to the pasture vegetative development and inteannual climatic variations, due to AQP5 involvement in providing appropriate saliva fluidity. At rumen level, four indicative regions were monitored: atrium, dorsal and ventral sac, and dorsocaudal blind sac floor. All regions showed modifications linked to different stages of the pasture vegetative cycle. We observed macroscopic modifications in papillae mean area, which directly affects the SEF (Surface Enlargement Factor) during the pasture vegetative cycle, also linked to interannual climatic variations. Modifications were observed also at microscopical level as rumen epithelium keratinization degree and calibre and number of blood vessels. However, rumen ventral sac was the rumen region showing macro- and microscopical modification mainly related to pasture qualitative and quantitative changes. At the same time, we monitored the animal Body Condition Score (BCS). Obtained results allowed the validation of BCS as representative parameter of morphofunctional modifications, which are strictly related to ecological-productive variations of the grassland systems. The research gave the outputs to provide breeders a simple method for improving farm

management and to define the best practices allowing breeders to fulfil European Union aims for biodiversity maintenance through animal husbandry.

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Vegetation succession caused by abandonment of traditional land use on the island of Molat (Croatia) during 100 years period

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During the last few decades vegetation changes, especially vegetation succession of open habitats, became a common process on large areas in Croatia. Many plant communities arose and are maintained by some form of agricultural activities (mowing, pasture, cutting, burning etc.). Abandoning such traditional land management practice lead to vegetation succession and large changes in floristic composition of such, antecedent agriculturally used areas. The island of Molat (22.8 km^2), belongs to Zadar archipelago in central part of eastern Adriatic, has been influenced by intensive agricultural activity during the first half of the 20^{th} century. Depopulation began during the 60-ties and local inhabitants decreased their agricultural activities. These social and economic changes affected vegetation. Recent situation was assessed during the field work between 2007 and 2010. Historical vegetation analyses were done using GIS tools based on cadastre for the whole island from the year 1910, aerial photographs from the years 1959, 1986 and 2006, and vegetation mapping made between 1966 and 1968. The vegetation was divided in physiognomic types because of lack of phytosociological information for the past researched periods. At the beginning of the researched period rocky grasslands, covering an area of 16.7 km^2, occupied the largest part of the island, while its area diminished to 0.45 km^2 by the end of the period, in 2006. On the other hand maquis occupied 1.25 km^2 in 1910, while in 2006 it spread to 12.2 km^2. Along with mentioned changes a vegetation dynamics path, as well as stages appearing during the process of succession, was determined during the researched period. Using phytosociological relevés and chronosequence methods in this research vegetation series belonging to *Myrto-Quercetum ilicis* was reconstructed as present on the island.

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Effect of the climatic factors and different agricultural activities on species richness and functional groups of the Pannonian dry grasslands in Tihany Penisula

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The aim of the study was to compare the effects of different agricultural usage (grazing and mowing) on the vegetation of dry grasslands. The study areas were situated in the Tihany Peninsula (Balaton Uplands National Park, Hungary) which is dominated by grassland habitats. Phytosociological samples were collected in 1994, 2002, 2006, 2007 and 2008 in three sites. Site1 was a Hungarian grey cattle pasture which had been under intensive agricultural usage as a hayfield till 1994 and then it was turned into pasture. A drinking area (Site2) was separated within this area where cattle spend more time. Site3 is an area with the same conditions like Site1 but it is under continuous mowing by the National Park. We made

10 quadrats of 2x2 m in each site. For the statistical analyses we used ANOVA and as post-hoc test Tukey-Kramer test was applied. Diversity was analysed by rank-abundance curves and the Rényi diversity profiles. Precipitation and temperature data from 1994 and from the period 2000-2008 were evaluated in monthly intervals.
On the basis of the species composition and cover values the drinking area was different from the other two sites because the coverage values were lower and number of species was given mostly by weeds which is a good indication to trampling and the presence of a large quantity of nitrogen as well. The species composition and coverage values of Site1 (pasture) and Site3 (hayfield) showed strong similarity. The Rényi diversity profiles represent clear differences between the sites: Site1 and Site3 were the most diverse areas and the samples which were taken near the drinking area showed the lowest diversity. Changes in vegetation of the grassland are associated with climatic changes, especially with the shifts of precipitation (for example instead of broad-leaved species such as *Festuca arundinacea* narrow-leaved *Festuca* species with xeromorph characters were dominant since these have better adaptation to the drier period).
Results showed that grazing and mowing are also a good opportunity to maintain grasslands (the species richness and the diversity are higher) but in case of grazing it is important to take care of the appropriate number of livestock (considering the results in the drinking area).

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Grasslands of the Biosphere Reserve Vienna Woods (Austria)

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As part of a syntaxonomic revision of the Pannonian grasslands of Austria, we present a classification of the grasslands of the Vienna Woods (Wienerwald). This region, although geographically belonging to the Alps, has strong floristic affinities to the Pannonian Basin. The eastern slopes of the Vienna Woods are a hotspot of xero-thermophytic vegetation and exhibit the highest vascular plant species richness in Austria at a scale of 3' × 5'. We used the TWINSPAN classification of a large data set including relevés from all over Eastern Austria and Southern Moravia as starting point. Relevés that were considered as misclassified at the level of alliances were manually re-arranged. From this table, an excerpt containing only the relevés of the Vienna Woods was used for the present study (1055 plots). Clusters for which no ecological difference could be detected were merged. The final delimitation of associations and subassociations was achieved by adjusting their diagnostic species so as to get units that were most informative in terms of environmental conditions. All re-arrangements were based on the summarised cover of diagnostic species within individual relevés. As a result, the grasslands of the Vienna Woods were classified within 22 associations (plus two additional subassociations) belonging to ten alliances and four classes. Within the Seslerio-Festucion pallentis, a new association for the Carex humilis grasslands of the eastern margin of the Alps was described. The semi-dry grasslands of the study area previously classified as Onobrychido viciifoliae-Brometum were described as new association and assigned to the Cirsio-Brachypodion. The Anthoxantho-Agrostietum tenuis is reported for Austria for the first time. The syntaxonomy of these units is discussed within a broader geographical context.

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The impact of the mole rat (*Nannospalax leucodon*) on the structure and diversity of a loess steppe in Hungary

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The diversity is one of the central questions in ecology and it plays an important role in the stability of the ecosystems. Not only the interaction of plants affects the diversity but the ecosystem engineering animals (such as subterranian rodents) also have an impact on it. Considering this our aim was to investigate the species richness and diversity of the grassland influenced by the digging of the mole rat and to study the effect of this disturbance to the diversity. We made the survey in Battonya-Tompapuszta which is a unique area in Hungary because of the excellent quality of soil and extension of the natural loess meadow.
We recorded the presence/absence and the coverage of the species in 50x50 cm plots in 5x5 cm microquadrats, 12 plots were made on mounds and 12 plots in a control area with no mounds. The data analyses were made with using the Shannon- and Simpson diversity indices, the differences between the plots was tested by one-way ANOVA. There was no significant difference in the number of species ($p=0,162$), in the Shannon-diversity ($p=0,373$) and not either in the Simpson-diversity ($p=0,505$). On the basis of traits (life form, canopy height, vegetative propagation) the sites separated clearly: on the mounds there were mostly hemiphanerophyte, dicotiledonous, and lower plant species with runners whilst in the control area the hemicryptophytes, graminoides and higher species were dominant.
These are preliminary results, we will plan to continue the survey and examine mounds with different state (new, inactive and old mounds) because the effects can depend on mound age.

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POSTERS

The effects of natural and human disturbance on the plant communities and plant landscape of a representative Apennine sector (Monti Sibillini National Park, central Appenines)

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We present here a phytosociological study of the vegetation and plant landscape of Piè Vettore (Monti Sibillini National Park, central Apennines) and their connections with the lithology, geomorphology, bioclimate and anthropic features.
The area investigated includes the southern slopes of Monte Vettoretto and Monte Vettore, between 1300 m and 1600 m in altitude. It is located in the extreme southern sector of the Sibillini Mountains, close to the foothills of the north-western part of the Laga Basin. This area is characterized by the outcrop of lithotypes that belong to the Calcare massiccio s.l. Formation and to the Corniola Formation, which overlap each other along an overthrust front, with the turbiditic and siliciclastic terms of the Laga Formation. This formation outcrops extensively only at the extreme eastern edge of the area. The local substrate is covered by overall detritis deposits of limestone.
The vegetation is influenced by the great geological and geomorphological complexity and by human activities, which have profoundly transformed the vegetal landscape over the years. The western sector is characterized by a mosaic of grasslands affected by the vegetational dynamism that arises from several morphogenic processes. The eastern sector is largely covered by conifer reforestation of black pine (*Pinus nigra*), which is sometimes mixed with *Abies alba*, and these date back to the 1950's and are called the Pineta di Pie' Vettore. The heterogeneity that characterizes this forestry sector is linked to the presence of original native forest and the edges of preforestal neoformations. Some of these natural formations are of a lasting character.
The detailed phytosociological analyses have made it possible to survey the great floristic and vegetational diversity of the investigated area, as demonstrated by its 12 vegetation types. These were reproduced for the phytosociological map at a scale of 1:5,000. Eight of these vegetation types belong to Habitats of Community Interest. During the detection phase, species of considerable interest were also found: *Moneses uniflora*, *Centranthus angustifolius*, *Goodyera repens*, *Gypsophila repens*, *Asarum europaeum*, *Astragalus danicus*, *A. vesicarius*, etc.
Moreover we investigated the phytosociological communities and morphogenetic factors relationships. In particular the relationship analysis highlighted the importance of the morphostructure, the instability level and the substrate particle size.
This work has allowed us to describe and highlight the complex dynamic-catenal relationships that characterize the plant-landscape and to identify the hydrogeological instability indicator at floristic and community vegetation level.

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Evaluation of nature conservation management effects on grasslands in Budapest

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Budapest outstanding natural treasures that urbanization and other anthropogenic factors partly missing and on the one hand endangered status. The remaining areas are also at risk, but this decrease is Pénzes diversity also refers to Budapest in 1942, published of flora and fauna. The remaining values are important to preserve. The conservation areas but figured prominently in the various areas of the threats detection and good treatment choice.
The main city area where appears four valuable grassland habitats were investigated. Each of the four areas located in Budapest, in which Harang valley and Ferenc mountain limestone bedrock formed steppe, while the small Kis-sváb Mountain formed dolomite bedrock sloping hills of Buda, the hilly sandy grassland, Tamariska hill, which is located in Csepel. The ongoing study areas of conservation treatments are conducted with the purpose of the survey, each of the treatments protected species diversity and the effects of exploration, document the status changes taking place in the area.
The plots 6-6 pieces 2 × 2 m quadrat Braun-Blanquet's phytosociological recording was finished, the percentage of species currently cover. In all cases the previous years, we have treated and non-treated areas or parts of the degraded area compared to the control area were compared. The plant cover recordings of nature conservation significance using ecological indicators were analyzed, and the kind of life-Pignatti types was evaluated.
The evaluation of the tests coenological it was concluded that the compositional diversity, the mowed (treated) area species richer than the untreated, and the species of the shrub layer and also reduces the life of the display area diversity.

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Habitat fragmentation in traditional Central-European landscape

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We have studied the structural and spatial configuration of nonforest habitat types and habitat fragmentation in Trilateral Park Goričko-Raab-Örség (three border region between NE Slovenia, SE Burgenland- Austria and western Hungary). In this part of Central Europe the traditional landscape with its typical semi-natural and cultural elements is still very well preserved. The studied area in all three countries has similar climate conditions and geomorphological features, as well as vegetation types. Thus we expect also the habitat matrix will be similar in all three parts of Trilateral Park.
We followed national standard habitat mapping methodology (after P. Devillers & J. Devillers-Terschuren) and for detailed analysis we used GIS. The field survey was carried out in 2011 between May and September. We have aggregated similar habitat types into several aggregates, from which the most important were semi-natural semi-dry grasslands on acidic soil, mesophilous and wet grasslands, meadow orchards and meso- and eutrophic mesic grasslands.
In Slovenia and Austria the semi-dry grasslands are still quite representative, but in Hungary such habitats are scarcer and more randomly distributed. The percentage of reforested and abandoned grasslands is very high in Hungary (partly because of depopulation and demographical decrease, partly because of inconsistent land use), but surprisingly low in Austria (the main reason is perhaps the continuity of land use). We can assume that in Austrian part the intensification of land use is more present than in Hungarian part of the Trilateral Park, where either abandonment or very dynamic changes in terms of land use (meadows were ploughed, then abandoned, and after a while ploughed again or changed into pastures or grasslands) are still in progress. In Slovenia these changes were only of minor

importance so in our opinion the landscape in Goričko Park reflects almost the same habitat structure as it was some 100 years ago.

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Preliminary results of the monitoring of *Sideritis raeseri* Boiss. & Heldr. in Galičica National Park, Macedonia

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Galičica Mountain, situated between Lake Prespa and Lake Ohrid (Albania and Macedonia), hosts an important population of the Western-Balkan endemic species *Sideritis raeseri* (Mountain Tea). The typical habitat of this species in Galičica National Park include the Pelagonide closed calcicolous sesleria grasslands (EUNIS: E4.41723), Pelagonide closed calcicolous fescue grasslands (EUNIS: E4.41724), Helleno-Balkanic stripped grasslands (EUNIS: E4.437), and Sub-Mediterranean common juniper thickets (EUNIS: F3.164). The collection of the areal parts has been the most important pressure on the population of this traditional medicinal plant. More recently, habitat loss, in particular due to natural succession of forest on secondary grassland, has aggravated the threats to the local population. The role of wildfires in the maintenance of the habitat for this species is not well understood. Having recognized *Sideritis raeseri* as a species of great conservation need, the Public Institution National Park Galičica adopted a set of management actions, including a ban on collection of this species in most parts of the park. The monitoring of selected populations of *Sideritis raeseri* has been conducted since 2010 to provide feedback information needed to adjust management activities in the Zone of Sustainable Use where collection is still allowed. The monitoring focuses on two target populations in this zone. The population around the Visok peak and the adjacent peaks has been affected by the large 2007 wildfire, whereas the population around the Tri Mazi peak has not been affected by wildfires for several decades. The size of the Visok peak and Tri Mazi macroplots were 10 ha and 5 ha, respectively. Systematic total counts were conducted each year in both macroplots since 2010. Following the adjustments of the methodology and its practical implementation in 2010 and 2011, the first reference values for the size of the sampled populations was established in 2012 (105.9 ind./ha and 47.6 ind./ha, respectively). Although the size of either of the sampled population is not statistically representative of the respective target populations, its decline would be a signal for action and justification to check the status of the rest of the population. However, the baseline values for the size of the population within the limits of its natural fluctuation will be established only through repeated measurements over a prolonged period.

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Ptilostemon gnaphaloides in Italy: phytosociology, ecology and distribution

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Genus *Ptilostemon* Cass. (Asteraceae), according to the most recent genetic survey, encompasses four sections: *Lamyra, Platyrhaphium, Pterocaulos, Ptilostemon* (Vilatersana et al., 2010). Section *Ptilostemon* includes two species: *P. gnaphaloides* and *P. chamapeuce*. *P.*

chamaepeuce (L.) Less. occurs in Greek East Aegean Islands, Albania, Crete, Cyprus, Greece, Israel, Lebanon, Syria, Turkey. *Ptilostemon gnaphaloides* (Cirillo) Soják naturally grows in different countries of Eastern and Southern Mediterranean. It includes two different entities of subspecific rank: subsp. *pseudofruticosus* (Pamp.) Greuter, occurring in Greek East Aegean Islands, Crete, Turkey; and subsp. *gnaphaloides* in Greece, Lybia and in a restricted part of southernmost Italian peninsula (locus *classicus*) within Reggio Calabria administrative province (Euro+Med, 2006-2013; Gangale et al., 2011). The Italian stands of *P. gnaphaloides* are spread on some rare calcareous outcrops occurring in a territory mostly characterized by crystalline rocks. Thanks to new field investigations an updated distribution range of the species in the study area is provided, besides allowing the analysis of the species-environment relationships through the correlation of local distribution with environmental gradients. *P. gnaphaloides* is considered as an element of the Mediterranean chasmophytic and garrigue vegetation (Brullo et al., 2001), as well as is reputed the taxonomically closer *Ptilostemon chamapeuce* (L.) Less. occurring in mainland Greece and Crete (Dimopoulos et al., 1997; Bergmeier et al., 2011). Aim of this work is to determine the structural and functional roles played by this rare species in rocky habitats on the basis of the phytosociological and ecological features, statistical analysis and a GIS based model. On the base of the floristic, ecological and phytosociological data the communities of *P. gnaphaloides* are referred to associations often characterized by other rare and/or endemic species such as *Euphorbia dendroides* L., *Erucastrum virgatum* (Presl) Presl, *Thymus capitatus* (L.) Hoffmanns. & Link, *Centaurea ionica* Brullo, *Lomelosia crenata* (Cirillo) Greuter & Burdet ssp. *pseudisetensis* (Lacaita) Greuter & Burdet, etc. Final considerations are devoted to the conservation measures of the investigated species and its communities.

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Analysis of the soil-vegetation relationships in the plant communities around Kratovo

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In this study, we aim to show a consistent relationship between soils and vegetation. Besides vegetation, there are a number of other soil-forming factors such as climate, and the biological activity (organisms), topography or relief, soil parent material and time during which the soil forms (Jenny, 1941, 1961, 1980). On the other side, (Major, 1951) showing that vegetation, like soil in Jenny's soil formation (or pedogenic) equation, is dependent on the same five mathematically-independent groups of factors. For this purpose we compared the floristic composition of some different communities registered in the north part of the Republic of Macedonia- near the Kratovo: fragment of association *Astragalo- Morinetum*, two subassociations - *brachypodietosum* and *scleranthetosum* of association *Erysimo-Trifolietum* (Ćušterevska et al. 2012). These vegetation communities except floristic, were also compared by the results obtained through the analysis of some soil parameters (mechanical composition, chemical properties- pH, humus, and pedotransfer function, and they were textural classified according classification of Scheffer & Schachtschabel (1989). The vegetation descriptions were treated numerically by assigning to each plant species Ellenberg's indicator values for M (soil moisture), R (soil reaction), N (soil nitrogen) and K (continentality), because Ellenberg's indicator values have been suggested as useful method of estimating site conditions using plants. Actual relationships between the vegetation compositions and their environmental conditions were calculated using a detrended correspondence analysis (DCA). Although the

investigated vegetation develops on a relatively small territory, still analysis showed significant correlation between examined parameters.

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Vegetation of the hilly pastures on the mountain Galičica

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The results of a phytosociological investigation of the hilly pastures mainly growing on limestone on the Galičica Mt. (SW Macedonia) are here presented. This area is characterized by a temperate continental climate. The data set included 50 phytosociological relevés of grasslands recorded between 2009 and 2010, were carried out through the Braun-Blanquet methodology. All the data obtained were submitted to multivariate analysis. The main environmental gradients of species composition were analyzed by Detrended Correspondence Analysis (DCA). For the ecological interpretation of ordination axes, ecological indicator values were used. Investigated community syntaxonomically are connected to the class *Festuco-Brometea*, order *Astragallo-Potentiletallia*, and alliance *Saturejo-Thymion*. Their floristic composition, diagnostic species and environmental parameters are shown in favour. The most dominat species of the investigated vegetation type are: *Acinos arvensis*, *Alyssum strigosum*, *Arenaria leptoclados* var. *viscidula*, *Bombycaelena erecta*, *Bromus squarrosus*, *Bupleurum gussonei*, *Cerastium brachypetalum* subsp. *roeseri*, *Crupina vulgaris*, *Convolvulus elegantissimus*, *Erodium guicciardii* var. *glanduliferum* f. *glanduliferum*, *Festuca callieri*, *Festuca valesiaca*, *Koeleria splendens*, *Leontodon crispus*, *Medicago minima* var. *longiseta*, *Medicago rigidula* var. *rigidula*, *Minuartia hamata*, *Petrorhagia saxifraga*, *Poa bulbosa*, *Psilurus aristatus*, *Sanguisorba minor* subsp. *balearica*, *Sideritis montana* subsp. *remota*, *Teucrium capitatum*, *Trifolium dalmaticum*, *Valerianella coronata* and *Ziziphora capitata*.

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Floristic composition of stands with *Pinus pinaster* Aiton in South Dalmatia (Croatia)

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According to Flora Europaea, maritime pine (*Pinus pinaster* Aiton) is native conifer of the south-western Europe: in Portugal, Spain, South France and Italy. The species is subdivided into two subspecies: i) ssp. *pinaster* (=*P. mesogeensis* Fieschi & Gaussen) distributed in central and western Mediterranean region, including the Adriatic, and ii) ssp. *atlantica* H. del Villar in South France and along the Atlantic coast of Spain and Portugal. The species is broadly distributed by afforestation programmes in different countries both within and outside the natural range, and the differentiation of autochthonous and non-autochthonous stands is still controversial. The aim of this study was to present floristic composition of stands with maritime pine in Konavle which is the most southern part of Dalmatia. Phytocoenological relevés from the stands with *Pinus pinaster* were collected using the Braun-Blanquet (1964) approach near village of Čilipi in 2013. The plot size was set at 200 m^2. Nomenclature of plant species follows Flora Europaea (Tutin et al. 1964-1980, 1993). These stands appear

within the order *Quercetalia ilicis* Br.-Bl. ex Molinier 1934. The stands are found at altitudes between 37 and 120 m a.s.l. on the calcareous substrata. It appears mostly on southern expositions on the slopes between 5 – 50° with the cover of 80-100%. Number of species in the relevés was between 19 and 32 (average 23.4). Altogether, 44 species were presented in the stands, while 11 occur in a single relevé. Eleven species were common to all relevés, while 22 species were occurred in more than 50% of relevés. Character and dominant species (with frequency of ≥80%): *Pinus pinaster* Aiton, *Pistacia lentiscus* L., *Myrtus communis* L., *Calicotome infesta* (C. Presl) Guss., *Arbutus unedo* L., *Clematis flammula* L., *Smilax aspera* L., *Rubia peregrina* L., *Lonicera implexa* Aiton, *Asparagus acutoflius* L., *Erica manipuliflora* Salisb., *Cistus salvifolius* L. and *Brachypodium retusum* (Pers.) Beauv. This study presents the first detailed data on floral composition of the stands with *Pinus pinaster* on the eastern Adriatic coast. Further analysis is required to determine naturalness of the stands and complete floristic and ecological knowledge of maritime pine stands in Croatia.

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Distribution, ecology and conservation status of rare plant *Ramonda nathaliae* in the Republic of Kosovo

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The rare plant *Ramonda nathaliae* is Balkan endemic and relic species which belong a very small group of poikilohydric angiosperms that are able to survive in an almost completely dehydrated state. This study focuses on: ecological characteristics between the localities, age structure of the populations, and elaborate the risk assessment for extinction of *R. nathaliae* populations in Kosovo. Nevertheless, up to now there is only a few data from other authors for *R. nathaliae* distributions in Kosovo. We started a thorough exploration of the two various habitats and ecological characteristics of *R. nathaliae* plants in Gllobojica and Gotovusha localities (Sharri Mountains). This species is distributed only in these localities in Kosovo. The ecological responses of this species between these localities are more diverse than expected. We can explain the observed differences mostly as a response to the variations in basic environmental conditions in the habitats. Almost all examined morphological characteristics, plant density and phenological traits were significantly higher at Gotovusha locality. Locality with more regeneration (with new plants) was observed in Gotovusha populations, while in Gllobojica locality the *R. nathaliae* population is very small and number of young plants is very low. According to IUCN Red List Categories and Criteria, conservation status of *R. nathaliae* populations in Kosovo should be estimated as Endangered (EN), B1ab(iii, v)+B2ab(iii, v). Area of occupancy (AOO) is less than 10 km^2, extent of occurrence (EOO) is less than 200 km^2 and number of localities it's no more than 2 locations.

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The Flora and Vegetation Diversity of Argozu Valley (Kıbrıscık -Bolu) in Western Black Sea Region of Turkey

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The study area Argozu Valley is situated southern slopes of Koroglu Mountains and 15-20 km towards the northern side of Kıbrıscık-Bolu. Koroglu Mountain is at 35 km southeast of Bolu in West Black Sea Region. The research area is located in A3 square according to Flora of Turkey's grid square system. The research area is in Euxine province of Euro-Siberian Region and between Sub-Euxine and Xero-Euxine in mountain belt. Volcanic with andesite characteristic rocks occur in the area. Climatic conditions are continentally and semi condimental climate, as the annual precipitation is about 570 mm and the mean annual temperature is 9,8^{o}C. The major vegetation types of Argozu Valley are forest, rupicol and alpine grasslands. The general vegetation of the area covered by *Pinus nigra* and *Pinus sylvestris* forest trees. The line of the forests reaches an altitude t of 1600 -1650 m. After this altitude the vegetation of the forests has been covered by alpine vegetation and *Festuca varia* grasses. The main forest vegetation types of *Pinus nigra* is generally distributed in line on the southern slopes at an elevation of 1100-1500 m after the elevation *Pinus sylvestris* forests begin to distribute. *Pinus nigra* forest has got to floristic links in the between Central Anatolian Steppe and Xero-Euxine flora region. The floristic diversity of the forests species has got the Irano-Turanian and Mediterranean flora elements, such as *Bornmuellera cappadocica*, *Barbarea trichopoda*, *Crocus ancyrensis*, *Campanula argaea*, *Dianthus lydus*, *Rhamnus thymifolius*. *Pinus sylvestris* forests are distributed on all of the slopes after an altitude of 1500-1700 m, range to the north and northwestern slopes. It has got to local *Abies nordmanniana* ssp. *bornmuelleriana* forests are situated towards the extreme north-west direction of Bolu. The floristic diversity of the forests species is composed of basically the Euro-Siberian flora elements. Alpine grassland vegetation has got meso-xerophyll characteristics. The Rupicol Vegetation has got orophylic characteristics. *Saxifraga exerata* var. *exerata* community is spread in Argozu Valley and all the direction at an elevation of 1450-2300 m. *Festuca varia* community is found in Argozu valley after the *Pinus sylvestris* layer at an elevation of 1600-1650 m and quite well spread up to 2350 m on all the high altitude of the area. The community is a Mediterranean community of high mountains which belong to the class *Daphneto-Festucetea*.

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Biodiversa project SIGNAL: a cross-site study on grassland resilience challenged by the interactive effects of drought, invasive species and land use

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The Biodiversa SIGNAL project is an international comparative study assessing the effects of drought, climatic changes, invasive species and land use on grassland diversity and functioning along a pan-European climatic gradient. Participating countries are: Austria, Belgium, Bulgaria, France, Germany, Hungary, Israel, Italy, Switzerland and Turkey.
The Hungarian study site situated in the middle of the country, near to villages Tiszaalpár which was inhabited since bronze ages. Our study area is covered by semi-natural grasslands which composition is the following: main grass species are *Festuca pseudovina*, *Poa angustifolia*, *Cynodon dactylon*, *Bromus hordeaceus*, *Elymus repens*, *Koeleria cristata*. The most frequent dicots are *Achillea setacea*, *Trifolium campestre*, *Veronica prostrata* and *Galium verum*.
The main aim is to assess the resilience status and the functional significance of biodiversity elements in different grasslands to the interactive effects of current main environmental

threats. These are exemplified by extreme droughts (simulated by rain-out shelters), land-use changes (simulated by different cutting heights (3 cm and 10 cm) and by grassland abandonment) and biotic invasion. Maybe the most interesting question is the resistance of different grasslands to neophyte invasion. In this case we apply a legume (*Lupinus polyphyllus*) and a non-legume (*Senecio inaequidens*) species.
Environmental data is continuously logged and transferred to a central database. We collected information about precipitation, PAR, soil moisture and temperature outside and inside shelters. Response parameters are species specific cover estimates before and after drought manipulation, biomass per plot sampled twice per growing season.
Further objectives are to combine the strengths of joint experimental and GIS modelling approaches, to produce practical recommendations to take up new biodiversity-function related indicators and their measuring protocols to monitoring activities and contributing to the development of the European Long-Term Ecosystem Research Network. Additional aim is to contribute to other global science networks, such as INTERFACE, IGBP and DIVERSITAS within the Earth System Science Partnership, and to link scientific excellence to policy and practice in the field of biodiversity.

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Flora and Vegetation of the Subalpine Belt in Central Dinarides – Preliminary Results

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Central Dinarides are situated on the border area between Croatia and Bosnia and Herzegovina. A floristic survey was conducted during July 2011 and covered the area of Male Poljanice, Velike Torine, Veliki Troglav, Ledena gora, Vještića gora and Razdolje. Altitude range was from 1400 to 1913 m a.s.l. According to the Köppen climate classification, the studied area belongs to the snow-forest climate with a cold summer (Dfc).
During the research 181 species of higher plants from 51 families were recorded. The most abundant families are *Asteraceae* and *Poaceae* (9.4% each), *Rosaceae* (7.7%), *Fabaceae* (7.2%), *Lamiaceae* (6.1%), *Caryophyllaceae* (5.5%) and *Cichoriaceae* and *Scrophulariaceae* (5% each). In the life form spectrum hemicryptophyta are predominant (61.3%), followed by chamaephyta (16.1%), phanerophyta (11.9%), geophyta (8.3%) and therophyta (2.4%). Considering the distribution area, eight species are endemic: *Arenaria gracilis*, *Carduus collinus* ssp. *cylindricus*, *Cerastium grandiflorum*, *Dianthus integer*, *Euphorbia capitulata*, *Lonicera borbasiana*, *Oxytropis dinarica* and *Silene sendtneri*. According to the Red Book of Vascular Flora of Croatian, three species are vulnerable: *Arctostaphylos uva-ursi*, *Campanula cochlearifolia* and *Dianthus integer*, five taxa are near threatened, one taxa is least concern, and for five taxa data are deficient.
The alliance *Pinion mugi*, which form the final vegetation top layer, are significantly present only in the area of Klek, Male Poljanice, Velike Torine and Veliki Troglav. Quite often this habitat type is degraded and covered with stands dominated by *Genista radiata*, as it was on the Jaram area. More than half of the species found in these stands grow also on the mountain grasslands of the order *Seslerietalia juncifoliae*, which occupy the largest area in Central Dinarides, and where 101 taxa were found. From the total number of plant species, 14% were found only within the alliance *Festucion bosniacae* ("*pungentis*"), and the same is within the alliance *Seslerion juncifoliae*. Small stands of forest from the suballiance *Saxifrago rotundifoliae* - *Fagenion* and *Vaccinio-Piceenion* were also detected in the area of Male Poljanice.

For a quality evaluation of floristic and vegetation diversity of the whole potential transboundary protected areas, as initiatives of the institutions for the protection of nature of the Republic of Croatia and Republic of Bosnia and Herzegovina, an additional field research is needed throughout all vegetation seasons.

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Comparative analysis of bryoflora in polydominant and oligodominant forests on Tara Mountain (W Serbia)

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The research was conducted during 2011 and 2012 on Tara Mountain in western Serbia. The material was collected on two localities: Mitrovac and Crveni potok (peat bog) on about 1000-1100 m above the sea level. Both of these localities are in the National park "Tara". The surveyed habitats were oligodominant forest *Piceeto-Abieto-Fagetum* on Mitrovac and relict polydominant forest *Piceeto-Abieto-Fageto-Alnetum mixtum* on Crveni potok. The aim of this study is to compare bryophyte flora on these two sites, and to define how type of forest influence the bryophyte species composition. Total number of 37 (10 liverworts and 27 mosses) taxa was recorded in Mitrovac, and 28 taxa (6 liverworts, 22 mosses) in Crveni potok. Bryophytes on Mitrovac belong to 29 genera and 24 families, and on Crveni potok total number of taxa belongs to 20 genera and 18 families. Sorenson's Similarity Index for these two localities have value of 0.52. Ecological indices for light, pH and humidity were analyzed. According to the chemical reaction of the substrate, on Crveni potok, dominant group are acidophilous bryophytes, while in Mitrovac there are equal proportion of acidophilous and indiferent species. According to humidity, higrophilous species have greather participation in bryoflora of Crveni potok than bryoflora of Mitrovac. On both localities dominant species are skyophytes which is in correlation with light condition in investigated forests. Species from genus *Sphagnum* were found on both localities, but in Mitrovac there is only one species, while in Crveni potok there are 4. This research showed that there are differences in species composition between polydominant and ologodominant forest, which can be explained on severeal ways: type of forest, habitat conditions etc.

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Stands with *Arundo plinii* Turra and *A. micrantha* Lam. along the eastern Adriatic coast

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According to recent molecular phylogenetic, biogeographic and morphological studies, three distinct species of *Arundo* L. (*Poaceae*) were distributed along the eastern Adriatic coast and islands: (1) *A. donax* L., the cosmopolitan Giant Reed distributed from Sub-tropical Asia to the Mediterranean Basin, and two circum-Mediterranean taxa (2) *A. plinii* Turra and (3) *A. micrantha* Lam. Presence of *A. plinii* has been previously reported within the *Myrto*

communis-Pistacietum lentisci (Molinier 1954) Rivas-Martínez 1975 (*Quercetalia ilicis* Braun-Blanquet ex Molinier 1934) and *Narcisso tazettae-Asphodeletum microcarpi* Šegulja 1969 associations (*Scorzonero villosae-Chrysopogonetalia grylli* Horvatić et Horvat 1963) on some localities in southern Croatia. Phytocoenological relevés from the stands of *A. plinii* and *A. micrantha* were collected in South Croatia (Dalmatia, 19 relevés), Montenegro (12 relevés) and Albania (three relevés were collected near the towns of Shkodër and Elbasan) in the period from 2009 and 2012. Vegetation data were interpreted in terms of syntaxonomical classification, based on cover and floristic affinities, following the Zürich-Montpellier approach and the International Code of Phytosociological Nomenclature. *A. micrantha* appears along the coastal belt from the cities of Split and Dubrovnik in the South Croatia. It is character and dominant species of the new proposed plant association *Arundinetum micranthae*. In some relevés, *A. plinii* and *A. micrantha* appear together in the same stand. According to floristic structure, physiognomy and ecology, new association belongs to the *Artemisietea vulgaris* Lohmeyer, Preising et Tüxen ex von Rochow 1951 class. This nitrophilous community has developed as low (2-4 m) and dense shrub formation between 5 and 21 m a.s.l. It was frequently found on clayey soils that keep humid for most of the year and appears exclusively on southern expositions on the slopes between 5° and 60° with the cover of 100%. Number of species in the relevés was between 13 and 17 (average 14.3). The association had a large number of companions, mostly from the *Scorzonero villosae-Chrysopogonetalia grylli* Horvatić et Horvat 1963 and *Quercetalia ilicis* Braun-Blanquet ex Molinier 1934 communities. In this study we compare the floristic composition of new association with *Arundinetum plinianae* Biondi, Brugiapaglia, Allegrezza et Ballelli 1992 (=*Arundinetum collinae*) from Adriatic coast and other Mediterranean areas, and some communities from the *Arundinion collinae* Brullo, Giusso, Guarino et Sciandrello 2010 alliance (*Lygeo sparti-Stipetea tenacissimae* Rivas-Martínez 1978). The syntaxonomic status of the stands with *Arundo plinii* and *A. micrantha* is also discussed.

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Succession and revitalization of steppe grasslands on Deliblato Sands (Banat, Serbia)

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Deliblato sands represent a unique geomorphological and biogeographical phenomena and the largest continental sand area in Europe. It's located in South-East Banat, in Northern Serbian province of Vojvodina. Its area spreads over 34 829 ha in the directions southeast and northwest. Its characteristic is a specific geological structure – large crust of aeolian siliceous-carbonate deposits of sand originating from the Pleistocene. The wind Kosava has molded expressive dune relief, altitude between 70 and 200 meters. Unusual relief and soil, with moderate continental climate and absence of surface water conditioned forming of specific sand, steppe, steppe-woods and forest vegetation. As the largest oasis of sands-steppe and steppe-woods vegetation in Pannonian Basin, Special Nature Reserve "Deliblato Sands" is one of the most important centers of biological diversity of Europe and the most important steppe area in Serbia.

Since the year of 1815 the process of forestation has begun with the goal of binding and stopping the expansion of sand. With the goal of localization of sand, in 1978 grazing was completely forbidden.

Planted species without grazing and lack of management in steppe and sand areas, enabled an expansion of bush vegetation and all-around succession of vegetation towards steppe-wood and forest, which led to the disappearance or retreat of characteristic steppe and sands species.

With the goal of recovery of steppe eco-systems, since the year 2004 an experimental area in Korn pasture has been selected, where bushes were mechanically destroyed on 220 ha. In this area was also enabled grazing for 400 sheeps and 100 goats and a couple of dozens of autochthonous cattle.
The research is based on vegetation elaboration that had been done during 2012 and 2013. Main goal was to do floristic and phytocenological analyses of vegetation on experimental area, during various levels of succession and revitalization, as well as to point out the influence of succession of vegetation on diversity of flora in Deliblato sands. Comparing life forms and ecological indexes of old and new vegetation data (DCA analysis was done with the JUICE 7.0 and R 3.0), it was found that the restoration and revitalization of the pasture Korn has allowed the re-establishment of typical steppe communities *Chrysopogonetum pannonicum* Stjep.-Vesel. 1953, with returning of most of the typical differential species of this community and recovery of biodiversity index (beta-diversity). However, the presence of non-native and invasive species is still at alarming levels.
The results of this study indicate that the revitalization of the pasture Korn is example of good management and should be implemented at other sites in the Special Nature Reserve "Deliblato Sands".

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Plant functional trait responses to secondary succession in N Croatia

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In recent decades there is a common problem of land-use change in Croatia and Europe. A decline in traditional agricultural practices leads to the abandonment of agricultural land which leaves many of landscape areas exposed to the natural succession.
The successional processes and their impact on biodiversity of inland was explored using plant functional traits at the level of three series classified according to their different habitats and environmental factors, which significantly alter during the progression of succession. Plant functional traits show a great correlation to the successional stages and are highly correlated to the successional pathway. A significant decrease of hemicryptophytes and an increase of macrophanerophytes was noticed during the succession progress. Also a significantly increased in European floristic elements at the expense of Eurasian and cosmopolitan plants has been observed. In the later stages of succession species begin to flower earlier and have a shorter flowering duration. It also leads to a significant increase in pluriennial and decrease in annual and biennial plants. Earlier stages are characterized by a greater proportion of plants with scleromorphic type of leafsand heavier diaspore and germinule weightin contrast to the later stages in which mostly plants with mesomorphic leaf anatomy type and smaller diaspore weight are dominant.
Secondary succession causes major changes in species composition, structural characteristics and functional features of plants and habitats on which they grow. The aim of new insights on floristic, structural and functional changes in the succession process is to serve as useful guidelines for effective management planning of such habitats in Croatia and beyond.

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Multitemporal analyses of coastal dune landscapes in Central Italy: what has happened in the last 60 years?

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The current degradation of the Mediterranean coastal landscape highlights the necessity of performing long term multitemporal analysis to guide land managers seeking to improve coastal conservation, planning and management. This work sets out to quantify landscape changes for the last 60 years in one sector of the Italian coast, and to analyze the spatial configuration of natural dune cover types in relation to the anthropogenic ones in order to investigate the processes underlying these changes. On the basis of detailed land-cover maps (dated 1954, 1986 and 2006), we assessed landscape changes by transition matrices. The spatial pattern of natural dune cover types (Beaches with Pioneer annual Vegetation, Herbaceous Dune Vegetation and Woody Dune Vegetation) for the three dates was described by patch-based (Patch Size and Shape Index) and edge-based metrics (patch shared boundaries with manmade cover types) and compared using the non-parametric Kruskal-Wallis median test. Multitemporal analyses provided a description of the coastal changes which have occurred in the last half century. Particularly notable are consistent intensification of agricultural and reforestation activities in the inner sectors of the dunes and a widespread urbanization. The natural dune categories originally distributed in a few large and elongated patches have undergone a substantial reduction of extent and an alteration in their spatial pattern, this now reduced to many small and regular patches. A significant rise of contacts between natural dune categories and urbanized areas and infrastructures was observed. Such landscape analysis could be useful in identifying the management strategies for coastal dune areas.

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Relic forest of Macedonian pine (*Pinus peuce* Grisb.) on calcareous parent material in Macedonia

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Macedonian pine forests of the Balkan Peninsula, growing on silicate, have been studied relatively well in syntaxonomical terms. Ivo Horvat for the Bosnian-Montenegrin-Macedonian type of forests in the subalpine zone, in terms of vertical distribution, indicates the Macedonian pine forests for silicate and Bosnian pine forests for limestone, as characteristic types of vegetation. Although the presence of Macedonian pine forests within the framework of its recent range is characterized by silicate geological material, in case of suitable micro conditions: north sides, depressions, funnel-shaped holes, valleys and higher altitudes, i.e. in the places where the microclimate provides enough soil moisture and humidity, they also appear in limestone bedrocks and those habitats mostly constitute refugiums.
The refugial Macedonian pine forests in Macedonia on limestone covers significant area of the subalpine zone in the form of compact stands on NidzeMountain, locality called Belo Grotlo, and fragments occur in SharPlanina, locality called Plat and they are with relict character. They are creating the timberline of the forest there. The abovementioned have been noted and tentatively named (Em et all.), but they haven't been scientifically elaborated yet. This article is the contribution towards their description, according to the regulations of the

Code of phytosociological nomenclature (Weber, Theurillat and Moravec) and according to the middle – European school of Braun Blanquet, while the material from the abovementioned sites have been synaxonomically processed. According to the results obtained from the vegetation researches of the Macedonian pine forests on limestone, we present one new association *Dryadeto octopetalae-Pinetum peuces* ass. *nova* and preliminary we added it to the alliance *Orno-Pinion* Em.1978, order *Erico-Pinetalia* Ht. 1959 and class *Erico-Pinetea* Ht. 1959.

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Chromosome number of some endemics and relicts plant species from the Galičica Mt

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In this paper we present some of the results obtained from the caryologic analysis of certain flora endemities and relicts of the Mountain Galičica - *Nepeta ernesti-mayeri* Diklić & Nikolić, *Fritillaria ionica* Hal. var. *ochridana* Micevski, *Crocus cvijicii* Košanin and *Lilium heldreichii* Freyn. So far no data regarding their caryologic status has been available, and this is the first time to provide information on their chromosome number (excluding *Crocus cvijicii* Košanin). All the caryologically analysed samples were found to contain uniform diploid chromosome number, and with all of them there is absence of intraspecies numerical variability within the studied population.

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Ambrosia artemisiifolia L. registered in the Republic of Macedonia

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Ambrosia artemisiifolia L. is invasive specie and strong allergen that is a major threat to the environment as an ecological, agronomic and economic, but also health problem from allergologic aspect. It is naturally distributed in N. America, but as an adventive's plant incorporated the territory of South America, Europe, Asia, Africa and Australia. On the territory of Europe this species is widespread in much of the continent and mostly as domestic plant. Conducted detailed field investigations of specific sites to determine its distribution, habitat characteristics and vitality of the discovered populations. Analysis and monitoring of concentrations of pollen in Skopje (42 º 01 'N, 21 º 27' E, 275 m a.s.l.) are performed with the volumetric method (Hirst 1952) using a Lanzoni VPPS 2000 seven day sampler in the period of 2003-2011. Chronological studies in the Republic of Macedonia confirmed the presence of *Ambrosia artemisiifolia* L. in Skopje (settlement Ilinden, side of a highway by hotel Bellevue) in ruderal place together with *Urtica dioica*, *Artemisia vulgaris* and *Chenopodium album*. The number of examples from *Ambrosia artemisiifolia* rises beside the highway and nearby farmland (planted with peppers, tomatoes and corn) from year to year. The highest concentration of pollen per year was registered in 2004 - 362 pg/m^3. Similar annual concentrations were registered in 2006 (357 pg/m^3) and 2009 (307 pg/m^3). Retrospective analysis and research conducted at the Institute indicate a low prevalence (4.1%), but confirm fierce allergenicity of this kind, among respondents in the Republic of Macedonia (intense skin reactions, ie greater than 4 and specific IgE class greater than 45 IU/ml). In recent years,

leading global campaign to find ways to control the spread and suppression of Ambrosia in newly settled areas. Our local planning lead to integration into European and worldwide programs to control invasive species and we are include in the project Sustainable management of *Ambrosia artemisiifolia* in Europe (SMARTER).

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Soil properties indicate past land use

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Four models from selected trait groups (plant functional traits, plant chorotypes, Ellenberg bioindicator values and soil properties) were built and their predictive power for the time since agricultural land use was abandoned (TAA) in SE Slovenia was compared. The analysis highlights an approach that determines the age of forest using ecological, chorological and pedological attributes. The aim of the study was to develop a tool, a combination of functional response traits, chorotypes, ecological characteristics and soil properties, which allows calculation of the TAA for a particular secondary succession stage.
Using old cadastral maps and orthophotos, employing an overlapping technique, the actual TAA for the sample plots was determined, which served as a dependent variable in modelling, as well as a control for modelling accuracy. The predictive power of four different ecological models was compared.
The study shows that information about the process of abandonment of traditional land use is stored within changes of plant functional response traits, chorotypes and Ellenberg bioindicator values of the study area, but is best reflected in soil properties.
Soil properties provide the most reliable basis for the elaboration of a prediction model for TAA.

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Frequency of *Anacamptis morio* within the fragmented patches of dry grasslands in the Goričko Landscape Park (NE Slovenia)

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The green winged orchid (*Anacamptis morio*) is a common species in Slovenia, distributed in areas up to 1000 m. The investigated metapopulation, located inside the borders of Goričko Landscape Park in one of the richest in the country, despite the appropriate habitats are strongly declined. The mosaic structure of landscape and the variety of anthropogenic habitats in Goričko are due to combined effects of physical, geopolitical and socio-economic drivers. The landscape structure in Goričko is a typical result of »frozen processes«, which appeared or influenced the landscape in the past. The study area (centred on 46˚50'- 46˚52' N, 16˚15'- 16˚52' E) covers approximately 6 km^2. We examined the response of green winged orchid to a long term habitat fragmentation. The following parameters - fragment area, fragment shape index, number of plant specialists per fragment, total number of plant species per fragment and fragment alpha diversity were observed on 80 dry meadow fragments (patches) and correlated with the total number of orchid specimens per meadow fragment. We were able to

record 181 plant species, 57 of them are typical dry meadow specialists. In total, 3812 specimens of green winged orchid were detected in 2012. Fragment area does not correlate with the number of orchids per fragment. The same is true for the fragment shape index. Total number of orchids per fragment is in a weak positive correlation with the number of specialists per patch and in significant negative correlation with fragment alpha diversity and species number per fragment. It indicates that the orchid prefers fragments with higher number of habitat specialists (regularly mowed fragments of association *Hypocherido-Festucetum rupicolae*) but is less frequent on those with higher alpha diversity rates. Later indicates fragments of different succession stages with woody plant species present, that have in general higher diversity indices values. The drivers, which affect today's occurence of *Anacamptis morio* are management type (mowing and fertilization) and time since abandonment. Conservation efforts should be focused to preserve fragmented meadows (especially larger patches) through proper management and avoiding further eutrophication and destruction.

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Fragmentation of hardwood floodplain forests – how it affects species composition?

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Generally, fragmentation is considered as one of the major threats to the diversity of forest ecosystems. Isolation of forest fragments increases their vulnerability to various external influences including the biological invasions and population declines of typical forest species. The aim of our study was to find out if the patch size has an influence on species composition of hardwood floodplain forests. The study is based on the dataset of 118 relevés ordered within the suballiance *Ulmenion* (riparian mixed oak-elm-ash forests along great rivers). Relevés were sampled using the standard methods of the Zürich-Montpellier School (Braun-Blanquet 1964; Westhoff 1973) on the plot area 20×20 meters, during vegetation seasons 2010 – 2012. Localities were chosen according to the forestry map of recent distribution of hardwood floodplain forests and cover all lowlands with alluvia of great rivers (Morava, Danube, Váh, Hron, Tisa) in Slovakia. Information about area, perimeter and shape index of the forest patch for each relevé were obtained using ArcGis 9.2 software. Recorded species were assigned into the three groups: (i) "good forest species" – diagnostic for *Ulmenion*, constant for *Ulmenion*, diagnostic for *Salicion albae*; (ii) "neutral species" – diagnostic for *Carpinion betuli*; (iii) "negative species"– archeophytes, neophytes and ecological aliens (species native to Slovakia but coming from different habitats). The influence of area, perimeter and shape index of forest patch on the occurrence and cover of species from defined groups was tested using Kruskal-Wallis non-parametric Anova with multiple comparison of mean ranks (Statistica 7.0) and generalised linear models (R-software). First results show significant increase in the number of species diagnostic for *Ulmenion* and *Salicion albae* in bigger patches. Number of neophytes is independent on patch area, but cover of neophytes is significantly higher in smaller patches. These results confirmed the negative influence of fragmentation to the natural species composition of the *Ulmenion* forests.

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Conservation and sustainable use of halophytic vegetation

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Saline sites are recognized as internationally important habitats. In Serbia, such habitats occupy about 250.000 ha of salt affected soils of different salinity levels. Most of saline habitats are not managed in sustainable way, despite a certain potential for sustainable utilization (i.e. grazing, hey production, collecting of medicinal, aromatic and ornamental plants). Analysis of distribution and diversity of halophytic vegetation clearly indicated significant floristic and vegetation diversity, and a presence of some very fragile, specific and of priority halophytic communities and corresponding endemic (e.g. *Plantago schwarzenbergiana*), rare (e.g. *Salicornia europaea*) and critically endangered species (e.g. *Salsola soda* and *Suaeda pannonica*).
Cluster Analysis was carried out on remarkable data set consisting of relevés of all available literature sources of the halophytic vegetation in the Republic of Serbia, as well as our own unpublished phytosociological records (dataset contains near 1600 relevés). Processing of the data was performed by PC-ORD 5, using Euclidian distance measure and Ward´s method algorithm for dendrogram construction.
Cluster analysis of the whole data set showed three distinct vegetation groups. The first cluster consists of the vegetation spread on very salinized wet solochaks of the class *Thero-salicornietea,* whereas the second and third cluster represents communities belonging to the class *Festuco-Puccinellietea*. Conservation measures of these unique ecosystems, especially of the *Thero-Salicornietea* class, so far have not been sufficiently implemented, causing often vegetation succession and related biodiversity loss. Some of these habitats are very poor in species, but are of the high biodiversity importance, especially in term of presence of the rare obligate inland halophytes (e.g. *Suaeda maritima, Salicornia europea*, *Salsola soda*, *Camphorosma annua* etc.). The most proper conservation measure for this type of habitats is strict control of use and management in term of nomination into the protected nature areas of the first priority. Two other groups of halophytic vegetation are currently used as pastures mainly, whereas no special management practices have been performed. Some of these halophytic habitats are overgrazed and thus quite degraded. A number of medicinal and aromatic plants were determined in these two clusters, including *Chamomila recutita*, *Mentha pulegium*, *Achillea colina*, *Taraxacum serotinum*, *Artemisia santonicum*, etc. Set of recommendation measures gives basis for biodiversity conservation, sustainable management and use of halophytic grasslands, mainly in term of rotational and combined grazing and wild collecting of herbs at small scale.

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Phytocoenological conditions of the species *Chouardia lakusicii* (Šilić) Speta on the Balkans

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Taxa of the genus *Chouardia* are distributed along the Dinaric Alps, from Planinsko Polje near Postojna (Slovenia) in the northwest to Albania in the south-east. The genus contains only two species: *Ch. litardierei* (Breistr.) Speta and *Ch. lakusicii* (Šilić) Speta. Ecology of *Ch. litardierei* has already been described in details. It appears within the orders *Trifolio-Hordeetalia* Horvatić 1963 and *Agrostidetalia stoloniferae* Oberdorfer 1967. On the other hand, areal and phytocoenology of *Ch. lakusicii* are still remain unknown. The species is an endemic of the Mediterranean to sub-Mediterranean part of the Western Balkans (Dalmatia,

South Herzegovina, Montenegro). In Croatia, *Ch. lakusicii* is assessed as a threatened taxon in vulnerable (VU) species category. Generally, the species follows the distribution of sub-Mediterranean forest and shrub vegetation of the alliance *Ostryo-Carpinion orientalis* Horvat 1954. The aim of this study was to investigate the ecological conditions of the sites with *Ch. lakusicii*. Phytocoenological relevés were collected using the Braun-Blanquet (1964) approach at all known localities with *Ch. lakusicii* in South Croatia (Dalmatia) and Montenegro (in total 11 relevés) in 2012 and 2013. Vegetation data were interpreted in terms of syntaxonomical classification, based on cover and floristic affinities, following the Zürich-Montpellier approach and the International Code of Phytosociological Nomenclature. In Croatia, *Ch. lakusicii* was found within rocky and dry grasslands (the *Scorzonero villosae-Chrysopogonetalia grylli* Horvatić et Horvat 1963 order) dominated by associations: *Stipo bromoidis-Salvietum officinalis* Horvatić 1963 and *Bromo erecti-Seslerietum interruptae* Trinajstić 1987 ex Terzi 2011. In Montenegro, it is developed in dry rocky crevices of the order *Moltkeetalia petraeae* Lakušić 1968 (*Asplenietea trichomanes* Br.-Bl. 1934). The species grows only on calcareous rocks and the majority of populations are recorded in zones between 560 and 800 m in Croatia, and up to 1590 m on Orjen Mountain in Montenegro. Our findings contribute essential baseline information that should aid in future evaluations of the state of *Ch. lakusicii* populations both in Croatia and Montenegro. Populations of *Ch. lakusicii* are an important part of the region's natural heritage in need of conservation measures to ensure their survival.

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Ex-situ Conservation for the 21st Century: Plant-biogeographical Groups in the Botanical Garden of the Faculty of Science (University of Zagreb, Croatia)

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Croatia is an important country in the sense of vascular plant richness and endemism, as well as the vegetation richness; is the third European country regarding plant biodiversity. Botanical gardens around the world are recognised as the institutions most concerned with *ex situ* conservation of wild plant diversity: our Garden also has a long tradition in cultivation of rare, endemic and endangered Croatian plant species, resulting in very valuable plant collection dating from the beginnings of the Garden (1890-ies). Most of the indigenous plants are grown in three rockeries: the Karstic, the Mediterranean and the sub-Mediterranean, originally planted according to the phytosociological principles. In that *ex situ*-Garden communities grow 668 indigenous taxa, out of which 208 are statutory strictly protected or protected. From these, 79 taxa are listed in the Red Book of Vascular flora of Croatia, 38 are endemic in Croatia, 12 are globaly endangered, while 30 taxa are endangered in Croatia. Only 14 taxa we cultivate today in the Garden are included in Natura 2000 Ecological Network. The Global Strategy for Plant Conservation (GSPC, Target 8) calls for 75% of threatened plant species to be conserved in *ex situ* collections until 2020, so there is a long way to go in order to achieve this target at the Botanical Garden of the Faculty of Science.

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Changes of floristical and coenological features of beech forests in central Apennine (Italy)

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The main purpose of this study is to investigate floristical variability in the different stands of the local forests, integrating floristical, structural and functional analysis. Environmental and structural parameters, as well as the floristic list, were collected through 40 relevées. Floristical and coenological variability were analyzed using indicator species analysis (INSPAN), and Ellenberg indicator values were used to characterize the communities ecology and strengthen their interpretation. Species were also classified into Social Behaviour Types, in order to assess a functional significance to the floristical variability. Statistical significance was assessed through a Kruskal-Wallis ANOVA test. Preliminary results show that the altitude represents the main significant parameter able to differentiate two main beech communities, representing respectively microthermic and mesophilous forest. The microthermic one ranges from 1300 to 1900 m a.s.l. and is characterized by lower temperature and light values. Overstory composition is almost monospecific, with the *Fagus sylvatica* predominance, while the understory is composed mainly by *Cardamine kitaibelii*, *Polystichum aculeatum*, *Anemone nemorosa* and *Epilobium montanum* (*Cardamino kitaibelii-Fagetum sylvaticae*). The mesophilous one, that ranges from 1200 to 1500 m a.s.l., is characterized by higher temperature and light values; the increase of oriental and mediterranean species within this community is linked to the influence of mixed woods communities with more termophilous species like *Cyclamen hederifolium*, *Sorbus aria*, *Laburnum anagyroides*, *Lilium bulbiferum*, *Hepatica nobilis* and *Viola alba* (*Lathyro veneti-Fagetum sylvaticae*). Structural data analysis shows differences in number of individuals and DBH measures, detecting probably the beech natural expansion processes to higher altitudes. Comparison between microthermic and mesophilous communities in terms of Social Behaviour Types shows that the first one have an higher frequency of beech forest species, while the higher frequency of forest generalist species in the mesophilous one highlights the interpenetration with mixed forests.

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Vegetation Development in the Natural Forest Reserve of Gaisberg (Austria)

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Following the intentions of various conservation programs, an attempt was made to maintain and improve the naturalness of selected forest areas for the purpose of biodiversity enhancement. This is often done by admitting forest development by abstaining from harvesting. What this means for the herb layer of beech and oak-hornbeam forests in the Vienna Woods was analyzed in a natural forest reserve. Based on a systematic monitoring grid, data were collected three times from 216 squares each 1 m² in the course of 10 years. It could be noted that the coverage of the herb layer has decreased significantly over 10 years. At the same time the number of species decreased also significantly from 9.6 to 7.3 species / m². The largest losses in terms of coverage value and number of species were found in high-growing young growth areas and clearings. By means of the ecological indicator values according to Ellenberg, the changing light regime on these surfaces was confirmed to be the motor for the impoverishment of the herb layer. But even in the old growth forest, the herbaceous layer must adapt to dense canopy, as the European beech (*Fagus sylvatica*) gradually regains their potential proportions. This occurs mainly at the expense of black pine (*Pinus nigra*) and sessile oak (*Quercus petraea*) encouraged by forestry measures, which reduces the light availability of the herb layer even further.

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The effect of the grazing with Hungarian grey cattle on the vegetation of a grassland with low production

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The present study includes coenological results about the effects of grazing with Hungarian grey cattle in saline grasslands in Dinnyési fertő Nature Conservation Area.
The coenological relevés were prepared in 8-8 pieces of 2x2 m quadrats. The analysis was carried out on the basis of social behaviour types of Borhidi and the grassland management functional types. In addition we calculated Shannon- and Simpson diversity indices for the plots. The significance between the differences of the diversity values was found out with one-way ANOVA and as post-hoc test Tukey HSD test was applied.
On the basis of our results this kind of managment is favourable for the grazing and trampling tolerant grass species and decreases the proportion of the dicots.The classification of species based on the social behaviour types of Borhidi shows the spreading of the ruderal competitor species, mainly *Cynodon dactylon* with the progress of the grazing season. The number of species was higher in the grazed plots contrarily the diversity values were significantly lower than those in the controll plots.
Grazing prefential from a bird conservation aspect increases the number of species, however, it modifies the species relations and the diversity in a negative way.

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Species composition changes of *Rumicetum alpini* in removal experiment by integrated management methods

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The research presents results of the *Rumex alpinus* removal experiment on mountain pastures in Karavanke (Slovenia) after first monitoring year. *Rumex alpinus* is a noxious weed that can spread on large areas on montane and alpine pastures. As these pastures are part of Natura 2000 areas or other areas under nature protection the use of herbicides for removal is not allowed.
Therefore we setted an experiment and tested different integrated methods of *R. alpinus* removal: controlled cattle grazing, pigs rooting, mowing, heat treatment, covering with black foil and manual digging in 4x4 plots and four replicates. After the treatment the plots were sown by commercial grassland mixtures. Vegetation was sampled before and after treatment at the end of vegetation season.
Highest loss of *Rumex* biomass after the first year was found by manual digging and foil treatment, some improvement was also made by pig digging also, other methods just reduced shoot number, while cover and biomass of vegetation remained high. Similar results were obtained in sampling of vegetation changes. Manual excavation and foil changed species composition most and proved to be most effective.
Further treatment and monitoring will be needed, at least for some vegetation seasons, and transfer of these methods on large-scale surfaces has to be made.

This work was supported by project ALPA titled Nature sustainable management of mountain pastures on protected areas (2012-2014).

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Vegetation recovery processes in Patagonian arid steppe

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For centuries, Patagonian dry grasslands supported large herds of wild herbivores grazing on native grasses and scrubs. In the early 20th century, pioneers established a system of land use based on grazing of domestic animals, characterized by stocking rates above the carrying capacity of the pastures, thus leading to the degradation of plant communities.
We hypothesized that the interplay among plant-plant spatial interactions, grazing history, and species functional traits affects the recovery and assemblage processes of the shrub community after short-term abandonment in north-eastern Patagonian arid steppe.
The study area was located in Peninsula Valdés (Chubut province, Argentina), at altitudes ranging from 10 to 80 m a.s.l., with mean annual precipitation of 240 mm. It is partly included in the San Pablo de Valdés Reserve, where sheep rearing was forbidden in 2005. Outside the protected area, pastures continued to be subjected to sheep grazing.
We selected six sites, two in grazed pastures and four in ungrazed pastures (two of which intensively grazed, and the other two low intensity grazed before 2005). The sites were compared with regard to: shrub cover percentage (evaluated in 10 m x10 m randomly selected plots); shrub patch dimension and richness, spatial interactions among shrub species depending on patch dimension (patches were sampled along 200 m long linear transects); species richness and composition, vertical relations among species, and traits related to avoidance strategies and disturbance (1 m x1 m plots sampled along 200 m long linear transects). Data was collected in 2011.
Our results indicated that in abandoned pastures recovery processes act through the increase in shrub patch size, formation of new patches, change in patch composition and richness, and in within-patch relations among shrub species. Sites subjected to different past grazing intensities did not show significant differences. The increase in shrub cover was due to a significant expansion of the dominant shrub *Chuquiraga avellanedae*. The mechanism of new patch formation and spread was mainly based on facilitative interactions between the dwarf shrubs, poorly palatable and disliked by wild herbivores (guanacos), and young individuals of the dominant species emerging from their canopy. As patch size increased, dwarf shrubs were covered by taller ones or grew at the edge of the patch, indicating a phase of competitive exclusion. Plant-plant spatial interactions involved changes in the composition of plant traits linked to avoidance strategies, which were indicators of grazed conditions, and of plots with shrub cover lower than 50%, while less need for defence against animal browsing was highlighted in ungrazed pastures and shrub-dominated plots. These results suggest that management plans aimed to preserve biodiversity and forage resources should work to recreate grazing conditions close to the wild ones or to impose a short-term period of ecosystem rest that allows the plant community to recover.

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Some bioaccumulator plants of heavy metals in Golesh-Republic of Kosovo

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Golesh located near Prishtina International Airport and became part of the territory of three municipalities: Drenas, Fushë Kosovë and Lipjan. The soil is composed of serpentine rocks with high concentrations of heavy metals, which is also one of the deposits in Ferronickel factory in Drenas. After observing the terrain we observed that the dominant plant species is *Alyssum murale* and some other associated plants. Analyze is found in substantial concentrations of Ni (Nickel).

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Invasive *Brachypodium rupestre* on Ćićarija (Croatia) grasslands: threat to plant diversity or good feed for animals?

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During this research (2008-2010) the occurrence of the invasive species *Brachypodium rupestre* on the Ćićarija grasslands has been recorded. This grass is quite abundant in mowed meadows and grazed pastures (cover up to 25%), with even greater spread in abandoned meadows and pastures (cover more than 25%).
This phenomenon could be explained because of the low intensity use of grassland: in hay meadows, competition for light after abandonment and the higher water and soil nitrogen content, allow the invasion of *B. rupestre* which quickly spreads by means of rhizomes and tends to form extensive patches.
Our results indicate that *B. rupestre*, in comparison with the abandoned meadow, had a greater neutral detergent fibre fraction (NDF, 733.0 vs. 616.5 g/kg DM) and better energy value (NEL, 5.82 vs. 5.35 MJ/kg DM) due to lesser content of acid detergent fibre (ADF, 328 vs. 365 g/kg DM). Spring amount of crude protein was 132 g/kg DM.
Indicator species analysis (ISA) detected the *B. rupestre* as indicator species related to unmowed meadows and dry pastures.
The analyses performed in this study indicate that undergrazing and non-periodic mowing make the grasslands quite homogeneous. As a matter of fact, meadows are more subjected to the invasion of *B. rupestre* and they are more vulnerable than pastures to the loss of floristic diversity because of management abandonment. For this reason, regular mowing should be maintained and incentivized. Because of its clonal growth organs (rhizomes) *B. rupestre* spreads very quickly after fire. Consequently, the use of controlled burning must be a very limited application.
As regards pastures, since the threat of loss of species diversity is lower, a low grazing pressure should be maintained by grazing rotation. *B. rupestre* is nutritious but less palatable species by qualitatively classification and the grazing with less selective herbivores (cattle, donkeys and horses) could be a successful solution to control this invasive species.

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The role of different *Festuca* species in dry open sandy grassland communities of Danube-Tisza area in Hungary

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Festuca pseudovaginata (Penksza 2003) is a new species of European vascular flora. We have lack of information about its ecology and role in plant communities. In this study we would like to define the ecological factors of *Festuca pseudovaginata* and to compare to other well known *Festuca vaginata* communities.
The two study areas are located in Kiskunság which is a semi-arid area with the typical vegetation type of open sandy grasslands. 10-10 coenological relevés were made with Braun-Blanquet method in quadrats of 2x2 m. Soil samples were taken from 0–15 and 15–30 cm depth. For data analyses we used cluster analyses, the Shannon-diversity index, Rényi-diversity profiles and the social behaviour types of Borhidi.
The cluster analyses showed that *Festuca pseudovaginata* and *Festuca vaginata* samples separated perfectly. Plots dominated by *Festuca pseudovaginata* were definitely different from the quadrats dominated by *Festuca vaginata*. 64 % of the species occurred just in the *Festuca pseudovaginata* dominated sites. According to Rényi diversity profile larger values were measured in case of *Festuca pseudovaginata* in both sites. In *Festuca vaginata* dominated grasslands the amount of ruderal competitors and specialist species were higher but in *Festuca pseudovaginata* grasslands the amount of natural disturbance tolerant and weed species were dominant so this area was more disturbed and degraded. *Festuca vaginata* dominated quadrates were characterised by higher nitrogen, phosphorous and potassium content while the plots dominated by *Festuca pseudovaginata* were connected to lower nitrogen, phosphorous and potassium values in the 0–15 cm layer.

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News from Carl Studniczka's herbarium (ord. Onagrarieen, Cucurbitaceen and Portulaceen)

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Most of the analysed herbal material (64 herbarium sheets, with 164 samples of herbal plants) in this part of the C. Studniczka's herbarium (ord. Onagrarieen, Cucurbitaceen and Portulaceen) were collected in Europe (55 herbarium sheets, 86%), and 9 sheets originate from North America. Most of the herbarium samples were collected in the area of Czech Republic (12 herbarium sheets) and Austria (12). According to the written localities following countries are registered and these are: USA (9), Germany (9), Italy (4), Croatia (3), France (3), Montenegro (3), Poland (2), Hungary (1), Russia (1), Slovakia (1), Switzerland (1), Romania (1), Norway (1) and Great Britain (1). According to the affiliation to particular herbarium collections, the most representative plants are those from Flora Dalmatiens collection. In the part of the herbarium which has already been analysed new collections is mentioned and there are: Herbarium von Phaner Zollikofor in Marbach and Flora der Marmos. There are 25 herbarium sheets that are unmarked and therefore we do not know which herbarium collection they belong to. Apart from Studniczka, additional 22 collectors or botanists are registered. Following botanist or collectors of herbal material are mentioned for the first time, in the part of the herbarium which has already been analysed, and there are:

Canby, Kerner, Kraut, Malinverni, Pittoni, Schemmann, Schuppli and Uechtritz. The oldest herbarium sheet dates from 1856, where as the newest ones date from 1902. The exact year of collection is missing from 10 herbarium labels. According to Studniczka, within 64 herbarium sheets, in analysed part of the herbarium (Ord. Onagrarieen, Cucurbitaceen, Portulaceen) there are 18 genera with 49 species, and 1 varieties. The most species represented genera are *Epilobium* (22 species and 1 varietes) and *Oenothera* (6 species). According to Flora Europaea there are 19 genera with 39 species of plants and 6 subspecies. The most species respresented genera are: *Epilobium* (15 species and 3 subspecies) and *Oenothera* (5 species).

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