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Roma 6-9 April 2016

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GEOREFERENCED VEGETATION DATABASE – SAPIENZA: STATE OF THE ART, BASIC STATISTICS AND FUTURE PERSPECTIVES

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In Italy, many research groups are aimed to establish and encourage the development of a national "Geobotanical Archive", based on floristic and vegetation plots recorded relying upon the European phytosociological tradition (e.g Braun-Blanquet's approach). Recently, several initiatives have been finalized to the fulfillment of a global vegetation-plot database repository (i.e. EVA and GIVD). As part of this process here we present the "Georeferenced Vegetation Database - Sapienza University of Roma " project (Global Index Vegetation-Plot Databases ID: EU-IT-011 registered since 2012-02-27, http://www.givd.info/ID/EU-IT-011).

It is an ongoing vegetation-plots database, which collects relevés sampled in the whole Italian territory.

Most of the data stored in the GVD-Sapienza are phytosociological relevés (72.67 %), the database contains also plots where data have been collected using other sampling methods (27.34 %). At present, the 21.917 vegetation plots encompassed in GVD-Sapienza come from multiple scientific sources: 15.430 plots from published contributions on plant-communities; 6.487 from unpublished field research. The time span of the database covers the period from 1935 to 2015, all are geographically referred with an accuracy scale.

This archive was based on the need to go beyond a more consistent support to the coenological information and to explicitly enter the question of the requirement of a general, geographically exhaustive geobotanical survey for the country.

Nowadays, beside GVD-Sapienza other databases at national scale (i.e. BVN-ISPRA and AnArchive/VEGItaly-SISV) are driven by single initiatives. However, in the next future, a federate coordinated database is needed to optimize common efforts toward an unified system at national scale.

This report aims to present some basic statistical description, quality assessment and future perspectives of this growing georeferenced Italian vegetation database.

FLORISTIC DIVERSITY AND CONSERVATION RELEVANCE OF THE *FESTUCO-BROMETEA* CLASS IN SERBIA

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Dry grasslands of the *Festuco-Brometea* class are recognised for their high species diversity and significant conservation value.

In order to evaluate the floristic diversity and conservation relevance of dry grasslands of Serbia, the list of protected and endemic plant species was assessed.

The *Festuco-Brometea* class exhibited high floristic diversity (1323 plant species) and very high conservation relevance in view of the large number of Balkan endemic species (204). Within the analysed data set of 1323 plant species and subspecies, only eight plants have a nationally threatened status, of which two are considered extinct in Serbia - *Erysimum crepidifolium* and *Seseli hippomarathrum*. A total of 233 species and subspecies are protected by national legislation, of which 64 are strictly protected and 169 protected, which represents 17.6% of all vascular plants within our analysed data set.

There is therefore an urgent need not only to identify rich endemic areas but also to include them in future Important Plant Areas and NATURA 2000 areas.

Keywords: dry grasslands, floristic richness, Serbia

PATTERNS AND PROCESSES OF *LAURUS NOBILIS* L. REGENERATION IN THE ITALIAN FORESTS

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Laurus nobilis L. is considered one of the extant relic species of the late Tertiary Eurasian lauriphyllous forest belt, persisting in the Mediterranean vegetation. During the last decades, lauriphyllous species, including *L. nobilis*, are spreading in southern Europe, apparently favored by warmer and more humid environmental conditions due to suggested trends in climate change. Considering its biogeographical importance, however, few works focused on its ecology and coenology in S-Europe.

We investigate the ecology and rejuvenation of *L. nobilis* in the Italian forests, taking into account a selection of environmental factors and human impact. We analysed a national dataset of phytosociological relevés in stands with *L. nobilis* in order to describe the coenology of the species along geographical and topographical gradients in Italy. Ellenberg indicator values combined with climate data are applied to the classification in order to gain more insight into the ecology of *Laurus.* Additionally, we sampled 34 forests stands in central Italy, in order to assess the patterns of its rejuvenation.

Our results show that *L. nobilis* occurs in a wide range of distinct plant communities. Abundant regeneration is recorded especially in (1) *Quercus ilex* evergreen forests and (2) in deciduous mesophilous forests dominated by S-European oaks (*Carpinus betulus, Quercus petraea, Fagus sylvatica*). An increasing "Laurophyllisation" was detected by high rejuvenation of *Laurus* in stands where only few older individuals of the species were formerly scattered in the canopy. We suggest that changes in forest use and abandonment of forest grazing might major explanations for the local spread of *L. nobilis.*

Keywords: *Laurus nobilis*, coenology, lauriphyllous species, vegetation databases

INTERPRETATION OF ANNEX I MIRE HABITATS OF THE HABITATS DIRECTIVE IN LATVIA

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There are eight Annex I mire habitats in Latvia and, in general, the greatest challenge so far has been to draw the border between mire and forest. Still interpretation of some mire habitat types, such as 7150 Depressions on peat substrates of the *Rhynchosporion* and 7230 Alkaline fens, deserved more detailed analysis. Two questions had been raised: 1) should be vegetation on bare peat in raised bogs interpreted as habitat type 7150 Depressions on peat substrates of the *Rhynchosporion* or only as a part of 7110* Active raised bogs? 2) Should be *Carex lasiocarpa* dominated rich fen vegetation assigned to *Caricion davalliane* and interpreted as 7230 Alkaline fens? I used vegetation data analysis, such as NMS ordination and presence and abundance of diagnostic species of recently developed formal definitions of alliances in Europe to answer these questions.

KEYWORDS: MIRE HABITATS, HABITATS DIRECTIVE, *RHYNCHOSPORION ALBAE*, *CARICION DAVALLIANAE*

THE EFFECTS OF THE TATRA MARMOT (*MARMOTA MARMOTA LATIROSTRIS*) ON DIVERSITY OF ALPINE VEGETATION IN NATURA 2000 AREAS IN THE WESTERN CARPATHIANS

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Question: Do the marmots cause fine structural and compositional changes in alpine plant communities of European protected areas?

Location: Tatra National Park and National Park Low Tatras, the Western Carpathian Mountains, Slovakia, Europe.

Methods: For assessment of marmot effects we recorded data from 180 triad plots (60 marmot's burrow mounds, 60 next to each mound, and 60 controls). Data were derived from vegetation relevés and environmental variables, followed by Generalised linear mixed models with proper distribution and split-plot design for analyses of vegetation characteristics and for individual plant species responses.

Results: Cover and height of herbs and cover of mosses are significantly higher on next-to-mound plots than on burrow and control plots, while cover and height of graminoids, cover of lichens, and cover of litter are significantly the highest on control plots. Equitability decreases gradually in direction from burrow plots, next-to-mound plots to controls. Diversity indices are significantly higher on burrow mounds and next-to-mound than on controls.

Loose soil and increased nutrient content on burrow mounds were likely to subsequently encourage settlement of nutrient- and moisture-demanding species with larger requirements for soil depth (*Festuca picturata*, *Geum montanum*). Next-to-mound plots with trampling and grazing activities were often occupied by stress- and damage-resistant species (*Carex sempervirens*, *Ligusticum mutellina*, *Nardus stricta*). These plant species become dominant over less competitive alpine species, which were found in marmot-free controls (*Agrostis rupestris*, *Campanula alpina*, *Festuca supina*, *Luzula alpinopilosa*, *Oreochloa disticha*, *Senecio abrotanifolius*). Marmot impacts were the most concentrated on burrow mounds, but were also significant on next-to-mound plots.

Conclusion: Tatra marmots cause significant changes in the floristic structure and composition of alpine vegetation. Marmot activities reduced the dominance of common species and thereby enhanced community diversity.

KEYWORDS: ALPINE COMMUNITIES, MARMOT IMPACT, SPECIES RESPONSES

ARE THERE ANY DIFFERENCES IN HERB SYNUSIA BETWEEN BLACK LOCUST FORESTS GROWING ON ECOTOPES OF NATURAL HARDWOOD FLOODPLAIN FORESTS?

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Aim: Evaluation of the influence of Robinia pseudoacacia dominated forests on composition and structure of herb synusia in comparison with natural hardwood floodplain forests.

Location: Lowlands of Slovakia.

Methods: Study is based on 294 relevés from the class Robinietea (121) and the class *Querco-Fagetea*, suballiance *Ulmenion* (173) since 1995 to 2015 (http://ibot.sav.sk/cdf/). Black locust and hardwood floodplain forests relevés were recorded at Podunajská nížina Lowland, Borská nížina Lowland, and Východoslovenská nížina Lowland by standard methods of Zürich-Montpelliér school with 9-degree new Br.-Bl. scale. In JUICE program, for every relevé number and percentage cover values for neophytes, archaeophytes, native species, and all species; Shannon–Wiener index and equitability were calculated.

We have compared these two groups using t-test for independent samples by groups. Difference of these groups was demonstrated by agglomerative cluster analysis using method Beta flexible (-0.25) and Ruzička´s coefficient of dissimilarity.

Results: Number and cover of natural species were significantly higher in hardwood floodplain forests, and number and cover of alien species was significantly higher in black locust forests. Total number of all species was significantly higher in hardwood floodplain forests, but coverage of all species was not. Species diversity of herb layer is significantly lower in black locust stands.

Conclusion: There are several possible explanations. Black locust comes into leaf later and its canopy stays sparse and gappy and in this way supports occurrence of spring and heliophilous species. Ability of black locust to fix aerial nitrogen to soil stores improves conditions for nitrophilous alien species. Increase of cover of several alien and nitrophilous species in black locust stands can causes their lower total number of species and species diversity.

CHANGES OF SHRUBBY CINQUEFOIL *PENTAPHYLLOIDES FRUTICOSA* (L.) O.SCHWARZ CHLOROPHYLL A FLUORESCENCE DURING THE GROWTH SEASON

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Aim: The aim of the study was to identify the sex-related response to different growth conditions of dioecious plant *Pentaphylloides fruticosa*.

Methods: In three *Pentaphylloides fruticosa* (L.) O.Schwarz habitats differing by growth conditions (two different EU Protected habitats – 7230 Alkaline fens and 6210 Semi-natural dry grasslands on calcareous substrates) in Nature reserve "Čužu purvs" in Latvia monitoring and chlorophyll a fluorescence measurements were carried out monthly in summer of 2015th. Chlorophyll a fluorescence measurements were performed with fluorometer PAM 2100 (Walz, Germany). Leaves of 6 plants (3 female, 3 male) in 3 replicates per habitat were measured.

Results: Chlorophyll a measurements showed no significant differences between male shrubs in all three habitats during the whole summer. Similar tendencies were observed on female shrubs, however, in July chlorophyll a fluorescence of dry grassland female plants had significant difference when compared to June and August. The meteorological data suggests that the fluctuations might be explained by precipitation level. There was a significant difference between female and male shrub Fv/Fm in all three growth conditions during the whole summer. In general, this parameter was lower in female plants except for July, when it was higher. This might be explained by male plants being more tolerant to drought, but female plants being capable to faster react to changes in environmental conditions.

MATRIOSKA HABITAT CONCEPT: WHEN A PRIORITY HABITAT BECOMES A VALUABLE FRAMEWORK FOR OTHER HABITATS

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Can Mediterranean pinewoods incorporate different habitats?

Pine forests across Peninsular Italy, covering a wide part of habitat 2270* in Italy.

We sampled purely pine forests on stabilized dunes, excluding those on rocks, by means of plots (2×2 m) across stands dominated by three different pine species: *Pinus pinea* L., *P. pinaster* Aiton and *P. halepensis* Mill.

The dataset included 167 plots and 269 species. NMDS was used to investigate community patterns, which revealed three distinct groups in accordance with pine species dominance. Interestingly, when dominant pine species were cut off from analyses an indistinct pattern was revealed and weak differences in community composition were found. MRPP suggested that forests dominated by different pines species may be characterized, to some extent, by distinct vegetation assemblages. However, when the data set without pine species was considered, results showed few differences among vegetation plots, particularly when forests dominated by different pine species were compared. Besides, INSPAN showed that more than half of indicator species were typical of other EU habitats (i.e. shifting and fixed dunes herbaceous vegetation, holm-oak forests, annual grasslands).

Our results support the idea that Mediterranean wooded dunes with *P. pinea* and/or *P. pinaster* coastal forests, also comprehending *P. halepensis* forests, can be considered a "Matrioska Habitat". These forests, in fact, could incorporate several different EU habitats: 2110; 2120; 2250*; 2260; 6220*; 6420; 9330; 9340. Thus, priority habitat 2270*, mostly represented in Italy by planted stands, should be considered a valuable framework for other EU habitats including either priority ones. Probably these forests, represent the first case of conservation in planted forests showing a habitat not necessarily important itself but, because it has the potential capability of allowing the coexistence of different plant species and different habitats.

HERB VEGETATION DIVERSITY AND MEADOW FLORA UNDER PROTECTION REGIME (BASED ON THE STUDY OF CENTRAL FOREST AND POLISTOVSKY NATURE RESERVES, RUSSIA)

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The object of our research is herb vegetation and structure of meadow flora under and without the protection regime. It is well known that mainland meadows of the forest zone are formed and maintained by human activities. However after the exclusion of agricultural use grasslands deteriorate and become overgrown with forest. Based on the study of Central Forest and Polistovsky nature reserves we compare the structure of mainland meadow partial floras. We try to check the hypothesis that a significant reduction in species richness, in species saturation, and the disappearance of rare species takes place in the meadows under protection regime.

In the course of our research we have made taxonomic, geographic, coenotic, ecological and biomorphological analyses of meadow flora. Tests were made for a general meadow flora as well as for each meadow flora of the reserves and dedicated meadow coenofloras. The results allowed us to analyze species richness and saturation of their types.

We have allocated 10 types of herbal communities and have revealed particular features of composition and structure of coenofloras for each of these types. We have found significant decrease in species diversity, richness and saturation of many abandoned herbal communities. We discovered that rare and adventive species are more likely to be found in abandoned meadows. As an upshot of our research we have established that the similarity of the species composition in coenofloras is primarily determined by the presence of the anthropogenic factor while local features of the examined territories play only a minor role.

A PRELIMINARY OVERVIEW OF *SALICETEA PURPUREAE* MOOR 1958 CLASS IN WESTERN POLISIA (UKRAINE)

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Western Polisia is a geological macro-region, part of north-western Polisia, one of the largest lowland forest areas of Europe. It is a marshy region in Northern Ukraine comprising the Volyn and Rivne regions. This surface was formed during the last glaciation which left extensive lakelands, morraine plateaus crossed by large stream valleys. Geologically the territory is characterized by peaty and sandy soils and by alluvial sandy-muddy sediments along rivers.

Although several papers have been published since the end of the XIX century about the flora of this area, geobotanically it is not much investigated. The aim of our study was to investigate the diversity of the floodplain forests of the region. Totally 129 relevés have been made. We have analysed their syntaxonomic status, floristic and ecological features.

This abstract presents data from 79 relevés (100 m2 each), in which we recorded all vascular plants. They have been analysed by classification and ordination methods. The relevés have been compared with the relevés of similar vegetation in a wider geographical region. Data were analyzed using JUICE software.

Syntaxa were assigned to four groups. The most widespread communities in the region are those presenting *Salicetum triandrae* association (51 relevés). Inside the group 2 subgroups are clearly visible. The first presents the initial forest stage at the riverside with high level of disturbance, including many hydrophylous species. The other occurs on occasionally flooded sites (formed on high steep river banks). Communities of *Salicetum purpureae* are pretty rare. They occur only on poor sandy soils on flat extended riversides. Comm. of Salicetum fragilis occur on regularly or occasionally flooded sites along small streams, on deep alluvial soils, in places protected from disturbance. *Salicetum albae* ass. almost does not occur in the region. Supposedly sparse small area forests dominated by *S. alba* have artificial origin.

CANADIAN POPLAR PLANTATIONS – THREAT TO SOFTWOOD FLOODPLAIN FORESTS

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Aim: After the Second World War began intensive planting of Canadian poplar in lowland areas of Slovakia. Canadian poplar stands are planted in places which were originally inhabited by softwood floodplain forests. On many places over 60% of native forest was replaced by Canadian poplar plantation. Here we ask: How do the plantations of Canadian poplar influence biodiversity of vegetation?

Location: Podunajská nížina Lowland, Slovakia

Methods: Phytocoenological relevés of softwood floodplain forests (45 relevés) and Canadian poplar stands (38 relevés) were sampled from 2013 to 2015 using standard methods of Zürich-Montpeliér school with 9-degree new Br.-Bl. scale. Shannon-Wiener index, equitability and number and cover of native and non-native species of these two groups were calculated using Juice program and compared using t – test in Statistica program.

Results: The number and cover of native species and the Shannon-Wiener index of relevés are significantly lower in Canadian poplar stands. Number and cover of neophytes in native softwood forests and Canadian poplar plantations are not significantly different.

Conclusion: Softwood floodplain forests are one of the most invaded natural forest habitats. Number and cover of neophytes in native softwood forests and Canadian poplar plantations are comparable. We find out, that despite of the fact, that Canadian poplar stands are not more invaded than native forests, their influence on biodiversity of native species of their subcanopy is negative. This could be explained by intensive forest management, especially the ground preparation before planting.

KEYWORDS: BIODIVERSITY, FORESTRY, LEVEL OF INVASION, NON-NATIVE TREE, *POPULUS* X *CANADENSIS*, *SALICION ALBAE*, SLOVAKIA

WHICH GENERALIZATION OF REPLICATION PRINCIPLE IS SUITABLE TO DEFINE BETA-DIVERSITY CONSIDERING DIFFERENCES AMONG SPECIES?

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Calculating functional beta-diversity for species pairs is an easy and theoretically sound way to incorporate differences among species into measuring differences between plots. It is widely accepted that Hill-numbers should be used for diversity calculation, because they allows partitioning gamma diversity into independent alpha and beta components. Thus between-plot distance deduced from beta-diversity is also independent from the local richness.

Hill's diversity formulas are deduced from the replication principle. Thus this principle should be generalized to considering differences among species. Two such generalizations have been proposed, first by Leinster and Cobbold in 2011 (Ecology, 93:477-489) and by Chiu and Chao in 2014 (PLoS One 9: e100014). The two different generalizations lead to different formulas. In the presentation their properties will be compared. The most important finding is that formulas by Chiu and Chao does not satisfy the so-called twinning rule, thus replacing all species with another species having same properties leads to maximal beta-diversity.

POTENTIAL DISTRIBUTION OF INVASIVE SPECIES *AILANTHUS ALTISSIMA* IN FOREST COMMUNITIES IN WESTERN PART OF SLOVENIA

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Questions: What is the potential distribution of *Ailanthus altissima* and which are the most endangered forest communities for its invasion?

Location: Ailanthus appears sporadically all over Slovenia, but it distribution is dense only in it western part, therefore the elaboration took part there.

Methods: We collected all existing localities of ailanthus and integrated them in ArcGIS. For each locality we provided data on geology, geomorphology and climate. These data were used to build the model of its potential distribution. We used software package WEKA by means of which we developed classification decision tree. In ArcGIS we generated a systematic network of points at distance of 100 m on the whole study area and provided them with the same information as the training data. For each of the points we predicted the appearance of ailanthus. Then we randomly selected 50 points (25 within and 25 beyond area of its potential distribution), sampled and classified forest communities.

Results show the potential distribution of ailanthus in continuous surfaces in lowlands of the Sub-Mediterranean Slovenia, where winter temperatures and precipitation seasonality are relatively high, while temperature seasonality is low and slope is moderate. It spreads along rivers in the alpine area due to penetration of warmer climate; also humans as vector of spread should be taken into consideration. Ailanthus thrives well on limestone and terra rossa, but is not so invasive on acidic soils.

Conclusions: The most endangered are forests of pubescent and sessile oak on carbonate and terra rossa, hornbeam forests, riverine forest and submontane and thermophilous beech forests. The probability of appearance of ailanthus is lower in acidophilous oak forests and acidophilous and montane beech forests. Our model could not take into consideration that abundance of ailanthus is significantly higher on more open forest stands and stand gaps, and on other non-forest land uses within forest areas.

KEYWORDS: *Ailanthus altissima*, forest, invasive species, modelling, Slovenia

CONSERVATION OF WETLANDS AND THEIR SPECIES IN ITALY: TOWARDS A HABITAT CODE UNIFICATION AMONG EU CLASSIFICATION SYSTEMS AND RAMSAR WETLAND TYPES

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Wetlands are cradles and sustainment of biological diversity, store wild relative of important domesticated plants and are important areas for the supporting of ecosystem services;   at present occur on approximately 5% of the earth surface. Increased anthropogenic pressures and climatic change, however, are amplifying wetlands habitat loss and degradation. In the European different biogeographical regions, wetlands host many species in need of protection and threatened ecological communities and in addition are important stop and destination areas of African-Eurasian migratory waterbirds which ecologically dependent also on European wetlands for at least part of their life cycle. Worldwide the "Ramsar Convection", an international agreement for the conservation of wetland particularly for the protection of waterbirds, provides a framework for the wise use of wetlands and their resources, also through the identification and description of Wetland of International Importance with a classification of "Wetland types". Behind this classification systems, however, EU28 countries have adopted different classification for habitats at European level: formerly the Corine Biotopes classification and later Palaearctic classification and EUNIS. In particular, in order to establish a common language, a list of habitat types to be protected has been produced and listed in the Habitat Directive (Annex I) with crosswalks to Corine Biotopes and Palaearctic. Aim of this study is to improve coherence among Ramsar wetland types and the corresponding EU vegetation types present in Italy intending to provide useful information both on the presence and status of wetland and on the pattern and habitat suitability of migrating birds. The Ramsar Classificiation System, in order to have a better correspondence with other classification codes was extended, in some case, with a 2-level hierarchical level (such in the case of the type G "Intertidal, mud, sand or salt flats" and H "Intertidal marshes") to better fit both the Habitats Directive and EUNIS habitat types). Results of the cross reference will be functional from completing and updating the Ramsar Site Information (RIS) Form to assessing Eurasian distribution and conservation of wetland habitats and the habitat fidelity of African-Eurasian bird migration.

Keywords: Wetlands, classification system, Ramsar, Natura 2000

HERB VEGETATION DIVERSITY IN THE NORTH OF CENTRAL FOREST RESERVE (TVER' PROVINCE, RUSSIA)

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Aims: In the territory of Central Forest Nature Biosphere Reserve, some patches of grassland mostly exist in the place of abandoned settlements surrounded by old-growth forests. Their area is steadily declining due to forest expansion, while these peculiar herb communities still remain poorly studied. The aims of our investigation is to assess the diversity of herb vegetation in the northern (strictly protected) part of the Nature Reserve and the adjacent territories (under agricultural use), to characterize the ecological features of the syntaxa, and reveal the main driving ecological factors, which cause their diversity.

Location: Andreapol district, Tver' Province, Russia.

Methods. We analyzed 111 relevés (10x10 m) made in July 2014. Classification procedure was carried out by using numerical methods. For ordination we ran Detrended Correspondence Analysis (DCA). Landolt's and Ramensky's scales were used to evaluate ecological conditions.

Results. The herb vegetation has been classified into three classes *Molinio-Arrhenatheretea*, *Galio-Urticetea* and *Epilobietea angustifolii*. Within *Molinio-Arrhenatheretea* we revealed 2 orders, 3 alliances, 3 associations and 2 communities. Two other classes are represented by only 1 community each. Four main driving ecological factors are light, grazing intensity, soil moisture and soil particle size.

Conclusion: Meadow communities in the Reserve core area display now certain signs of degradation and successional changes, i.e. the occurrence and abundance of grasses is relatively low, while those of forbs (including ruderal species) and mosses are rather high. After 25 years without agricultural use, tall-herb communities have emerged in many places. Meadows in the Reserve are considered as habitats for some rare and protected plants and animals. The disappearance of the meadows will lead to the decrease in local biodiversity. Thus, introduction of a specific land-use regime is required to save valuable meadows in the protected area.

NUMERICAL CLASSIFICATION OF PLANT COMMUNITIES OF ISTANBUL-BELGRADE FOREST (TURKEY)

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Background: Phytosociological studies in the Belgrade forest have different results due to the sampling strategy and classification techniques. This study aims to reclassify vegetation of Belgrade Forest using all available relevés in a single database.

Study area: The Belgrade Forest is one of the most important part of the northern forest zone of Istanbul and also falls into Castanetum-Fagetum transition zone. Mean annual precipitation is around 1111.4 mm and the mean annual temperature is 12.7°C.

Material and Method: A total of 628 relevés (338 plant species) were compiled from Yaltırık (1963) and Yönelli (1986). The vegetation data were classified by using Twinspan (Hill, 1979) method and optimal number of clusters was determined with crispness of classification from Twinspan results.

Results and Discussion: The classification of the forest vegetation revealed 4 clusters which gave higher numbers of diagnostic species. In addition, maquis community (*Chamaecytisus pygmaeus-Erica manipuliflora*) was seperated on the fourth level of the division and defined as another association. As a result of the classification and literature review, 4 associations and 2 subassociations were determined. *Quercus petraea* dominated forests were classified as *Salvio forskhali-Quercetum cerridis* Barbéro et Quézel 1979 which consists of *Quercetosum frainetto* and *Fagetosum orientali* subassociations, pure *Fagus orientalis* forests as *Ilici colchicae-Fagetum orientalis* Akman, Barbéro et Quézel 1978 and *Carpinus betulus-Acer campestre* dominated forest as *Trachystemo orientalis-Carpinetum betuli* Kavgacı *et al.* 2011. Consequently, the results of this study were found to be more consistent with the classification of Yaltırık (1963) which sampled different vegetation types and moreover predefined forest stand types than Yönelli (1986) which focused on dominant forest type. Reclassification of the vegetation data gave more detailed information about the region.

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SCLEROPHYLLOUS FORESTS OF THE IBERIAN PENINSULA: NUMERICAL CLASSIFICATION AND CHARACTERIZATION

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Questions: A numerical analysis of the classification, distribution patterns and floristic and environmental characterization of the broadleaved sclerophyllous forests in the Iberian Peninsula and surroundings (Southern France) was carried out. The aim is to revise the traditional approaches and formalize them with numerical methods.

Location: Iberian Peninsula (Portugal and Spain) and Southern France.

Methods: A database of about 4000 relevés originally classified in the *Quercetalia ilicis* Br.-Bl. ex Molinier 1934 order (forests and woodlands mainly dominated by *Quercus ilex*, *Q. rotundifolia*, *Q. suber* and *Q. faginea s.l.)* was compiled from online databases (SIVIM) and bibliographical sources. Some poorly sampled areas were completed with field work. Environmental layers on climate and soils were used to characterize the classification results. In order to remove sampling biases, the whole relevé dataset was submitted to resampling techniques. Several unsupervised classification methods are compared: hard (Partitioning Around Medoids, PAM) and fuzzy partitioning (Fuzzy C-means), as well as fuzzy non-partitioning (Noise Clustering). We choose the number of significant diagnostic species versus the number and characteristics of the generated groups as the criterion for selecting the optimal clustering solution. The main environmental gradients were explored with ordination techniques and statistical tests were applied to the characterization of the recognized groups.

Results: Up to eight main groups corresponding to syntaxonomical units of the traditional classification were identified in the clustering results, arranged in somewhat different ways depending upon the classification method. In general, the more oceanic and mesophytic forests dominated by *Quercus ilex*, *Quercus suber* and *Quercus faginea* subsp. *broteroi s.l.* were separated from the more continental and drier forests mainly dominated by *Quercus rotundifolia*. Among the former, the holm oak forests showed a clear isolation, and some thermophile SW Iberian forests appear as a floristically well characterized subgroup. The main gradients within the Q. rotundifolia forests were related to soils (basic vs acidic) and climate (thermic regime). Other minor patterns seems to be influenced by land use, as suggested by the analysis of differential species.

KEYWORDS: SCLEROPHYLLOUS FORESTS, IBERIAN PENINSULA, FUZZY CLUSTERING, INDICATOR SPECIES, VEGETATION DATABASES, PHYTOSOCIOLOGY.

COMPARATIVE STUDY OF OAK SEEDLINGS AND WEED VEGETATION PATTERNS IN THE FOREST STAND OF BOTANICAL GARDEN OF SZENT ISTVAN UNIVERSITY (GÖDÖLLŐ, HUNGARY)

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One of the last stand of the unique *Aceri campestri-Quercetum roboris* forest association can be found in the locally protected Botanical Garden of Szent István University. During the forest reconstruction process finished in 2010 adventive and non-indigenous ligneous plants have been removed from one part of the area. This research surveys the situation following the reconstruction, with particular attention paid to the distribution and quantity of *Quercus petraea* seedlings as well as the quantity and abundance of 13 weed and weed-like species affecting the spreading of seedlings.

Sampling has been implemented by using the spatial network covering the 1.5 hectare forest. 157 quadrates have been sampled in 10 metres distance from each other. The number and surface cover of oak seedlings was significantly higher in the renewed areas; the majority of these plants emerge in the inner, opened-up areas of the reconstructed forest. The land cover of oak seedlings in the non-reconstructed forest area was only 1.5%. Based on the sampled areas 53% of the total forested area has been occupied by the weeds and weed-like species. The reconstructed area has slightly smaller total weed cover compared to the untouched part of the forest, although the total abundance of these species showed increasing tendency in the past two years. *Hedera helix* – that hinders the renewal of oaks – has the largest land cover among these weed species: altogether 30.2% regarding the whole forest. During the last two years the ivy has spread significantly in the reconstructed area. *Sambucus nigra* also covered large areas. Many young specimens of this plant can be found outside the reconstructed area.

Two invasive species also appeared in the opened-up areas of the reconstructed forest: *Robinia pseudo-acacia* and *Solidago canadensis*. In recent years the more intensive appearance and spreading of weeds and weed-like species represent further hazards in the more disturbed regions of the forest.

KEYWORDS: FOREST STAND, *QUERCUS PETRAEA*, SEEDLINGS, WEEDS, RECONSTRUCTION, MONITORING

DESCRIPTION OF MIXED BY WILD MAMMALS DIAGNOSTIC HORIZONS FOR SURVEYING WILD BOARS PRESSURE IN THE MEDITERRANEAN FOREST ECOSYSTEMS

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Aim: Wild mammals disturbance is powerfully studied in relation to the plant species and communities response, while the effects on soil and mainly on the diagnostic horizons of humus systems and forms are very little known. Castelporziano Reserve since long time is affected by wild mammals impact, mainly the boars causing a loss of species in the forest understory and a change in the structure of the humus systems.

Location: Castelporziano Reserve.

Methods: Soil/humus profiles and phytosociological relevès were performed in the same sites representative of the main soil and vegetation types of the Reserve.

Results: A mix organic with organic-mineral soil horizons was observed in the sites affected by the boars rooting. This critical situation is rather common also in other Mediterranean forests with a considerable load from wild boars, where a horizon that seems decidedly organic to the naked eye becomes organic-mineral after laboratory analysis; the usual homogeneity of diagnostic horizon is generally destroyed, wild boards mixing with their nose horizons of different origin and composition.

Conclusion: As a consequence, the physico-chemical and morphological parameters are unable to support the standard criteria of humus systems and forms classification.

In order to overcome the presence of wild mammal mixed horizons, we propose definitions and codes for appropriated new soil/humus diagnostic horizons.

KEYWORDS: HUMUS SYSTEM, HUMUS FORMS, DISTURBANCE, WILD MAMMALS, SOIL DIAGNOSTIC HORIZONS, MIXED HUMUS HORIZONS.

PATTERNS AND ENVIRONMENTAL DRIVERS OF COMPOSITIONAL VARIABILITY OF THE HABITAT 6210 (*) IN THE REATINI MOUNTAINS (CENTRAL APENNINES – ITALY)

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The Habitat 6210(*) includes temperate, dry to semi-dry, hemicryptophytic grasslands of secondary origin, belonging to the class *Festuco-Brometea*. These grasslands host a very high plant diversity, are very rich in endemic *taxa* and provide key ecosystem services. Nevertheless, the decline in the extent and connectivity of these grasslands, particularly in mountain areas, has been repeatedly documented across Europe, constituting a major conservation problem. In mountain areas, this decline is mainly due to the colonization by woody species following land abandonment.

Since environmental conditions strongly interact with changes in management in determining the patterns and rates of successional processes, we aim at identifying which environmental drivers influence the habitat shifts in vegetation composition and structure in support of conservation decision on the Habitat.

We performed 64 phytosociological relevés in the Reatini Mountains, within the 6210(*) "environmental range", and associated to each relevé broad scale environmental (e.g. lithology and annual rainfall) and topographic variables (e.g. altitude and slope). The data was explored through multivariate analyses. Our results show that: i) within the "environmental range" of 6210(*) different grasslands occur, some of which may not be referred to the Habitat, and ii) the environmental variables that drive the variation between habitat types differ from those causing the within-habitat heterogeneity. This variability should be taken into account in the monitoring and conservation plans in order to preserve or enhance the conservation status of this Habitat.

Keywords: semi-natural grasslands, habitat directive, constrained ordination, *Phleo ambigui-Bromion erecti*

THE CATALOG OF VEGETATION SERIES AND GEOSERIES OF CORSICA : A REGIONAL TOOL FOR SYMPHYTOSOCIOLOGICAL KNOWLEDGE AND MANAGEMENT ISSUES

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From 2012 to 2015 the dynamico-catenal phytosociology investigations were carried out in Corsica in order to improve knowledge of the dynamics trajectories of vegetation. The typological results include 78 serials and geoserials units. In parallel mapping work was conducted in several mountains and valleys of the island to map these units and refine their chorological description. If this contribution of knowledge has allowed a better understanding of the structural patterns and vegetation dynamic of Corsica, it is now necessary to organize all the data collected.

The catalog project of vegetation series and geoseries, commissioned by CarHAB program has three main objectives: (1) allow and facilitate the identification of the series and geoseries vegetation; (2) serve as a reference in the context of the definition of conservation management objectives; (3) federate national and international communication between scientists, managers and local authorities.

This poster presents the objectives and challenges of this collective project while addressing the catalog structure modalities. A descriptive index of a vegetation serie will also be presented.

Keywords: vegetation series and geoseries, Corsica

ECONOMIC EVALUATION OF TWO INVASIVE PLANT SPECIES - PRELIMINARY RESULTS

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The spreading of invasive species causes serious environmental problems nowadays. The recognition of these negative effects, understanding, and protection against them are based on estimates, assessing the size of the damage. Black locust (*Robinia pseudoacacia* L.) and tree of heaven (*Ailanthus altissima* Mill.) are widespread and for native vegetation and flora they are extremely dangerous woody-stemmed plant species in Hungary.

In our research we analyzed economic potential and cost of repel of the above mentioned species and items of these. During the data collection we sent thematically compiled questionnaire to the relevant state institutions (national park directorates and state forest companies). In addition, other publicly available background information was collected as complement of data. Questionnaires concerned items of income and expense, a total of 15 items in aspect of the analyzed species for the 2009-2013 period. A significant number of incoming data came from national park directorates, but most of the state forest companies did not give information despite of multiple requests.

During evaluation of data, we found that costs of black locust reduction were so high - sometimes hundreds of millions of HUF - that those could not be compensated by revenue from the sale. However, in the case of the state forest companies, incomes were several times bigger than costs in each year. Judgment of tree of heaven was negative in all areas. They could not be sold, so no revenue was derived from their presence, but reduction was very expensive.

KEYWORDS: INVASIVE SPECIES, ECONOMY, *ROBINIA PSEUDOACACIA*, *AILANTHUS ALTISSIMA*, FOREST

EVIDENCE FROM MULTIVARIATE MORPHOMETRIC STUDY IN THE *QUERCUS PUBESCENS* COMPLEX IN THE SOUTH-EAST ITALY

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Under the name of *Quercus pubescens* s.l. there is a complex of deciduous oak taxa with a mainly SE-European distribution and a large ecological niche. Apulia is the easternmost region of Italy, isolated from a geographical and physiographical view-point, and characterized by the highest number of oak taxa (10) amongst the Italian administrative regions. In the taxonomical and phytosociological literature of the Apulia region, more than one taxon belonging to the *Quercus pubescens* collective group is reported. In particular, some authors stated that other taxa, namely *Q. virgiliana* Ten., *Q. dalechampii* Ten. and *Q. amplifolia* Guss, should be added to the Apulian list of white oaks in the place of *Q. pubescens*. Accordingly, some phytosociological papers reports these taxa as playing a guide role in specific phytosociological associations (*Cyclamino-Quercetum virgilianae, Irido-Quercetum virgilianae, Stipo-Quercetum dalechampii*).

In order to verify if the different taxa belonging to the *Quercus pubescens* identified for the Apulia region were possible to be associated to real differences in the morphological characters , twenty-four populations of *Quercus pubescens* s.l. located in different ecological-geographical areas were sampled in the Apulia region. A total of 367 trees, 4254 leaves and 1120 fruits were collected and analysed using both univariate and multivariate analysis procedures. All the morphological characters analysed exhibited a continuous trend of variation so that none of them was suitable to be used as a discriminating factor between oak populations or individuals.

Our results suggested that it was unlikely that more than one species belonging to the *Quercus pubescens* complex occurred in the study area. The comparison between the Apulian populations and a genetically pure *Q. pubescens* population coming from a different geographical area strengthened the assumption of the occurrence of a single oak species in both areas.

Keywords: South Italy, fruit, leaf, morphometric data, *Quercus*, statistical analysis

BIOTOPES OF MOUNTAIN CRIMEA

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The developed classification of Mountain Crimea biotopes includes 124 types. It is based

on the classification of EUNIS, which is elaborated for the EU, nevertheless, its units often have regional limitations. Therefore, in this classification there are given appropriate analogues of EUNIS, CORINE, Pal. Habitat, and Natura 2000. This is the base for its further implementation into the pan-European system. Although, the separation of biotopes is based on vegetation classification, the number of syntaxa is not always match to the scope of biotopes. Moreover, some biotopes could combine syntaxa of different classes, if they are interconnected and operate as an entire system.

Basing on the method of synphytoindication (Didukh, 2011) there was determined the character of correlative links between the 12 leading ecological factors. There was proved that the indirect effect of ecological factors through the edaphic conditions change (humidity, degree of salinity, and nitrogen content) has much more impact than the direct change of thermal regime or precipitation.

In order to separate and evaluate rare biotopes there were used 12 indicators. They reflect the relation of biotopes to the impact of human activity, the recovery rate, the distribution patterns, environmental conditions, vulnerability to the penetration of invasive species, and the presence of rare species and rare communities.

Eight biotopes (sub-Mediterranean and steppe) are related to the extremely rare class with local distribution, low recovery, and a high risk of losses. They all need the comprehensive protection measures. 35 biotopes (forest, forest-meadow, and petroglyphic) are rare, with limited distribution, and low recovery, which requires targeted protection measures. 35 biotopes are sporadically distributed and require specific protection measures. In conclusion, 78 habitats (63%) in the Mountain Crimea need to be protected that indicates the high value of this region.

THE INFLUENCE OF WATER REGIME FLUCTUATIONS ON SURVIVAL POTENTIAL OF THE FEN ORCHID *LIPARIS LOESELII*

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Aim: The aim of the study was to find out the influence of water level fluctuations on fen orchid *Liparis loeselii* (L.) Rich. in EU protected habitat 7210 Alkaline fens with *Cladium mariscus* near Lake Engure, Latvia.

Methods: In *L. loeselii* locality monitoring of the water level fluctuations and chlorophyll A fluorescence were carried out every two weeks from 6th of the June till 7th of the August, 2015. A standardized ruler was used for the water level measurements. Chlorophyll A fluorescence measurements were performed with fluorometer PAM 2100 (Walz, Germany).

Results: Specimens of *L.loeselii* were growing in moss on root nets of tuffs of *Schoenus ferrugineus* L. surrounded by *Cladium nariscus* (L.) Pohl. Chlorophyll A fluorescence measurements showed that Fv/Fm of *L. loeselii* PSII was below normal throughout the whole summer. Increased precipitation and habitat water level in the end of June and beginning of July led to decrease in Fv/Fm and increase in qN. This was followed by decrease in precipitation and as the habitat water level dropped, the Fv/Fm returned to its previous level while qN decreased.

Conclusions: Both the vitality and the survival potential of *L. loeselii* is strongly influenced by rapid changes in habitat water level. However it is not the only influencing factor. The overall low Fv/Fm level indicates on some kind of permanent stress factor, which probably could be the habitat overgrowth by *C. mariscus*, leading to increased shading of *L.loeselii*.

Keywords: chlorophyll a fluorescence, alkaline fen, *Liparis loeselii*, survival potential

ECOLOGY-COENOTIC PECULIARITIES OF PIONEER VEGETATION OF UKRAINE

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Pioneer vegetation of Ukraine include 78 associations by 9 classes. DCA-ordination analysis by the R-project program of 1492 relevés has showed that humidity degree and air permeability of soil, and also concentration of mineral nitrogen compounds are the leading factors of their ecological differentiation.

Humidity change defines an ecological differentiation of syntaxa of the *Ammophiletea* class, and a reaction of soil solution defines the same for the *Koelerio-Corynephoretea* class. For the *Isoëto-Nano-Juncetea* class the ecological differentiation of *syntaxa* is defined by the saturation degree of a substrate by mineral salts, by the light regime of ecotope, aridity-humidity of climate. For the *Bidentetea tripartitae* class the ecological differentiation is defined by the carbonate content in soil, humidity change, concentration of mineral nitrogen compounds, termoregime; for the *Thero-Salicornietea* – by the degree of climate continentality, substrate salinity, its acidity and cryoregime; for the *Cakiletea maritimae* – by humidity change, cryoregime, reaction of soil solution, concentration of mineral nitrogen and calcium compounds; for the *Crithmo-Staticetea* class – by the light regime of ecotope and degree of aridity-humidity of climate; for the *Crypsidetea aculeatae* – by the aeration of ecotope and content of nitrogen compounds.

KEYWORDS: PIONEER VEGETATION, ECOLOGICAL DIFFERENTIATION, UKRAINE

SUCCESSION OF MINEROTROPHIC MIRES AND ITS RELATIONSHIP WITH AVAILABILITY OF NUTRIENTS

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Biodiverse rich fens have become very rare due to acidification and eutrophication as well as fragmentation of the landscape. Minerotrophic mires are characterized by base-rich and nutrient-poor conditions. Bryophytes are sensitive indicators in rich fens ecosystem. Recent studies has demonstrated ongoing successional changes in bryophyte communities in terms of a decline of so called "brown mosses" and calcium-tolerant peatmosses and an increase of calcifuge peat mosses or late-successional stages. This succession leads to transformation of species-rich brown-moss communities to species-poor Sphagnum-dominated communities, what is associated with biodiversity loss. In order to test the effect of local conditions (e.g., nutrient availability) on this succession, we establish field experiments in the two contrasting Central-European regions, the Bohemian Massif and the Western Carpathians. Fen waters in the Bohemian Massif contains higher concentrations of P and K as compared to the Western Carpathians and different successional pathways may be therefore expected.

We established the first field experiment in autumn 2015 to test whether there are any differences between direction and speed of succession, number of species and proportion of functional groups of bryophytes among fens differing by availability of nutrients. We experimentally removed dominant *Sphagnum* species of individual successional phases (*S. warnstorfii* , *S. teres*, *S. recurvum* agg.) and will test whether and how fast the community will bounce back to previous successional stage under different nutrient levels. The second field experiment will test the same processes in the patches where late-successional calcifobe species *S. palustre* and *S. recurvum* agg. that recently spread in the study regions dominate in rich fens. We will facilitate dispersal of early-successional brown mosses by putting their stems into experimental plots after removal of dominant species and will hence focus predominantly on their establishment. If they will establish successfully we will interpret this result as support for the hypothesis that acidic poor fens developed under rather high calcium content in water may be a product of succession triggered by nutrient enrichment. Both experiments simultaneously test an applicability of patchy removal of late-successional peatmosses as an active management in deteriorating species-rich fens.

EFFECTS OF LONG TERM DOMINANT REMOVAL ON ALPINE *FESTUCA VARIA* GRASSLAND (THE NORTHWESTERN CAUCASUS)

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Questions: *Festuca varia* grasslands are widespread in the alpine belt of the Caucasus. What is the role of the main dominants, narrow-leaved grasses *Festuca varia* Haenke and *Nardus stricta* L. in their structure, and are there any subordinate species able to replace dominants in their abundance and function?

Location: Grassland at ca. 2750 m a.s.l., Teberda State Biosphere Reserve, the northwestern Caucasus, Russia.

Methods: We established permanent plots with three treatments: *Festuca varia* removal, *Nardus stricta* removal, *F. varia* and *N. stricta* removal and the control (no removal). After 20 years of the treatment, aboveground phytomass was clipped and weighed. Species richness, phytomass of functional groups and community biomass weighed leaf traits were compared by ANOVA.

Results: Dominants didn't response to each other removal. In all the treatments non-dominant narrow-leaved grasses increased, however they could not compensate biomass of dominants. Removal also positively influenced broad-leaved grasses and forbs. The community biomass weighed specific leaf area increased and leaf dry matter content decreased in all the treatments. The remaining species produced less amount of litter.

Conclusions: Contributing together more than 75% to the total community biomass, dominants determine functional structure and composition of grasslands, and there are no species which are able to replace them over a 20-years period.

KEYWORDS: COMPETITION, ALPINE COMMUNITY, BIOMASS, LITTER

SYNTAXONOMIC POSITION AND POPULATION ECOLOGY OF *DRACOCEPHALUM AUSTRIACUM* IN PANNONIAN AUSTRIA

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Aims: Austrian Dragonhead (*Dracocephalum austriacum*) is a critically endangered species with highly disjunctive distribution and only rare occurrences in Austria, which is listed as priority species of the Habitats Directive, Annex II. We wanted to address whether *D. austriacum* is randomly distributed within its habitats or occupies a certain ecological niche in terms of its syntaxonomic position and to gain information on population ecology for a long term conservation management.

Location: Hundsheim Hills and Vienna Woods, Austria.

Methods: Standard vegetation assessment using Braun-Blanquet relevés was used to address its syntaxonomic affiliation. Correlation and correspondence analyses was carried out to distinguish between stochastic and deterministic patterns of distribution. Matrix population analysis was done to clarify the contribution of seeds and different stages to population dynamics.

Results: Vegetation data on occupied and null sites suggest that *D. austriacum* has clear affiliations to rocky steppe grasslands (*Seslerio-Festucion* alliance), regularly accompanied by elements of thermophilous fringe vegetation of the *Geranion sanguinei* alliance. Accompanying species and population ecology parameters provide further reasoning for a certain ecological niche depending on interacting species, especially dwarf shrubs and matrix graminoids. Overall population growth seem to be stable due to regular reproduction and long-lived adults. However, dispersal distances are small and germination rate and seedling establishment is poor, thus the populations are restricted to small areas with nearly no tendencies to occupy new habitats.

Conclusion: The species has narrow ecological requirements and occupies habitats in refugial areas of the Pannonian Region and exhibits very low capacities to expand to open sites. Thus the species is highly vulnerable to extinction and depends on continuing conservation measures for safeguarding the existing sites.

Keywords: dry grasslands, habitats directive, ecological niche, population ecology, rarity, *Seslerio-Festucion*

VIOLA: DATABASE OF HIGH MOUNTAIN VEGETATION OF CENTRAL APENNINES

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Background: Long-term studies represent an unique and valuable way to observe large-scale vegetation changes over time and for predicting how land use change and climate changes affect the biodiversity of high-mountain habitats. The use of vegetation databases for comparison of old and new records is considered by many researches as a good option for assessing vegetation change, moreover play a special role in monitoring and analyzing vegetation. On such a basis, the researchers of Envix-Lab set up the VIOLA database (database of high mountain VegetatIOn of centraL Apennines), included into the GIVD id:EU-IT-019 (http://www.givd.info/ID/EU-IT-019).

Study Area: Gran Sasso, Majella, Matese, Monti della Meta and Velino in Central Apennines.

Methods: The database was built using the software TURBOVEG. Particular attention was given tot harmonize the nomenclature of the species reported in the phytosociological relevés. We followed Conti et al. (2005, 2007) for taxonomic scheme and nomenclatural updates. Inside VIOLA we created an Ecological Database where the respective Ellenberg indicators values proposed for Italian Flora (Pignatti 2005), life form (Raunkiaer 1934) and chorotypes (Pignatti 1982) have been associated to each species. Moreover, we assigned for each relevé the corresponding European Union (EU) habitat, following the guidelines of the Italian Interpretation Manual of the 92/43/EEC Habitats Directive (Biondi et al. 2009), the Interpretation Manual of European Union Habitats (European Commission 2013) and the related land unit type (sensu Stanisci et al. 2010).

Results: VIOLA actually includes 1546 plots (92.76% sampled on herbaceous vascular plant and 7.24 on woody vascular plant), but the database is continuously updated. The oldest plots in database dated from 1955, whereas the newest is dated 2014, in our case most of date comes from 1990's till present. The plot size ranged from 0.5 to 300 m2, but the highest number of plot (77.36%) are concentered in the 10/100 m2 range. Regarding to growth forms, the highest numbers of species belong to the hemicryptophytes (526 of 796), while for the chorotypes the highest numbers of species belong to Eurasian and Orof. South European species but a consistent numbers of species (94) belong to the Endemic chorotype. Moreover, several statistical analyses were made on VIOLA metadata

Conclusion: VIOLA Database offers a sound base for carrying out several ecological and floristic studies both accounting of the temporal changes and of the spatial heterogeneity across different sales. Furthermore is an efficient instrument for analyzing EC habitat distribution and for assessing their changes over time. Moreover, it provides useful information on shifts in altitudinal distribution of species according to global warming, on changes in land use, and other natural and anthropogenic processes.

KEYWORDS: VEGETATION DATABASE, HIGH MOUNTAIN, CENTRAL APENNINES INTRODUCING THE IAVS

VEGETATION CLASSIFICATION WORKING GROUP (VCWG)

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Aims: The objectives of this presentation are to introduce a new IAVS Vegetation Classification Working Group (VCWG) by 1) arguing for the importance of international collaboration, 2) providing a brief history of the VCWG, 3) outlining specific objectives of some of the VCWG subgroups, and 4) introducing a call for submission to a special issue on vegetation classification approaches in *Phytocoenologia*.

History: Around 60 IAVS members met last summer during the IAVS Symposium in Brno to discuss international cooperation regarding vegetation classification practices. For some years there has been an IAVS Special Committee devoted to vegetation classification. Members of that committee and participants at the meeting decided to form a new working group of IAVS, which is now official. Since that meeting, the group has grown to 166 members from 41 countries of six continents; we have formerly accepted our By-laws and elected a Steering Committee.

The Working Group: The general scope of the Working Group includes vegetation classification at any spatial or organizational scale, particularly the underlying methodologies and standards, ultimately allowing greater understanding and crosswalks among national classification systems. Both the number of interested members worldwide as well as multistate conservation efforts (IUCN red lists, etc.) suggest such international collaboration is essential. In an effort to organize our priorities, several goals were discussed at the Brno meeting that have evolved into subgroups; these include increasing our international network, comparing and finding commonalities between classification approaches, coarse-scale (up to biomes) and fine-scale vegetation classification, appropriate methods for survey and analysis, and highlighting the relevance of vegetation classification in the 21st century. In addition, the VCWG maintains a web page that highlights all aspects of vegetation classification as well as the activities of the VCWG.

VEGETATION DATABASES AND LONG-TERM ANALYSIS OF HIGH MOUNTAIN EU HABITATS: DETECTING ECOLOGICAL AND STRUCTURAL CHANGES IN CENTRAL APENNINES

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Questions: We investigated the ecological and structural traits of high mountain EC-Habitats in Central Apennines over the last 60 years focusing on two questions: (1) do ecological and structural changes occurred over time?; (2) Do these changes arise similarly on all the EC habitat types?

Location: Central Apennines high mountain belt (Italy)

Methods: We used historical and recent phytosociological relèves contained in a vegetation database VIOLA to explore the temporal changes in EC habitat assemblage of three high-elevation habitats (Bushes with *Pinus mugo* - code 4070*, subalpine calcareous grasslands - code 6170 and Calcareous and calcshist screes of alpine levels - code 8120; 92/43/EEC - Habitat Directive) considering diagnostic and most common species. After appropriate re-sampling procedures, we extracted a set of georeferenced relevees referable to two time periods (1955- 1989 and 1990-2014). Then we assessed vegetation changes comparing the ecological (Landolt temperature and nutrient indicators) and structural traits (Growth forms) of the habitat types over time.

Results and discussions: We observed significant differences in the ecology and structure of the analyzed habitats, and each habitat had a specific temporal trend. In the "bushes with *Pinus mugo*" habitat we observed a general decrease of subalpine and herbaceous species that could be related with the ongoing increment of cover of *Pinus mugo*. In "calcareous screes of alpine levels", we found an increase of termophilous species and dwarf shrubs, which is consistent with the trends observed in Europe where was attributed to climate warming. Subalpine calcareous grasslands does not change over time and such stability is most likely related with the characteristic high cover that make it less susceptible to filling processes.

Conclusions: Our results, based on the comparison of historical and recent phytosociological relèves contained in vegetation database, agree with previous studies that report consistent changes in the community assemblage of high-elevation habitats. Climate and land-use change are most likely related with the observed variations. Despite the limitations of using vegetation databases for assessing temporal changes, we are confident that the implementation of adequate resampling procedures and the focus on diagnostic and most common species, offer a good support to describe the long term changes that otherwise are impossible to catch.

KEYWORDS: Landolt indicators, growth forms, vegetation change, diagnostic species, common species, *Pinus mugo*, subalpine grasslands, alpine summit vegetation

ENDEMIC FLORA AND VEGETATION OF NATIONAL PARK "SHARRI" IN KOSOVO: THE ROLE OF UNIVERSITY OF PRIZREN IN SUPPORT FOR SCIENTIFIC RESEARCH OF THIS AREA

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National Park "Sharri" is characterized by natural values and rarities, with a large number of important forest ecosystems and other ecosystems preserved, with the number of

endemic and relict species. National Park "Sharri" is located in southeastern part of Kosovo and includes a surface of 53469 hectares and lies mostly in the territory of region of Prizren. The Prizren University "Ukshin Hoti" is located very close of this park and is the first University in Kosovo that is being established a study program for forest and environmental sciences. In this case, this university has started to construction the building infrastructure and the creation of the research laboratory for scientific research in this field. The number of vascular flora is more than 2000 plant species in this National Park, including about 20 local endemic plants of Sharri Mountain, among them, *Achillea alexandri* Regis, *Bornmullera dieckii*, *Dianthus scardicus*, *Crocus scardicus*, *Viola dukadjinica*, *Pinguicola balcanica*, *Alyssum scardicum.* In addition except local endemic plants, there are some tertiary endemic and relics plants in this park: *Ramonda nathaliae*, *Ramonda serbica*, *Pancicia serbica*, *Quercus trojana*, *Taxus baccata*, *Pinus peuce*, *Pinus heldreichii*. This National Park, it characterized not only by the diversity of flora, but also with vegetation. In this massive described 112 associations within whose importance are those with endemorelic character as fir, pine and stenoemdemic plants. Some of the characteristic associations of this park are: *Pinetum mugo serpentinicum*, *Achilleo-Pinetum mugo*, *Fago-Aceretum visianii*, *Ajugo-Pinetum peucis*, *Rhododendro-Pinetum peucis*, *Fago-Pinetum heldreichii*, *Junipero-Pinetum heldreichii*, *Coccineo-Deschampsietum scardici*, *Achilleo alexandri regis-Onobrychis scardica*, etc. Therefore the role and importance of University of Prizren "Ukshin Hoti" in the future for exploration of flora and vegetation of this National Park will contribute to the preservation and promotion of its values.

THE NEW "VEGETATION MAP OF SICILY (ITALY)": A SYNTHETIC OVERVIEW OF THE DISTRIBUTION OF EUROPEAN HABITATS ON THE TERRITORY

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The new "*Vegetation map of Sicily (Italy)*", recently published (Gianguzzi, Papini & Cusimano, 2015), shows also a synthetic overview of the distribution of European habitats in the territory; the study area has been extended to small islands circum-Sicilian (archipelago of the Aeolian; Aegadian, Pelagie Ustica and Pantelleria islands), for a total area of 25,703 km².

Our work allowed to resume the knowledge status of the phytosociological studies on vegetation carried out and to identify the actual plant landscape of the region; the map was compiled in a Geographical Information Systems (GIS) environment, in order to produce a cartographic representation in 1:10,000 scale (reduced to a 1:250,000 scale).

At the reference scale 36 phytocoenotic types are represented, 16 of which related to European habitats of zonal vegetation (Mediterranean maquis, *Quercus ilex* woods, *Quercus suber* woods, *Castanea sativa* woods, *Quercus pubescens* deciduous woods, mesophilous deciduous woods, *Fagus sylvatica* woods, *Betula aetnensis* woods, woods dominated by woody gymnosperms, forest edge shrubs, orophilous pulvinate shrubs, shrublands and garrigues on substrates of carbonate nature and on substrates of siliceous nature, *Ampelodesmos mauritanicus* grasslands, mesophilous and sub-hygrophilous grasslands and pastures), 11 related to azonal vegetation (riparian vegetation, psammophilous herbaceous vegetation, chasmo-halophitic vegetation, etc.) and 9 related to anthropogenic vegetation (arable lands and extensive herbaceous crops, vineyards, olive groves and dry cultivation mosaics, hazelnut groves, irrigated citrus groves and orchards, greenhouses, built-up areas).

Gianguzzi L., Papini F., Cusimano D., 2015 – *Phytosociological survey vegetation map of Sicily (Mediterranean region).* – Journal of Maps:1-7 (http://dx.doi.org/10.1080/17445647.2015.1094969).

A SNAPSHOT OF ITALY THROUGH THE LENS OF THE FIRST EUROPEAN RED LIST OF HABITATS

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Along with several other European countries, Italy is contributing to the development of a European Red List of Habitats, on behalf of the EC - DG Environment (Rodwell et al., 2013, Contract N. 070307/2012/624047/SER/B3). The habitat types taken into account are resulting from a critical review of the types listed in the EUNIS classification, largely based on plant communities, revisited in the light of the most recent acquisitions in vegetation science.

Starting from a huge amount of data, mostly heterogeneous and partial, available for the Italian territory, the work done to date allowed to identify the actual occurrence in Italy of the considered habitats. At present, 157 types have been identified, representing more than 66% of the recognized European diversity. Some of them are narrowly distributed, while others are widely spread, although sometimes showing local peculiarities deserving of special attention.

On this ground, the protocol for the habitat assessment based on criteria and thresholds proposed by Keith et al. (2013, PLoS ONE 8(5): e62111) and derived from the IUCN parameters in use for the red-listing of the species (IUCN 2012, v.3.1, 2nd ed.), was experimentally tested on the Italian data. Some results and critical issues are here discussed. Among the main critical points: poor quantitative data availability, none or very few data on quantitative and qualitative trends, ambiguity in habitat interpretation at national level, large use of the "expert's opinion".

Among the main results: a relevant step towards the harmonization of continental knowledge on vegetation science. Among the main challenging issues: focusing on the weak aspects of the assessment methodology, pointing out that criteria and thresholds should be calibrated on the macrotype of habitat and, not less important, should carefully consider the irreversibility of some ecological processes, particularly for those habitats featured by strong geographical and/or ecological barriers.

KEYWORDS: ASSESSMENT, CONSERVATION, REDLISTING, THRESHOLDS, THREATENED VEGETATION TYPES

THE HABITAT MONITORING UNDER ARTICLE 17 OF THE 92/43/EEC DIRECTIVE IN ITALY: THE CONTRIBUTION OF VEGETATION SCIENCE

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The 4th National Report ex Art. 17 of the 92/43/EEC Directive in Italy (period 2013-2018) will try to fill a number of gaps still affecting the former versions of the Italian Reports, where territorial data were still missing for large parts of the country and the assessment was mostly based on the use of the expert opinion. Similar inconsistencies also emerged in other European countries (State of nature in the EU, EEA 2015). In order to reach this aim, a nationally shared protocol for monitoring the vegetation-based Annex I Habitats is currently under development. The most prominent issues addressed by the ongoing project are: i) fixing standardized, updated and scientifically grounded methodological tools, on the basis of the European guidelines (Evans & Arvela 2011, ETC-BD); ii) providing comparable data at national and European level; iii) harmonizing the territorially fragmented knowledge and iv) supporting nationally standardized measures for the conservation of terrestrial, brackish and freshwater Habitats. Promoted by the Italian Ministry for Environment (MATTM) and coordinated by the environmental agency ISPRA, the development of such a tool is being carried out by the Italian Society for Vegetation Science, with the support of a large team of experts. Open issues, such as the favourable reference values and the optimal thresholds for each considered parameter (range, area, structure and function), have to be dealt with, in a condition of large uncertainty. Due to its centrality in the assessment process, especially the concept of "typical species" should be developed with care, trying to combine the need for synthetic indicators with the great floristic diversity of the Italian Habitats. A clear definition of the parameters is crucial for a correct application of the monitoring protocol, to successfully contribute to the whole process of halting biodiversity loss in Europe.

KEYWORDS: BIODIVERSITY, CONSERVATION STATUS, HABITAT DIRECTIVE, VEGETATION

VEGETATION AND CONSERVATION STATUS ASSESSMENT IN *PLATANUS ORIENTALIS* WOODLANDS OF CRETE

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Questions: The plane (*Platanus orientalis*) forms riparian woodlands in the Eastern Mediterranean. Greece has a special responsibility for the conservation of this Natura 2000 habitat type (92C0) as it hosts by far the majority of stands in the European Union. The following questions are addressed: Which associations of *Platanus* woods can be distinguished in Crete and how do they differ in ecology and distribution? How is the conservation status of the Cretan *Platanus* stands and which are the major threats?

Study area: The South Aegean island of Kriti (Crete).

Methods: A set of 81 relevés was numerically classified. The conservation status of 74 *Platanus* woods was assessed by criteria-based surveying.

Results: We found three distinct plant associations. The *Euphorbio characiae-Platanetum orientalis* occurs in rocky stream beds and alluvial fans without or with periodical surface water flow. The *Hyperico hircini-Platanetum orientalis* is usually found along rivers on schistose substrata with permanent water supply in the west of the island. The *Equiseto telmateiae-Platanetum orientalis* has the widest distribution range and occurs in valleys with seasonally or permanently high water table on calcareous substrata. Conservation status assessment revealed that one third of the stands was in *good* condition, while for two thirds conditions were *unfavourable*. The most prominent threats are water abstractions (54% of plots), water and soil pollution including waste and garbage disposal (31%). Seventy percent of the surveyed stream reaches suffer from fragmentation and disturbance through plantations and roads. The widespread invasive plant species *Arundo donax* and *Oxalis pes-caprae* affect 42% of the stands. Effects of non-intensive grazing, local erosion and leisure activities constitute additional impacts.

Conclusion: Our results throw light on the ecological variation of *Platanus* riparian forests and may help decision makers to concentrate on specific conservation issues related to the most relevant threats.

KEYWORDS: *PLATANUS ORIENTALIS* WOODLANDS, CRETE, CONSERVATION ASSESSMENT

ECOLOGICAL CHANGES CAUSED BY *EICHHORNIA CRASSIPES* IN EGYPT

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Eichhornia crassipes was recorded in Egypt in the 19th century, but it did not reach the plague proportions exhibited in the Nile Delta until recent times. The construction of a series of river control schemes caused several ecological changes in the Niel system, which encouraged the growth and spread of *Eichhornia* in almost all the aquatic habitats in the Nile system.

Eichhornia crassipes (Mart) Solms is an invasive weed known to out-compete native plants and negatively affect microbes including phytoplankton. The spread and population density of *E.* crassipes will be favored by global warming. The present study shows clearly the fast growth of *Eichhornia* in the Egyptian Nile system.

KEYWORDS: *EICHHORNIA*, EGYPT, AQUATIC

HERBARIUM NG, COULD THIS BE THE FUTURE OF HERBARIUMS?

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The term herbarium is simply a collection of dried specimens. Lawrence (1951) and others include in their definitions the arrangement of specimens in the sequence of an accepted classification and are available for reference or other scientific study. "Herbarium" used in its original sense, however, referred not to a collection of plants, but to a book about medicinal plants. Tournefort in about 1700 used the term as an equivalent to *hortus siccus* (Stearn, 1957), and this use was taken up by Linnaeus who also adopted it as a substitute for *hortus siccus*, *hortus mortus*, and others. It was largely through his influence that it superseded the former terms.

In its more than four-hundred-year history the herbarium has become an institution. Today one associates the term herbarium not only with preserved plant specimens but also with certain botanical activities. The herbarium is the basic reference source of the taxonomist and has become a center for research as well as teaching and public information. Herbaria range from small personal collections (mostly of a few hundred specimens with a few notable exceptions) to large collections of colleges, universities, private foundations and governmental agencies involving millions of specimens.

In this study, the author tries to answer these questions: How large Herbariums should become? What kind of materials are to be included? How can information and materials be efficiently retrieved? How to improve the Herbariums and is it possible to stop collecting plants? Could "Herbarium NG" system be a suitable substitute for the Herbariums as we know today?

EFFECTS OF MANAGEMENT ON CHANGES IN SEMI-NATURAL DRY GRASSLANDS OF NATURA 2000 NETWORK IN HUNGARY

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Aim: We used monitoring data of semi-natural dry grasslands (6210* Xerothermic grasslands Festuco-Brometea and 6250* Pannonic loess steppe grasslands) of Natura 2000 network in Hungary to detect the effect of nature conservation management and abandonment. We tried to find out which conservational practice can promote best the vegetation development towards the target composition, and to maintain the species rich grasslands.

Location: Six study sites of the Natura 2000 network were selected in different parts of the country: Mátra Mt. (Fallóskút, Parádóhuta), Gyöngyösi Sár Mt., Cserhát Mt., Küdői Hill, Baranya Hills. All grasslands were on loess substratum, between 250-650 m asl.

Methods: We analysed 286 vegetation plots (2x2 m) which are recorded between 2006 and 2015. The number of species, Shannon-diversity and evenness were calculated. The effects of management were tested using one-way ANOVA and Tukey HSD for post hoc tests.

Results and Conclusion: Our study detected significant changes in the plant diversity of grasslands in the period of observation (F=17.27 p=2.2e-16). We got the lowest diversity values in the Küdői Hill, which can be explained by lack of management after the removing of shrubs. The mowed grasslands showed the highest diversity, positive effect of regular mowing is shown in the Cserhát. On the Sár Mt. and Baranya Hills lack of management (cessation of burning and grazing for the last 15 years) caused fast shrub encroachment. Maintaining of man-made semi-natural grasslands and improving their natural condition require constant nature conversation management and according to our results grazing by sheep or mowing is recommended.

Keywords: nature conservation, management, monitoring, diversity, loess steppe

THE IMPORTANCE OF THE NATURA 2000 NETWORK FOR EUROPEAN BIODIVERSITY

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Background. In May 2015 the European Commission published the report *The State of Nature in the European Union* on the condition of the habitat types and species covered by the Birds and Habitats Directives. It reported on the trends of habitat types and species that are listed in the Annexes of the directives, for the period 2007-2012. However, the report gives no insight into the contribution of Natura 2000 to the conservation of species that are not included in these lists. Additional studies are requested to assess the overall effectiveness of the Nature Directives in the light of the EU strategic target, expressed within the Biodiversity Strategy to 2020, to "halt the deterioration of all species and habitats and achieve a significant and measurable improvement in their status…."

Aim of the project. The European Commission initiated in 2013 a research project on the importance of the Natura 2000 network for conserving European biodiversity. What is the presumed 'umbrella effect' of Natura 2000, related to its potential contribution in terms of halting and reversing the loss of species other than those for which the Natura 2000 sites have been set-up? For the analysis of the plant species, the EVA repository turned out to be very useful to answer the glaring question on the relevance of the Natura 2000 network for maintaining European biodiversity.

Methodology and results. We first assigned the georeferenced vegetation plots located in EU28 countries to 2x2 km grid cells, and indicated whether these plots intersect with Natura 2000 sites. Then we randomly selected 500 (at country level) or 2,500 (at European level) grid cells overlapping with Natura 2000 sites, and the same number of grid cells not overlapping with Natura 2000 sites. A grid cell with 5 or more Red List species was considered to be a hotspot. The total number of hotspots was calculated inside and outside Natura 2000 sites. The procedure was repeated 500 times to get statistically sound figures. The various analyses clearly show that the number of hotspots is significantly higher inside than outside Natura 2000 sites. Additionally, we analysed buffer zones around the Natura 2000 sites. The number of hotspots within these zones appeared to be intermediate between the numbers inside and outside, demonstrating their importance, as a gradient between core areas and their surroundings.

KEYWORDS: NATURA 2000, HOTSPOTS, STATE OF NATURE, EVA, RED LIST SPECIES

EUROSL – A EUROPEAN TAXONOMIC BACKBONE FOR VEGETATION DATABASES AND OTHER TAXON–RELATED DATABASES: VERSION 1.0

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Background: A taxonomic reference list is an indispensable tool to sample, manage and match biodiversity data from different sources. Merging vegetation databases or combining them with taxon-related attributes needs reliable and consistent information about the taxon concepts used and an appropriate naming.

Aim: Creating a "taxonomic backbone" of European vascular plants and bryophytes with links to widespread taxonomic references.

Methods: We used the Euro+Med plant list (Euro+Med 2006 et seq.), version 2015/04. For all families not yet covered there we used taxa from Flora Europaea (Tutin et al. 1968 et seq.). Additionally we included the aggregates from the Ehrendorfer (1973) list. For bryophytes we rely on Grolle & Long (2000) and Hill et al. (2006).

Results: EuroSL 1.0 covers > 45k accepted taxa and >77k synonyms from approx. 370 families. At the species level this means approx. 32k accepted names and >44k synonyms. EuroSL list will be published open access to allow referencing and connecting taxon-related databases beyond country borders. Future releases of EuroSL might contain additional taxonomic groups (algae and lichens), aggregates or new names as needed. However, a thorough documentation and transparency regarding taxon concepts, i.e. name usage = taxon circumscription, given by citing the source lists, will remain the highest priority. The first application of EuroSL will be the compilation of Ecological Indicator Values for Europe (EIVE version 1.0).

CHANGES OF SPECIES DIVERSITY ON PERMANENT PLOTS DOMINATED BY ALIENS AFTER 15 YEAR OBSERVATIONS

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Aim: To find out the dynamics of riparian plant communities dominated by invasive alien plants after 15 year observations on permanent plots.

Locality: Alluvium of the Morava river, Western Slovakia.

Methods: The method of repeated recording of species composition at permanent plots was used. Five permanent plots were established in 1999 at the bank and close alluvium of the Morava river. Plots were selected with regard to representation of the most frequent invasive neophytes in the region: _Aster lanceolatus, Helianthus tuberosus_, and _Impatiens glandulifera_. Every year in late summer relevé in each plot was made using standard methods of Zürich-Montpeliér school with 9-degree new Br.-Bl. scale. To determine the significant trends in neophyte and native species occurrence and cover on the plots, the analysis of time series was made by R-software. Significance of trends was tested using Mann-Kendall test for monotonic trend, Theil-Sen estimate of the slope was used to describe the trend line.

Results and conclusion: At the starting point on all permanent plots aliens dominated. On two plots during observations perennial grasses have prevailed and number and cover of neophytes have decreased. One plot remains permanently dominated by _Aster lanceolatus_. However, increasing number of native species at this plot indicates possible return of original vegetation similarly like on next two plots where cover of neophytes slightly increased, but the number of neophytes is stable or decreasing.

Keywords: riparian vegetation, neophytes, permanent plots, succession

CONTRIBUTION TO THE PHYTOSOCIOLOGICAL STUDIES OF THE ADRIATIC ISLANDS: PHYTOCOENOTIC DIVERSITY OF THE CROATIAN ISLAND OF OLIB

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Questions: The aims of the study were: i) to investigate the vegetation of the island of Olib for the first time, ii) to provide a contribution towards a better understanding of the phytocoenoses that have colonised the E Adriatic islands, and iii) to evaluate their levels of biodiversity in relation to phytogeographical position and geomorphological characteristics.

Location: The 18th largest Croatian island of Olib (26.13 km^2) belongs to the group of the N Adriatic islands in the Zadar Archipelago.

Methods: Fieldwork was carried out in 2015. For data collection the Braun-Blanquet approach (Braun-Blanquet 1964) was used. A total of 99 phytosociological relevés were classified by numerical methods.

Results: Altogether, 33 floristically and ecologically distinctive vegetation communities were identified and described (31 associations and 2 stands) within 28 alliances, 27 orders and 23 vegetation classes. Among them, *Salsolo sodae-Cakiletum maritimae* Jasprica et al. 2016 is described and proposed as a new association, belonging to the *Cakiletea maritimae* class.

Conclusion: The study has revealed a great phytocoenotic diversity, currently the low anthropogenic influence and the high biogeographical value of the study area. Spatial distribution of halophilous plant communities highlights the importance of variation in salinity gradient due to the microtopography. The *Quercus ilex* woodlands are considered as the potential vegetation type (*Myrto communis-Quercetum ilicis*). A strong depopulation during the past half-century accompanied by the abandonment of agriculture, have caused the grasslands to become overgrown with woody vegetation.

MULTILEVEL FORMALIZED CLASSIFICATION OF MESIC GRASSLANDS (*ARRHENATHERETALIA*) IN POLAND

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Questions: This is the first attempt to classify mesic grasslands found in Poland using la arge data set. The objectives of the present study were (1) to perform syntaxonomical revision of mesic grasslands using a multi-leveled formalized classification, (2) to determine diagnostic, constant and dominant species of delimited syntaxa, (3) to determine a distribution of distinguished units, (4) and to reveal variation of the vegetation along the main environmental factors.

Location: Poland (Central Europe)

Methods: The classification of Arrhenatheretalia order was carried out using data stored in the Polish Vegetation Database. Starting data set consisted of 53,400 relevés, from which 5670 relevés were assigned to *Arrhenatheretalia* order by authors of the original data. The subset of relevés was geographically stratified. The Cocktail method was used to create formal definitions of vegetation units at different hierarchical levels: alliance, order and class. Diagnostic species of delimited units were determined by phi coefficient. We compared the vegetation types according to environmental and biogeographical factors using detrended correspondence analysis (DCA).

Results: The comprehensive classification of mesic meadows is presented with detailed description of four alliances *Arrhenatherion*, *Polygono-Trisetion*, *Cynosurion* and *Poion alpinae* containing at least 17 associations. The multi-level formalized classification was created and formal definitions for all hierarchical units are proposed.

Conclusions: The classification and ordination analyses showed a clear differentiation in diversity of mesic grasslands according to different biogeographic regions and environmental factors.

Keywords: *Arrhenatheretalia*, hay-meadows, Cocktail method, diagnostic species, syntaxonomy, mountain meadows, pastures

E-SILVA PROJECT – DIVERSITY AND DISTRIBUTION OF NATURA 2000 FOREST HABITATS IN POLAND

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Questions: Natura 2000 habitats are relatively new form in the typology of vegetation. In Poland, as well as in many other European countries, identification of Natura 2000 habitats is based on the expert knowledge. There are no clear and formal criteria for identifying Natura 2000 habitats based on large scale analysis. In this study we aimed at 1) carrying out a syntaxonomical revision of forest plant communities based on phytosociological data form Polish Vegetation Database, 2) creating an expert system for identification Natura 2000 habitats and subordinated associations, 3) determining diagnostic, constant and dominant species, 4) determining a variability and distribution patterns of forest communities and Natura 2000 habitats, 5) preparing a guidelines for future Natura 2000 management.

Location: Poland

Methods: We used data set from Polish Vegetation Database containing about 70,000 relevés. We selected 22,000 relevés representing a variety of forest habitats and then performed geographical stratification of the data set. We carried out a classification of forest plant communities based on the Cocktail method and formal definition of vegetation units. Formal definitions were created for forest plant associations and also for 17 Natura 2000 habitats, which often comprise two or more forest associations.

Conclusion: The proposed formalized system of identification of Natura 2000 habitats will serve as a practical tool for management and conservation of valuable forest plant communities found in Poland. In the framework of e-Silva project an electronic information portal is being developed where all information about diversity and distribution are going to be placed.

Keywords: classification, e-Silva project, diagnostic species, Polish Vegetation Database

TRADITIONAL "MEADOW ORCHARDS", A NEGLECTED HABITAT TYPE WITH HIGH CONSERVATION VALUE: CASE FROM NE SLOVENIA

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Background: It is already known that semi-natural dry grasslands on calcareous substrates from the alliance *Bromion erecti* (HT 6210) are strongly declined vegetation types in Slovenia. However, their occurrence within the traditional orchards with high-stemmed fruit trees, is still purely known. Such »meadow orchards« are excluded from agro-environmental measures for this habitat type, which is essential for appropriate management. Thus, they are prone to abandonment or exposed to conversion of traditional orchards to modern fruit plantation.

Aims: To document the distribution and surfaces of dry »meadow orchards« in typical hilly region of Slovenia; To identify the conservation status of such habitats in a study area; To prepare a conservation plan for improvement of the conservation status of the "meadow orchards" in the study area.

Location: hilly region of Vinorodne Haloze (NE Slovenia) on sandstone bedrock.

Methods: habitat mapping and ArcGIS statistical tools.

Results: In the study area the habitat 6210 is present on small patches, which altogether cover the surface less than 10 km2. One quartier of them are in less favourable status, mainly due to scrub invasion after abandonment. However, there are additional 3 km2 of dry grasslands under the canopies of fruit trees. Only negligible part of the surfaces of 6210 (less than 10%) are included in the agro-environmental scheme; none from the "meadow-orchards". Furthermore, 20% of the plots with *Himantoglossum adriaticum*, a species from Annex II of the Habitat Directive, from Vinorodne Haloze was found in the "meadow-orchards".

Conclusion: The conservation plan, which is in development within the LIFE project, is anticipating a raised economic interest for further sustainable use of dry grasslands on more than 8 km2, where at least 200 farmers will participate, also with revitalisation of fruit trees. Scrub clearing and rescue trimming plus re-planting of fruit trees successfully started.

KEYWORDS: MEADOW ORCHARDS, NE SLOVENIA, *BROMION ERECTI*

WHICH TRAITS INFLUENCE THE FREQUENCY OF PLANT SPECIES OCCURRENCE IN URBAN HABITAT TYPES?

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Questions: Several recent studies have aimed to identify functional traits that determine the regional abundance of plant species and to predict species´ ability to colonize new habitats. Here we aim to assess the relationships between frequency of plant species occurrence in urban habitats and species traits.

Location: Central Europe, Belgium and the Netherlands.

Methods: We used a species composition dataset from seven urban habitats each sampled in 32 large cities of 10 countries and added information about functional traits. To assess which plant traits generally promote species occurrence in the urban environment, frequency of species occurrence was related as dependent variable to the traits of the species as explanatory variables using regression trees.

Results: The most frequent species in cities regardless habitat types were those with short-term persistent seed bank consisting of seeds with low seed mass, majority of them being reported as weeds. Those of them demanding for nutrients growing in mesic or slightly wet conditions were noticeably more frequent than species of dry, acid and nutrient-poor soils or species of very wet soils, also characterized by high LDMC values.

Conclusion: The ability to colonize urban habitats by plant species can, to some extent, be explained by their traits. The most important traits are those that enable urban plants to colonize, grow and reproduce in highly productive habitats, and those that are adaptations to frequent disturbances.

Keywords: Central Europe, city, community assembly, species traits, urban ecology

LOWLAND HAY MEADOWS (6510) IN POLAND – PROBLEMS WITH IDENTIFICATION AND EVALUATION

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Annex I of the EU Habitats Directive defines habitat 6510 "Lowland Hay Meadows" according to lowland floodplain meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*). In Poland the first definition of the habitat 6510 has been taken in 2004, to coincide with the mesic hay meadows: *Arrhenatheretum elatioris* and *Poa pratensis-Festuca rubra* (*Arrhenatherion* alliance) communities. That corresponds to meadows growing on non flooded areas, on oak-hornbeam forest (*Carpinion*) and the dry form of riparian forests (*Ficario-Ulmetum*) habitats. At the same time, for the purposes of N2000 habitats inventory in the State Forests was prepared a guide to the identification of habitats, which recommended that all species-rich hay meadows (dry, humid to wet), that were not consistent with other meadow habitats (6230, 6410, 6440) should be identify as habitats 6510. In 2012 the official definition of the habitat was modified, indicating that all subassociations of *Arrhenatheretum elatioris* belong to habitat 6510 - from the wet *Arrhenatheretum elatioris caricetosum gracilis* (occupying riparian forest habitat) to dry *Arrhenatheretum elatioris salvietosum pratensis*. At the same time the set of species considered as characteristic for the habitat, and used in the assessment of its conservation status, did not change. It is still typical for moderately wet meadows. As a result, during the inventory of N2000 habitats, habitat 6510 is identified based on the occurrence of plant communities belonging to both *Arrhenatherion* and *Alopecurion* alliances, but also wet meadows belonging to *Calthion* and even typical rushes with the dominance of *Phalaris arundinacea* and *Carex gracilis*. The actual area of habitat is not known. The mismatch of the standard set of species to such a wide recognition of the habitat, resulting in poor evaluation of its status (structure & function parameter) and future persistence perspectives. There are also difficulties with the proper management of habitat.

KEYWORDS: NATURA 2000, HABITATS DIRECTIVE, DEFINITION AMBIGUITY

TEMPORAL CHANGES IN TAXONOMIC DIVERSITY DO NOT REFLECT CHANGES IN EVERY ASPECT OF FUNCTIONAL DIVERSITY

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Questions: Can short-term temporal changes in taxonomic diversity predict corresponding changes in functional diversity? Does the scale of analysis affect the strength of this relationship?

Location: Palea and Nea Kameni volcanic islands, part of the Santorini Archipelago, Greece.

Methods: Multi-scale vegetation sampling was conducted on April 2010, 2011 and 2012, using a set of 16 macroplots, comprised of 17 subplots of different size, in four communities that have been identified on both islands. Six multidimensional indices of functional diversity were calculated, using 26 functional traits, along with four taxonomic diversity indices for the three consecutive years. To estimate temporal turnover relationships among the different aspects of diversity, we calculated for each plot the differences in the value of each index and investigated the relationship between taxonomic and functional indices on the basis of the temporal values changes, for each pair of years separately. We repeated the analyses for the different scales and different plant communities.

Results: We found that short-term temporal changes in taxonomic diversity display diverse relationship patterns with functional diversity, depending on the aspect of functional diversity. Changes in the range of functional traits within the community depends strongly on changes in species richness, while changes in the functional divergence display weak negative correlation with changes in taxonomic diversity. The evenness in the distribution of abundance in the functional space displays weak to non-significant correlations with changes in taxonomic diversity. The strength of the correlation depends on the community and the scale examined: the correlation is stronger in the communities with less species, while diminishes as scale increases.

Conclusion: Despite the clear correlation in temporal changes between taxonomic diversity and functional diversity, the relationship depends on the aspect of the functional diversity assessed, the type of the community investigated and the examined spatial scale.

Keywords: functional traits, multi-scale sampling, taxonomic diversity, temporal turnover, scale

DESERTIFICATION IN EGYPT

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Egypt has a total area of about one million km^2, under arid and hyperarid climatic conditions, of which only a small portion (3% of total area) is agriculturally productive. The country is endowed with four main agro-ecological zones having specific attributes of resource base, climatic features, terrain and geomorphic characteristics, land use patterns and socio-economic implications. Therefore, it is found appropriate to formulate a programmes comprised of subcomponents geared to address the specific attributes in each of the agroecological zones distinguished as follow:

The Nile Valley: encompassing the fertile alluvial land of Middle and Upper Egypt, the Nile Delta region and the reclaimed desert areas in the fringes of the Nile Valley.

North Coastal zone: including the coastal area stretching east ward from North-Western coast to North coastal area of Sinai.

The Inland Sinai and the Eastern Desert with their elevated southern areas.

The Western Desert: encompassing oases and southern remote areas, including East Uweinat, Tushka and Darb El-Arbian areas.

Since significant variations in the environmental characteristics are apparent in each agroecological zone, the active factors and processes of desertification and their impacts are necessarily variable. Accordingly, it is not appropriate to formulate a unified programme to combat desertification in such zone. To address and focus on the varied natural attributes, priorities of actions and specific processes of desertification, sub-components of the action programme are figured out to facilitate investigation and identification of appropriate techniques, suitable indicators, monitoring, capacity building, awareness needs, participating stakeholders, required legislations, economic tools, incentives, finance, institutional setup, responsible parties, ongoing and future projects for combating desertification as well as social implication, geared and tailored for the needs of each agro-ecological zone to ensure the achievement of the Convention objectives.

KEYWORDS: EGYPT, DESERTIFICATION, VEGETATION

EXPERIMENT ON REINDEER GRAZING IMPACT ON FEN VEGETATION IN ALPINE-ARCTIC LAPLAND

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We studied the effects of reindeer grazing on fen vegetation in a treeless alpine-arctic study area across the border of Finland and Norway (68°49', 23° 49'). Studied vegetation mainly belongs to the alliance *Drepanocladion exannulati*. One characteristic feature is the abundance of *Salix lapponum*, a willow species subject to summer grazing by reindeer. Other characteristic species include *Eriophorum angustifolium*, *Carex rotundata* and among mosses *Sphagnum teres* and *Warnstorfia sarmentosa*. We explored the effects of long-term difference in grazing between Finland (summer and winter grazing) and Norway (winter grazing only) and of 13-year exclosure of reindeer grazing in the Finnish side.

We found differences in abundance, plant size and fruiting of *S. lapponum* between the grazing treatments. As a result of the lack of summer grazing, willows in the Norwegian side and in the exclosures were significantly more abundant, they grew taller and female plants had heavier and more frequent fruit bodies, than in the freely summer grazed sample plots.

Ordinations of pin-point vegetation plot data showed clear distinction between the Norwegian and Finnish sites. This mainly reflected differences in vascular plant community structure, while bryophyte communities had more overlap. However, the total cover of bryophytes was significantly higher in the Norwegian side. Ordinations did not clearly separate the freely summer grazed sample plots and the 13-year exclosures. However, the cover of *E. angustifolium*, grasses, willows and other shrubs were significantly higher in the exclosures.

Summer grazing by reindeer does have an impact on *S. lapponum* stands and vascular plant communities of northern fens. Bryophyte communities appeared more resilient to effects of reindeer grazing and trampling. Changes in reindeer herding can have significant effects and interactions with climate change on vegetation dynamics in the Arctic.

DIANTHUS PLUMARIUS SUBSP. *BLANDUS* - AN ENDANGERED SPECIES IN THE NORTHERN LIMESTONE ALPS?

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Aims: Endangerment analysis, survey of population and distribution areas, phytosociological inclusion of *Dianthus plum.* subsp. *blandus*, introduction of monitoring.
Location: Northern Limestone Alps, Austria, Styria, National Park Gesäuse.
Methods: Investigation by hikes, near reconnaissance and remote sensing. GPS-data and analog documentation of populations were combined to create maps showing distribution and extent of *Dianthus plumarius* subsp. *blandus.* 45 relevés (Braun-Blanquet).
Monitoring: eight permanently marked rectangles, clusters and growth stage were mapped and coordinates recorded, thus providing precise information for further monitoring activities. Germination experiments – in-situ, ex-situ.
Results: Habitats: open gravel slopes, shoulders, *Ericion carneae*, *Petasiteum paradoxi.* Habitus: cushion plants and stolons. Germination: in-situ average germination rate <5%, ex-situ >50%
Conclusions: Distribution areas of *Dianthus plumarius* in the National Park Gesäuse are now well-documented and revised. Further monitoring will provide detailed insight.

KEYWORDS: ROW ENDEMIC, DISTRIBUTION MAPPING, PHYTOSOCIOLOGY, MONITORING, *ERICION CARNEAE*, *PETASITEUM PARADOXI*

COMMUNITY OF THE *PEGANO-SALSOLETEA VERMICULATAE* BR. BL. ET DE BOLOS 1958 FROM NORTH-EASTERN PART OF BLACK SEE COASTAL

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Aims: to study diversity, ecology and floristic peculiarities of the *Pegano-Salsoletea* communities in north-eastern range limit.

Location: Small area of the *Pegano-Salsoletea* representing typical Mediterranean halo-nitrophilous scrublands occurring dominantly in coastal area of the Mediterranean, Saharan-Atlantic and Macaronesic Regions (Brullo et al., 2012) was described in south-eastern part of Crimea peninsula (north-eastern part of the Black Sea region). These thermophilous communities (isolated of the main class range) are related to a special landscape of intensively eroded higher sea terraces formed by Quaternary loams and Jurassic clays (so named "badlands").

Data and methods: The survey is based on 120 phytosociological releve´s. The classification of plant communities was carried out by the Braun-Blanquet method (Westhoff & Maarel, 1987). DCA ordination was applied to check the position of the classified vegetation types along main floristic gradients.

Results: All described communities are characterized by low indexes of species richness (2-13 species per plot). Syntaxonomical scheme:
Cl. *PEGANO HARMALAE-SALSOLETEA VERMICULATAE* Br.Bl. et O. Bolos 1958
    Ord. *Salsolo vermiculatae - Peganetalia harmalae* Br.Bl. et O. Bolos 1954
        All. *Atraphaco-Capparidion* Korzhenevskiy 1988
            Ass. *Atraphaco-Capparidetum* Korzhenevskiy et Klyukin 1988
                Subass. Typicum
                Subass. *Glaucietum corniculatae*
                    Var. *Seseli gummiferum*
                Subass. *Artemisietum santonicae*
Application of DCA ordination revealed sets of plant communities corresponding to ecological factors of salinity, humidity, local thermal regime and substratum type. Low-rank syntaxa distribution in certain landforms of "badland" landscape is determined by a specific direction of high sea terraces denudation.

Conclusion: Isolated plant communities of the *Pegano-Salsoletea* represent Mediterranean vegetation type occurring at the north-eastern range limit. Regional floristic peculiarities were demonstrated in the alliance *Atraphaco-Capparidion*.

KEYWORDS: syntaxonomy, *Pegano-Salsoletea*, plant ecology, Crimea

ESTIMATE OF ADAPTIVE CAPACITY OF PEDUNCULATE OAK (*QUERCUS ROBUR* L.) BY ANALYSING ECOLOGICAL NICHE OF THE SPECIES

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This study is a part of a project titled "Phenotypic and Genetic Diversity of Pedunculate Oak (*Quercus robur* L.) in Europe – FGErobur", funded by the Republic of Croatia and the European Union through the earmarked grants of the European Social Fund (ESF). It primarily focuses on answering the question could the survival of the pedunculate oak in Europe be threatened and in which extend by the upcoming climate change? It is predicted that due to the spatial variability of climate change, forest tree populations in southern and south-eastern Europe may face a significantly higher risk of extinction than populations in central and northern Europe. Generally, it is known that tree species have certain ability for adaptation to environmental changes. This ability depends largely on specie's genetic diversity as well as on its ecological niche span which have been shaping genetic diversity of a species, at least partially.

Therefore the ecological niche of pedunculate oak will be analysed to determine the change of niche breadth and its optimum, as well as the realized niche position within the available ecological span along the geographical gradient of this species. The ecological niche model will be created using the method of maximum entropy, which is implemented in the program Maxent (Phillips et al. 2006). A visualization model will be created in ArcGIS Desktop 10.2 software. The aim of the project is also to relate some phenotypic and genetic diversity traits (CO_2 assimilation and transpiration rates, phenology of leaves and shoots development, diameter and height increment, DNA-SSR and SNP marker analysis etc.) of sampled pedunculate oak progeny populations with environmental conditions in its habitats of origin.

The knowledge of phenotypic and genetic diversity of forest tree species and their dependence on local environmental conditions to which populations are currently adapted, is extremely important in the context of the expected climate change impact on their future survival.

KEYWORDS: FGErobur, *Quercus robur*, ecological niche, niche breadth, climate change, adaptation, environmental change, phenotypic, genetic diversity

DATABASE OF EUROPEAN SYNANTHROPIC VEGETATION

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Aims: Synanthropic vegetation (vegetation of man-made and heavily disturbed habitats) is very diverse, and besides important ecological aspects, it also reflects historical, cultural, economic drivers shaping the current face of European vegetation. Due to its omnipresence across Europe and intensive research in the past, many data sets on synanthropic vegetation have been acquired and stored in plot-based databases. The syntaxonomic system of the synanthropic vegetation has been developing in a multi-focus manner and has been constructed as a result of activities of many focus research teams in many European countries. EuroVegChecklist reflects this development by presenting a first, pan-European vegetation system. This study focuses on a brief overview of the data available, identification of gaps, and setting agenda of the data analyses aimed at revision of the syntaxonomic system of synanthropic vegetation in near future.

Location and methods: Until today we collected about 60.000 relevés (work in progress) from Europe, focusing on surveys using Braun-Blanquet classification approach and describing anthropogenous vegetation types (arable fields and ruderal). About 42.000 relevés were provided by the custodians of the EVA database, the rest comes from individual researchers, local (country) database custodians or has been captured from publication sources not featured in either vegetation database so far.

Results/Conclusions: Distribution of data across Europe differs greatly, with highest abundance in countries with long and rich tradition in vegetation research, including Central and Western Europe and some parts of the Mediterranean (Italy and Iberian Peninsula). Highly underrepresented are Northern and Eastern European countries – Fennoscandia and ex-USSR countries, probably because of use of different sampling methods and unaccessibility of published relevés.

Keywords: Europe, ruderal vegetation, segetal vegetation, synanthropic vegetation, vegetation database

NUMERICAL CLASSIFICATION OF GRASSLAND VEGETATION COMMUNITIES IN EUROPEAN ATLANTIC BIOGEOGRAPHIC REGION: METHODS AND FIRST RESULTS OF A LARGE SCALE STUDY OF PHYTOSOCIOLOGICAL ALLIANCES WITH BIG DATA

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Questions: What are the main phytosociological alliances in Western Europe along the Atlantic Arch for wet grassland vegetation communities? Are typologies consistent and continuous from one country to another at a wide geographical scale?

Location: The study area stretches from Northern Portugal until Northern Germany and is delimited by the Atlantic biogeographical region (European Environment Agency).

Methods and Results: (1) A request to EVA (European Vegetation Archive) has been made, and 55 052 vegetation plots had been selected, in studied area. (2) We applied twice a heterogeneity-constrained resampling on relevés (geographical grids and maximization of beta-diversity in each grid). We obtained two datasets of 19 887 relevés each, with some relevés in common in both datasets and some relevés specific to each dataset. (3) Unsupervised classification (fuzzy clustering) had been applied independently on both dataset. We compared both results, thanks to the relevés which are common in both datasets and to characteristic species, in order to detect which are the identical clusters, and which are the clusters existing only in one of the two resulting classifications. The aim of this is to remove artefact effect of dataset selection (clusters with no match in the other dataset results) and detect and select results representing a vegetation reality. (4) Semi-supervised classification is used on global dataset (combination of both datasets without duplications). Fixed clusters are those selected previously out of the comparison of results from the two classifications. Several mobile clusters are allowed to be generated by algorithm. Eventually, 25 007 relevés are assigned to 33 different vegetation types (clusters). (5) Vegetation types are compared by means of characteristic species, synoptic tables and Principal Component Analysis (PCA).

KEYWORDS: PHYTOSOCIOLOGICAL ALLIANCES, NUMERICAL CLASSIFICATION, GRASSLANDS, ATLANTIC BIOREGION, BIG DATA, FUZZY CLUSTERING.

STEPPE VEGETATION IN THE VOLGA REGION

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Questions: research of the steppe communities' diversity in the Volga region and preparation of its classification system.

Location: The research of the steppe vegetation in the Middle and Lower Volga areas are located within the Ulyanovsk, Samara, Saratov, Volgograd and Astrakhan regions.

Data and methods: The survey is based on 283 phytosociological relevés. The classification of plant communities was carried out by the Braun-Blanquet method (1964). Vegetation data were classified using TWINSPAN (Hill, 1979).

Results: The researches have established the 9 associations.

Syntaxonomical scheme:

Cl. *Festuco-Brometea* Br.-Bl. et Tx. ex Klika & Hadač 1944

    Ord. *Festucetalia valesiacae* Soó 1947

        All. *Festucion valesiacae* Klika 1931

            Ass. *Salvio nutantis-Stipetum pennatae* ass. prov.

            Ass. *Artemisio marschallianae-Stipetum pennatae* ass. prov.

            Ass. *Centaureo sumensis-Stipetum pennatae* ass. prov.

            Ass. *Salvio tesquicolae-Stipetum pennatae* ass. prov.

            Ass. *Thymo marschalliani-Stipetum pennatae* ass. prov.

    Ord. *Helictotricho-Stipetalia* Toman 1969

        All. *Helictotricho desertori-Stipion rubentis* Toman 1969

            Ass. *Achilleo setaceae-Kolerietum sclerophyllae* ass. prov.

    Ord. *Tanaceto-Stipetalia lessingianae* Lysenko et Mucina in Mucina et al. ined.

        All. *Tanaceto-Stipion lessingianae* Lysenko et Mucina in Mucina et al. ined.

            Ass. *Limonio sareptani-Stipetum lessingianae* ass. prov.

            Ass. *Salvio stepposae-Stipetum lessingianae* ass. prov.

            Ass. *Tanaceto achilleifolii-Stipetum lessingianae* ass. prov.

Conclusion: Study's vegetation is presented the natural and transformed steppe communities. Further researches will adjust the syntaxonomical system. Research was partially supported by RFBR grant 16-04-00747.

KEYWORDS: STEPPE VEGETATION, SYNTAXONOMY, *FESTUCO-BROMETEA*, VOLGA REGION

EXPANSION OF FOREST VEGETATION AT UPPER TIMBERLINE IN THE NORTH PARTS OF KOZUF MOUNTAIN MASSIF IN THE REPUBLIC OF MACEDONIA

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This paper attempts to define what changes occur with forest vegetation on the northern slopes of the Kozuf mountain range at upper timberline. For this purpose we defined three sub-goals: defining the current upper timberline of the forest vegetation, distribution of forest communities on Kozuf mountain range at the upper timberline, as well as modeling of possible upper timberline of the forest according to temperature indicators.

Comparative analysis method was used. The period of analysis covers 80 years. Different cartographic and written materials served as a basic material for analysis. Required sections of topographical maps were geo-referenced and digitalized as separate layers in AUTOCAD software. With layers switching, and with so-called "over-lay analysis" we got the differences in the distribution area in terms of upper timberline shifting. Forest vegetation was surveyed with recording and mapping of vegetation types. Part of it is processed by the method of Braun-Blanquet. The vegetation types development was observed, and the dynamics of populations and species movement was observed through these changes.

The obtained results show that with increment of upper timberline of the forest vegetation, the most represented is forest community of Scots pine *Fago-Pinetum sylvestris* on silicate geological substrate, and relatively smaller areas are accounted to the forest communities of mixed forest of fir and beech *Abieti borisii-regis - Fagetum*, and pure fir forest *Fago-Abietetum*, while the small area accounts for *Seslerio-Pinetum nigrae* and *Fago-Abietetum* forest communities on limestone geological substrate. Regarding the timberline of the forest in 30 years of the last century and the present state, the greatest expansion is on western exposure, in this case up to maximum of 400 m. The forest vegetation expansion is smallest on eastern exposure.

Keywords: Topographic maps , AUTOCAD software, timberline, forest communities ,expansion

DIFFERENTIATION BETWEEN THE ALLIANCES *SATUREJION MONTANAE* HORVAT AND *SATUREJO-THYMION* MICEVSKI IN THE CENTRAL AND SOUTHERN PARTS OF THE BALKAN PENINSULA

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The work deals with the vegetation of dry grasslands over carbonate geological substrate that develop in central and southern part of the Balkan Peninsula (Serbia, Kosovo, Bulgaria, Republic of Macedonia and North Greece) classified within *Festuco-Brometea*, *Astragalo-Potentilletalia*, *Saturejion montanae* and *Saturejo-Thymion*.

After collection of published and unpublished material (vegetation samples – relevés) the analysis has been proceed, numerical analysis of floristical inventory (relevés), structure (life forms), ecological conditions (climate) and, evolution/development of vegetation (horological spectrum).

The analysis revealed that the main division into two groups is based on geography and subdivision is more ecologically conditioned, each group into two subgroups, a steppe (flat surfaces with fragmented bedrock) and rocky grasslands. The analysis show that the main division reflects the evolution/development of flora and macroclimatic conditions and subdivisions reflect structural differences that reflect different ecological conditions. At the same time a syntaxonomic scheme is proposed, the northern group is treated as *Saturejion montanae* and southern within *Saturejo-Thymion*; with two groups of associations: groups of rocky pastures and steppic group. At the end there is a syntaxonomic scheme with description of several new associations.

Keywords: Balkan Peninsula, dry grasslands, *Festuco-Brometea*, *Saturejion montanae*, *Saturejo-Thymion*, phytosociology, carbonate, syntaxonomy

PATTERNS OF INVASIONS IN VARIOUS TYPES OF NATURAL AND CULTIVATED FOREST HABITATS WITH RESPECT TO THEIR RESIDENCE AND INVASIVE STATUS

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So far only few studies focused on alien species in forest ecosystems, as forests appeared to be more resistent to invasions. Recent studies revealed that it was only a temporary phenomenon and many forest habitats are continually being invaded by alien species. The aim of our study was to find out how various type of forest habitats in Slovakia differ in their level of invasion by alien plants. For the purpose of this analysis we have used database of forest relevés, included in the Central database of phytosociological relevés of Slovakia together with newly collected relevés that consisted of 10,392 relevés. From the original dataset we have omitted relevés of extreme sizes and relevés collected before 1960. Resulting database consisted of 5748 relevés. Relevés were classified within one of 23 EUNIS habitat types, based on the syntaxa, where they belonged. Vascular taxa were classified as either native or alien (archaeophytes, neophytes), based on the Inventory of alien flora of Slovakia (Medvecká et al. 2012). Invasive status of alien species was evaluated as well. Percentage and cover of alien species, together with percentage and cover of other subgroups (archaeophytes, neophytes, casual, naturalised, invasive species) in various habitat types was compared. The most invaded were plantations of alien tree species, especially *Populus* and *Robinia* plantations, even when cultivated tree species in the tree layer were excluded from the analyses. Riparian habitats and Mixed *Pinus sylvestris* - acidophilous *Quercus* woodland were among the most invaded types of natural habitats. Neophytes were most frequent in the *Populus* plantations and Riverine *Salix* woodland, whereas archaeophytes were most frequent in *Robinia* plantations and Mixed *Quercus - Ulmus - Fraxinus* woodland of great rivers. The results will serve as valuable scientific base for the qualified forest management especially in the protected regions. This contribution was supported by grant VEGA 2/0051/15.

Keywords: alien species, biodiversity, forest habitats, invasion

A BUNCH OF R FUNCTIONS TO ASSIST PHYTOSOCIOLOGICAL TABULATION

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Questions: A plethora of methods have been proposed aiming at phytosociological tabulation. Direct optimization is a natural way to approach the issue, but the huge number of possible combinations of species and relevé groups hinders any such attempt. Clustering methods based on (dis)similarity measures are one practical alternative, although rarely produce optimal outputs and can be far from the phytosociologist's objectives. After all: is it possible, with today computers, to directly optimize the finding of differential species patterns in a phytosociological table?

Location: Functions and indices are available at http://home.isa.utl.pt/~tmh/.

Methods: After the presentation of the DiffVal index at Ljubljana (2014), I've come to notice that I could improve the optimization procedure and that the index needed a minor correction. Therefore, a better performing method is now ready for disclosure. I illustrate the use of the technique on real and virtual datasets.

Results: I highlight the following R functions: "HC.optim.tdv", which accepts a phytosociological table and searches for a k-partition optimizing TotDiffVal index, i.e. searches for patterns of differential species by rearranging the relevés into k groups. Optimization can start from a random partition, or from a given partition (e.g. produced by any clustering method, or even a manual classification). Functions "tabulate" and "explore.tabulation" permit the visualization of the table, returning lists of differential species.

Conclusions: The used hill climbing optimization technique cannot assure the finding of the global maximum, however, multiple starts increase the probability of finding it. Yet, you can always compare the result of any clustering procedure (including manual classifications), and you can check if a partition is a local maximum or if it can be improved by rearranging relevés. I invite you to try these functions on your own data, and would be happy in case you give me some feedback about it.

KEYWORDS: tabulation, classification, optimization, hill climbing, R statistical software

THE INFLUENCE OF CHOSEN ENVIRONMENTAL VARIABLES ON SPECIES COMPOSITION AND DIVERSITY OF RIPARIAN TALL HERB FRINGE COMMUNITIES (THE NATURAL HABITAT 6430)

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Questions: Plant communities from *Senecionion fluviatilis*, which grow along lowland watercourses are natural component of riparian landscape and are protected by the Habitat Directive. For the successful protection of this habitat type, it is essential to understand how are species composition and diversity of studied communities affected by chosen environmental variables.

Location: Central Europe, Poland.

Methods: The dataset for analysis consist of 300 phytosociological relevés, carried out in 2008-2013 along randomly chosen parts of river valleys in NW Poland. Additional data were gathered: physico-geographical variables, physico-chemical soil parameters, vegetation complex characteristic and anthropogenic factors. The pattern of species and samples distribution along the gradients of environmental variables was analyzed based on CCA, with Monte Carlo permutation test and forward selection of variables, available in CANOCO 4.5.

Results: All applied environmental variables accounted for 30,4 % of total variance. Only 32 out of 64 included variables and dummy variables were statistically significant. Eigenvalue of first axis was high, the other axes were less important. The largest amount of variance was explained by one of dummy variables: *Salici-Populetum* (as natural potential vegetation), highly correlated with first axis. River size (large, medium, small or very small rivers), latitude and soil pH were also very important gradients along first axis. Following factors were important and highly correlated with second axis: headwater seepages, soil moisture and *Ficario-Ulmetum chrysosplenietosum*.

Conclusion: The occurrence of investigated plant communities depends primarily on river size and associated geographical and ecological factors. Soil moisture and organic matter content are responsible mainly for the internal differentiation of associations.

THE TWO SUBASSOCIATIONS OF *SALICI CINEREAE – SPHAGNETUM RECURVI* SOÓ 1955 IN HUNGARY

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Species composition and appearance of *Salici cinereae-Sphagnaetum recurvi* Soó 1955 associations required to divide it at least two subassociations in Hungary.

We compared 27 coenological relevés of 11 different mires recorded by us and other botanists. The hierarchical cluster analysis of them confirmed our field perception.

The main difference are the *Sphagnum* species between of them.

Those willow-carrs where the moss layer is continuous, dominated by *Sphagnum recurvum agg.* (*S. fallax, S. angustifolium, S. flexuosum*) and/or *Sphagnum palustre* belong to the *Salici cinereae-Sphagnetum recurvi* Soó 1955 *sphagnetosum fallacis* Nagy 2002. The *Sphagnum centrale* and *Sphagnum subnites* have been found just in this community.

Those willow carrs where the moss layer is rather spotted, dominated by *Sphagnum squarrosum* and/or *Sphagnum fimbriatum subsp. fimbriatum* and/or *Sphagnum teres* belong to the *Salici cinereae-Sphagnetum recurvi* Soó 1955 *sphagnetosum squarrosi* Nagy 2002.

Besides the above mentioned *Sphagnum*s, other eight peat moss species with low dominancy appeared in both subassociations.

The more hydrofrequent *sphagnetosum fallacis* often belts the central open peatmoss dominated associations (*Eriophoro vaginati – Sphagnetum recurvi* Hueck 1925, *Sphagno flexuosi – Eriophoretum angustifolii* Lájer 1988 and *Betulo pubescenti – Sphagnetum recurvi* Zólyomi 1931) towards to the lagg zone.

The *sphagnetosum squarrosi* subassociation can develop on outer edges of *Sphagnetosum fallacis* and can appear by the succession of terrestrial and floating *Calamagrosti-Salicetum cinereae* Soó 1955, *Phragmitetum communis* Schmale1927 , *Thelypteridi-Typhetum latifoliae* Nagy et al. 1999 mire associations. It foregoes the *sphagnetosum fallacis* during the bog formation succession, but follows it during drying.

Salix cinerea is common but *Sphagnum* species are rare in Hungary. Both of them can appear in wide range of wet habitats. This thing and the large variety of species constellation in the *Alnetea glutinosae* class requires further researches.

KEYWORDS: *SALIX*, *SPHAGNUM*, SUBASSOCIATION, MIRE, COENOLOGY

PREDICTING THE POTENTIAL SPREAD OF *ELAEAGNUS ANGUSTIFOLIA* L. IN THE FOREST-STEPPE ECOSYSTEMS OF UKRAINE

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The expansion of *Elaeagnus angustifolia* L. in Ukraine has countrywide character. Still, there are certain regions, which are not occupied by this species, but are surrounded by its populations or single individuals. Thus, there was created a map with distribution of this species within the northern and western boundaries of its area in order to determine the "white spots" which can be occupied.

To reveal the potential to grow and invade new territories there were chosen five populations of *E. angustifolia* within the northern and western boundaries. They was conducted an age analysis of each population, dividing the plant groups into 8 age stages: juvenile, immature, virginile, generative (g1, g2, g3), subsenile, and senile. Basing on the contribution of each stage to the population, there were developed conclusions about the population stability, regression or extension.

Results indicated that northern populations are old and regressive; therefore, they have less potential to spread. The forest zone is located next to the northern boundaries of *E. angustifolia* area, thus this species has little danger to the northern ecosystems. The western populations were young, numerous, and extensive. Moreover, the neighbouring Precarpathian area includes only several separated individuals of *E. angustifolia*. Thus, it indicates that the potential of western populations to occupy new territories is high, and they could be a serious threat to the Precarpathian ecosystems.

FORMALIZED CLASSIFICATION OF OAK-HORNBEAM FOREST VEGETATION IN CENTRAL AND WESTERN EUROPE: THE FIRST INSIGHTS

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Oak-hornbeam forests are one of the most common type of European mesophilous forest vegetation. The centre of their distribution is in the Central and Western Europe, especially in low-altitude regions with subcontinental climate. In spite of wide distribution of this vegetation type, their association-level syntaxonomy on the supranational scale is still unresolved and syntaxonomical systems used in different countries are rather inconsistent. In Central and Western Europe approximately 35 associations of oak-hornbeam forests has been recognized in literature in the last decades, but some of them are not validly described in the sense of the current International Code of Phytosociological Nomenclature or their syntaxonomical status is unclear.

The main aims of the project are as follows: (1) To make a syntaxonomical revision of the associations described so far. (2) To propose a revised syntaxonomical system with formally delimited syntaxa.

A representative dataset of relevés of the target vegetation in the study region had to be prepared. Relevés were obtained especially from the European Vegetation Archive (EVA). We selected relevés classified by their authors to oak-hornbeam forest syntaxa (mainly the alliance *Carpinion betuli*) as well as relevés with a total cover of tree species typical of oak-hornbeam forests higher than 5%. In the next step these relevés (ca. 33 000) were resampled according to their species composition to obtain a more representative dataset of the target vegetation. The final dataset contained more than 5000 relevés of oak-hornbeam forest vegetation. Using this dataset a revision of the associations was done based on multiple comparisons of species composition and the validity of the names of the accepted associations was checked according to the Code. Finally formal definitions of the studied syntaxa were prepared in the Juice software using formal logic.

KEYWORDS: *Carpinion betuli*, Central and Western Europe, forest vegetation, phytosociology, syntaxonomy

NATURA 2000 WETLAND HABITATS AS ELEMENTS OF FLOODPLAIN REHABILITATION POTENTIAL

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NATURA 2000 wetland habitats, plant communities and rare species were surveyed in 32 oxbow lakes in the regulated floodplain of river Drava (southern Hungary).

Majority of the oxbows are natural eutrophic lakes with Magnopotamion or Hydrocharition-type vegetation (3150), with Salvinia natans, Nymphaea alba, Nymphoides peltata, Nuphar lutea, *Trapa natans*, *Acorus calamus*, *Stratiotes aloides*. Alkaline fens (7230) are rather scarce, with *Carex elata*, *Utricularia vulgaris*, *Thelypteris palustris*. Alluvial forests with *Alnus glutinosa* and *Fraxinus angustifolia* (91E0) occur on the banks of the oxbows in some places. Natural tree species are: Salix alba, *Populus alba*, *P. nigra*, *Alnus glutinosa*. Shrub layer is rich with e.g. *Viburnum opulus*, *Frangula alnus*. Rare herbaceous species are e.g. *Urtica kioviensis*, *Hottonia palustris*, Caltha palustris, *Equisetum hyemale*, *Leucojum aestivum*. Wetland habitats are endangered most seriously by invasive species (Acer negundo, Fraxinus pennsylvanica, Solidago gigantea, Amorpha fruticosa, *Echinocystis lobata*, *Impatiens glanduligera*), and game (*Sus scrofa*, *Cervus elaphus*).

The floodplain of river Drava preserves in the oxbows significant plant and habitat diversity. In case of floodplain rehabilitation, they may serve as a valuable source of propagules for recolonization of reconstructed or rehabilitated wetlands.

Study was supported by Hungarian Research Grant OTKA 104552.

KEYWORDS: OXBOWS, NATURAL EUTROPHIC LAKES, ALKALINE FENS, *CAREX ELATA*, ALLUVIAL FORESTS, INVASIVE SPECIES, FLOODPLAIN REHABILITATION

WETLAND HABITATS OF EU IMPORTANCE IN THE PROTECTED AREAS OF LATVIA

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Diverse wetlands occur in Latvia, including the peat forming mire types of high conservation value. Therefore, from 2014 "Wetlands" LIFE project "Conservation and management of priority wetland habitats in Latvia" is carried out. The aim of the project is to introduce protection and management measures to secure the most favourable conservation status for wetland habitats of European and Latvian importance. The project has 4 sites and include Slitere and Gauja National Parks, Ziemelu Mires Nature Reserve (Ramsar site) and Raunas Staburags Nature Reserve where wetland studies are carried out.

The LIFE project sites comprise wetland habitats of EU importance – active raised bogs, transition mires and quacking bogs, mineral rich springs and spring fens, petrifying springs with tufa formation. For raised bogs, the management includes rising of the groundwater level in the degraded areas, for fens – cutting of trees and shrubs, but for springs – elimination of an invasive species *Heracleum sosnowskii*.

Prior to implementation of wetland habitat conservation and management actions, Management plans for the project sites are elaborated and include various studies – plant species, habitat, hydrological and geological studies. In the project sites there are 160 habitat monitoring relevés to follow the vegetation change after the implementation of management actions and 30 groundwater monitoring wells.

Good results of wetland management have also within other LIFE projects in Latvia, like "Restoration of Raised" bog habitats in the especially protected nature areas of Latvia". Wetland habitat and hydrology restoration actions were carried out in 4 sites, from them in Melnais Lake Mire positive and fast effect of raising groundwater rise was observed as an increase of *Sphagnum* species in raised bog habitats.

KEYWORDS: WETLAND, LATVIA, PROTECTED AREAS, HABITAT MONITORING

SALT GRASSLANDS ALONG THE GERMAN AND POLISH BALTIC SEA COAST. FIRST RESULTS OF A 2-YEARS VEGETATION SURVEY

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Introduction and Questions: Salt grasslands are a characteristic landscape element of the Baltic Sea coast; they have developed due to extensive grazing within the last 800 years and replaced common reed beds which are considered as the potentially natural vegetation. Natural salt grasslands represent a rare exception and occur in areas with high environmental stress. The influence of wild animals might affect the vegetation on natural or anthropogenic salt grasslands but has received low attention so far. Unlike reed beds, salt grasslands have a higher biodiversity and provide habitats for a very specialized flora and fauna. This coastal habitat is now highly endangered by embankments of large areas and abandonment of the traditional management. Therefore, salt grasslands have dramatically declined. Additionally, grass encroachment presents a major threat which is a commonly observed problem on many salt grassland types. We aim to present a transboundary vegetation characterisation and answer the following questions: How does grass encroachment alter the typical vegetation? Which wild animals occur and how do they influence vegetation composition and structure?

Locations and methods: We studied the vegetation along a ~500 km gradient in the vicinity of the Darß-region (Germany) up to Gdansk (Poland). We surveyed 10 different areas, including more than 80 plot-based vegetation records.

Results: Our results show that grass encroachment has a negative influence on salt grassland target-species. We observed different wild grazing animals and other wildlife at all study sides during the vegetation period. Within a preliminary analysis, particularly wild boars seem to have an influence on the structure and vegetation composition of salt grasslands in almost all surveyed areas. First results show a positive influence of turning the swards on salt grassland target-species through the creation of gaps. Wild boars had a positive influence by reducing grass encroachment.

KEYWORDS: BALTIC SEA COAST, SALT GRASSLAND, VEGETATION CLASSIFICATION, GRASS ENCROACHMENT, WILD ANIMALS

SUCCESSION TRENDS IN WET MEADOW VEGETATION - CAN WE PREDICT THEM?

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Aim: To describe succession trend and trend of groundwater level on permanent plot in wet meadow vegetation during 10 years long period. According to this results predict present situation on the locality and compare it with real status.

Locality: Alluvium of the Morava river, Western Slovakia.

Methods: Permanent plot was established within the flood plain of the Morava river. Phytocoenological relevé was recorded annually after spring inundation and before moving, using standard methods of Zürich-Montpeliér school with 9-degree new Br.-Bl. scale. Groundwater level was measured twice a month in borehole established next to permanent plot. Time series of species occurrence and cover were modelled with time being the only exogenous variable by a generalized linear model with binomial error probability distribution family and logistic link function, using Mallows or Huber type robust estimators, considering a simple linear trend. Trend in water levels were studied with standard linear model and robust MM-estimator as linear function yet considering significant seasonal component with annual period. In both cases, significance of the linear trend was tested along with the slope coefficients.

Results and conclusion

The groundwater level on the locality has significant increasing linear trend during observation period approximately 6 cm per year. Vegetation cover reflects this trend by retreat of originally abundant mesophilous herbs like *Potentilla anserina*, *Ranunculus repens* which were replaced by hygrophilous graminoids (*Glyceria maxima*, *Carex angustifolia*).

KEYWORDS: WET MEADOW, SUCCESSION, GROUNDWATER LEVEL, TIME SERIES

NUMERICAL CLASSIFICATION OF RAVINE FORESTS IN POLAND

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Communities of broad-leaved ravine forests are spatially limited to specific habitat conditions, including steep slopes with skeletal soil and unstable ground. Such places have been mostly inaccessible, and in many regions these ecosystems are the only remnants of unmanaged forests with high biodiversity value. Thus, in the EU, ravine forests are protected as a priority habitat (code 9180). In spite of the great importance, ravine forests in Poland are still insufficiently recognized and the syntaxonomical status of distinguished units is not clear.

Aims:

The aims of the presented study are *i)* to recognize the complete distribution and diversity of ravine forests in Poland, *ii)* to perform a numerical classification and *iii)* to determine reliable sets of diagnostic species for each of the distinguished units.

Study area:

The Carpathians, the Sudetes and Polish Jura (southern Poland).

Materials and Methods:

We established a database that consisted of all published relevés of ravine forests and unpublished relevés from our personal resources. The samples were then georeferenced and projected onto a map to detect areas that were insufficiently explored. In the vegetation season of 2015, ca. 100 new plots were sampled to fill the gaps in the distribution of the relevés. The final dataset included over 800 relevés, most of which are unpublished data.

To perform the preliminary classification, we used a modified TWINSPAN algorithm and cluster analysis. Ordination techniques were used to interpret the main ecological gradients responsible for the identity of the resulting clusters. Finally, statistical measures of fidelity (*phi* coefficient) were used to determine sets of diagnostic species.

Results:

Six associations were distinguished based on our results. The results also revealed that there is no foundation for some of the traditionally distinguished associations in Poland. The main ecological gradients responsible for diversity of ravine forests are moisture, soil type and altitude.

KEYWORDS: Poland, Ravine Forests, numerical classification, modified TWINSPAN

DIVERSITY AND ECOLOGY OF STEPPE PETROPHYTIC COMMUNITIES IN THE MOUNTAIN ALTAI (SOUTHERN SIBERIA, RUSSIA)

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Aim: Current study is focused on the syntaxonomy and ecological features of petrophytic vegetation in the steppe belt of the Mountain Altai (Southern Siberia).

Location: Mountain Altai (Southern Siberia, Russia).

Methods: Dataset of 135 releves was input in the TURBOVEG database (Hennekens 1996). The vegetation classification was produced using the Braun-Blanquet method and TWINSPAN analysis realized in JUISE 7.0. Ecological and floristic differences between petrophityc communities were studied using DCA ordination (DECORANA, Hill 1979).

Results: All diversity of plant communities was included in two classes. Class *Artemisio santolinifoliae-Berberidetea sibiricae* Ermakov et al. 2006 (communities of screes and rock outcrops) is represented by two alliances (*Artemision rutifoliae* et al. 2006 & *Grossulario acicularis-Berberidion sibiricae* et al. 2006). Class *Cleistogenetea squarrosae* Mirkin et al. ex Korotkov 1991 (Central Asian steppes) is represented by two orders. Order *Festucetalia lenensis* Mirkin in Gogoleva et al. 1987 (meadow-steppes) is represented by two petrophytic alliances (*Eritrichion pectinati-Selaginellion sanguinolentae* Ermakov et al. 2006 & *Sedion hybridi* Ermakov et al. 2006). Order *Kochio prostatae-Stipetalia krylovii* Ermakov 2012 (dry-steppes) included petrophytic alliance *Stipion orientalis* Korolyuk et Makunina 2009.

The DCA ordination demonstrated ecological peculiarities of petrophytic vegetation. Axis 1 was explained as factors of lithology and moisture. Along axis 2 all releves were divided into two groups representing two classes (*Artemisio santolinifoliae-Berberidetea sibiricae* and *Cleistogenetea squarrosae*) with gradual transition from petrophytic steppes on rock outcrops to communities of mobile screes.

KEYWORDS: PETROPHYTIC VEGETATION, SCREES, CLASSIFICATION, DCA ORDINATION, ALTAI MOUNTAIN, RUSSIA

COMMUNITIES OF THE *CAKILETEA MARITIMAE* AND *HONCKENYO PEPLOIDIS–LEYMETEA ARENARII* CLASSES ON THE SHORES OF THE RYBACHY AND SREDNY PENINSULAS (MURMANSK REGION, RUSSIA)

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Questions: The only vegetation survey made at this territory was published by A. Kalela in 1939 and did not include the whole territory of the peninsulas. The aims of our study were to study and classify the seashore vegetation of both peninsulas, define ecological characteristics of the syntaxa and analyze their phytodiversity.

Location: The Rybachy and Sredny peninsulas are situated at the 69th latitude and bounded by the Barents Sea; their territories belong to the Kola subprovince of subarctic tundra.

Methods: The communities of sandy and shingle spray zone and sea cost dunes were studied on the shores of both peninsulas in 2014 and 2015. Classification and ordination analyses are based on 37 original relevés.

Results: Three associations are identified and described within two alliances and two classes. The *Atriplicetum lapponicae* communities (*Cakiletea maritimae* class) are halo-nitrophilous vegetation growing on wash margins with seaweed debris. The *Tripleurospermo–Festucetum arenariae* and *Honckenyo diffusae–Leymetum arenarii* communities (*Honckenyo peploidis–Leymetea arenarii* class) are grasslands on longshore bars or sea cost dunes. *Cakiletea maritimae* communities have not been recorded in the region before. Communities of two identified classes have significant difference ($p<0.05$) in the median number of species and in diversity (Shannon index). The combined partial flora *Tripleurospermo–Festucetum arenariae* has the greatest number of species (54), but there were no significant difference in median number of species or Shannon index values between the *Tripleurospermo–Festucetum arenariae* and *Honckenyo diffusae–Leymetum arenarii* communities. The regional peculiarity of *Atriplicetum lapponicae* communities is the high frequency of *Atriplex kuzenevae*. The ordination analysis revealed ecological differences between the studied associations. The leading factor is the distance from the sea. It includes decrease in both salt stress and decaying organic matter.

Keywords: Northern Lapland, Russia, coastal vegetation, phytosociology, syntaxonomy, *Cakiletea maritimae*, *Honckenyo peploidis–Leymetea arenarii*

PROPOSALS FOR SURVEILLANCE SCHEME OF THE EUROPEAN PROTECTED HABITATS IN LITHUANIA

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Aims: While providing information under Art. 17 of the Habitats Directive on the conservation status of the habitat types, Member State has so far used the assessment based on the best expert judgement. No trends for the reporting periods 2004–2006 and 2007–2012 were noticed! What should be the procedure/system of collecting the information on the conservation status of the habitat types and its analysis that would allow grasping the ongoing changes?

Location: Lithuania

Methods: Lithuania is one of a few Member States, which has conducted the overall inventory of the habitat types of community interest. GIS data on the distribution, area, structure, species list, threats, etc. for each of 53 habitat types (in total more than 85 thous. polygons, covering the 4349 km^2 area) were analysed using various statistical software (including GIS, R project, Juice, etc.).

Results and conclusions: A surveillance scheme at national level for the habitat types of community interest has been proposed. For evaluation of range and area changes, periodic remapping of the habitats on at least 10% of the country's territory is intended. Territories/squares for remapping are arranged randomly with some correction for habitat types having distribution borders within the country (e.g. 9160 Sub-Atlantic and medio-European oak or oak-hornbeam forests of the *Carpinion betuli* or 91T0 Central European lichen Scots pine forests). For specific structure and function, permanent sampling plots (transects) are designed, in which the evaluation of the most important indices (species composition, structure of vegetation layers, invasive and expansive species, physical parameters) is carried out. Number of transects depends on the frequency of habitat types and ranges from 10 to 250. For future prospect conservation mode, management activities, threats, etc. are foreseen.

Finally, the procedure for the assessment of the conservation status of the habitats at the site level and national level is proposed.

HABITAT REQUIREMENTS OF ENDANGERED SPECIES IN A FORMER COPPICE OF HIGH CONSERVATION VALUE

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Transformation of coppices to high forests has caused fundamental changes in site conditions and a decline of many species across Central Europe. Nevertheless, some formerly coppiced forests still harbour a number of the declining species and have become biodiversity hotspots in the changing landscape. We focused on the best preserved remnant of formerly grazed and coppiced subcontinental oak forest in the Czech Republic – Dúbrava forest near Hodonín. To improve our understanding of the ecology of the declining species, we studied local habitat requirements of vascular plants most endangered at the national level. We recorded vegetation composition and sampled important site variables in plots with the largest populations of endangered species and in additional plots placed randomly across all major forest habitats. We demonstrated that sites with endangered species have a highly uneven distribution in ecological space and their species composition is often similar to open-canopy oak forests. Within this habitat, the endangered species are concentrated in places with a high light availability and high soil pH. Light-demanding species characteristic of subcontinental oak forests are the best indicators of these sites, while broadly distributed shade-tolerant and nutrient-demanding species avoid them. These results support the view that the occurrence of many endangered species in Dúbrava forest is a legacy of the long history of traditional management that kept the canopies open. The light-demanding species are now threatened by ongoing successional changes. Therefore, active conservation measures are recommended, including opening up the canopies, early thinning of young growths, control of expansive and invasive species and understorey grazing or mowing.

Keywords: abandoned coppice; environmental requirements; subcontinental oak forest; plant diversity; threatened species

LAND USE HISTORY AND GRAZING EFFECT ON PANNONIC LOESS AND SALT STEPPES, SALT MARSHES

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The persistence of the habitats based on historical maps (1783, 1859, 1882, 1944) are general used to evaluate and predict the on-going processes. Additionally to that recent and detailed habitat mapping and coenological surveys are inevitable to specify actions to a well-founded management plan. These steps of preparation were established in 2014 and 2015 thanks to the Swiss Contribution "Sustainable conservation on Hungarian Natura 2000 sites" SH/4/8 project at Kelemen-szék (2555 ha) located in the area of the Felső-kiskunsági szikes tavak és Mikla-puszta SCI, Hungary. The effects of grazing were studied with random coenological surveys of grazed (with buffalo and Hungarian grey cattle) and non-grazed control areas with the separation of higher and lower situated, alkaline and loess parts. Cluster- and detrended correspondence analysis (DCA) were used and distribution of social behaviour types and conservational values were evaluated.

Historical and recent habitat analysis of the area proved that contiguous grasslands remained intact in alkaline parts and notable size insetted arable lands typically were transformed from the pannonic loess steppic grasslands and most of the remnants are small fragments in relatively degraded state and under the pression of invasive plant species. On the other hand the pannonic salt steppes and marshes have the highest naturalness and show resistance to invasive species. Based on the coenological results it can be stated that the grazing was favourable from the point of naturalness in each type of habitat, than in the non-managed control areas, but the grazing had major act in the maintenance of the lower situated alkaline habitats which showed more sensitivity to the grazing as management and moreover to annual weather conditions as opposed to loess steppes.

Keywords: land use, grazing, management

STUDIES ON BOTANY OF WOOD PASTURES IN THE NORTH HUNGARIAN MOUNTAINS

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Wood pastures are one of the most endangered woody, semi-natural habitats in Hungary which are threatened by abandonment. These habitats are important because of their role in preserving of traditional land use and biodiversity. In the North Hungarian Mountains nature conservation has major act in the management of these habitats. Our main aim is to study the vegetation of 6 selected wood pastures from the geographical region.

The 6 research sites are typical examples in the North Hungarian Mountains and for the different states of use and abandonment: Erdőbénye wood pasture – continuous grazing (relatively intensive), Cserépfalu wood pasture – short abandonment in the past, Viszló wood pasture – abandoned cca. 5 years ago, Kisgombos wood pasture – abandoned cca. 20 years ago, Szőlősardó wood pasture – abandoned cca. 30 years ago, Hollókő wood pasture – abandoned at least 30 years ago, Erdőbénye, Cserépfalu and Hollókő wood pastures are under nature conservational protection and management.

To compare the sites we classified the main habitat types as treeless, wood pasture, shrubland and woodland parts. We collected botanical data in 2011 with the method of Braun-Blanquet – we gave the coverage of plant species in %. The size of quadrates was 2×2 m in grasslands, 5×5 m in shrublands and 10×10 m in woodlands. We studied the composition and diversity of flora.

We recorded 290 plant species. The composition of plant species generally dominated by competitor, disturbance tolerant and generalist species. Based on the composition treeless and wood pasture habitats have stronger similarity to each others between areas than to shrubland and woodland habitats at the same area. Floral diversity of used or recently abandoned wood pastures is usually higher, moreover diversity values of wood pasture and treeless habitats are higher than shrubland and woodland habitats at the same site.

KEYWORDS: WOOD PASTURES, ABANDONMENT, FLORAL DIVERSITY, NORTH HUNGARIAN MOUNTAINS

DISTRIBUTION AND COENOTIC AFFINITY OF CRITICALLY ENDANGERED *BECKMANIA ERUCIFORMIS* (L.) HOST IN CROATIA

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Aims: *Beckmannia eruciformis* (L.) Host) is a critically endangered species, with extremely rare occurrence in Croatia. Through its European areal it has high coenological variability (*Isoëto-Nanojuncetea*, *Phragmito-Magnocaricetea*, *Molinio-Arrhenateretea* and *Festuco-Puccinellietea*) and its habitats range from permanently flooded to dry, to even salinized. Therefore, its historical distribution in Croatia and its vegetation affiliation has been studied.

Location: The field study was made in Croatia, in Mediterranean region inside National Park Krka, in the narrow floodplain within karst canyon of the Čikola River.

Methods: Fieldwork was carried out in 2015. The phytosociological relevés were sampled according to the Zürich-Montpelier approach using the adopted nine-grade Braun-Blanquet scale and analysed in comparison to dataset from other European countries (Slovakia, Hungary, Serbia, Romania).

Results and conclusion: In Croatia, the species has survived in solely one small and permanent population within National park Krka in Mediterranean part of the country. The species composition indicates regular flooding and stagnation of the water level during certain period of the year. Occurrence of the alliance *Beckmannion eruciformis* Soó 1933 was not confirmed for Croatia. Similarly to Slovakia and southern Serbia, Croatian population belongs to non-saline flooded vegetation of the class *Phragmito-Magnocaricetea*. The Croatian population is highly vulnerable and depends on continuing conservation measures.

Keywords: *Beckmannia eruciformis*, distribution, Croatia, *Phragmito-Magnocaricetea*, coenotic affinity

PREDICTIVE MODELLING BASED ON HIGH RESOLUTION DATA IN THE ALPINE TERRAIN

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Aims: i) to assign the coordinates of the former relevés and plots of historical vegetation map, using GIS based on known parameters (elevation, slope, aspect, description of locality); ii) to construct a new vegetation model based on precisely located recent relevés and measured geographical parameters, and iii) on the basis of obtained results to predict trends in vegetation dynamics. Using a combination air temperature and precipitation data based on a current distribution, we predicted their climatic niches for future climate scenarios.

Methods: An application was developed for localization of the historical phytosociological relevés as a script written in a Unix shell (Bash). We used the GRASS GIS environment for high-performance computing on the supercomputer AUREL. A satisfactory range of values helped us to minimize errors that could have been caused by techniques in 1969 (estimation of elevation, slope and aspect). The type of landcover was determined from historical aerial photographs.

Results: The exact identification of former relevés appears as key factor while using vegetation data from alpine areas with rugged terrain for noticing changes and predictive modelling. Even other data, such as precipitation and air temperature extrapolated from climate models are of scale dependent. In alpine areas where the climate is not the only driver for vegetation changes, also the information such as management practices and level of erosion are one of the crucial input data.

Conclusions: The precise localization of relevés and plots in space is a crucial prerequisite for the exact analysis and forecasting of potential local and/or global changes. Traditional approaches need to adapt to the challenge for a greater precision and spatial objectivity within a GIS environment.

KEYWORDS: CLIMATE MODELS, GRASS GIS, VEGETATION MAPPING

INFLUENCE OF GEOGRAPHICAL GRADIENT ON PHOTOSYNTHESIS AND VEGETATIVE GROWTH OF PEDUNCULATE OAK (*QUERCUS ROBUR* L.) IN EUROPE UNDER DROUGHT STRESS

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The aim of this study was to determine the effect of long drought period on instantaneous rates of net-photosynthesis (P_N) and stem height increment (I_H) in six European provenances of pedunculate oak (Estonia, Lithuania, Poland, Hungary, Croatia and Italy) in relation to latitude of provenance origin. In spring 2014, two-years old plants (grown from seed) were individually planted in 50-litar containers filled with natural forest soil. Until the start of the experiment plants were exposed to natural rainfall. In spring 2015 plants were moved to greenhouse and experimentally controlled water supply started.

Experiment was established accordingly to split-plot design with two treatments (control and drought). In the control treatment, plants were exposed to relative moisture content in the soil of 45 % in all time, from 1st of April until 22nd of October. In the drought treatment plants were deprived of water from 1st of April until 22nd of July, and after drought period (from 22nd of July until 22nd of October) plants were re-watered and exposed to the same relative moisture content in the soil (about 45%) as plants in control treatment.

A strong negative correlation between inhibition of P_N and I_H in drought treatmant and the latitude of provenance origin indicates that the photosynthetic activity and vegetative growth of southern provenances are more sensitive to drought than the northern provenance (P_N: $R^2 = 0.412$, $P < 0.05$; I_H: $R^2 = 0.516$, $P < 0.05$). A strong negative correlation between compensation of P_N in post-drought period and the latitude of provenance origin ($R^2 = 0.779$, $P < 0.001$) indicate that the southern provenance had better ability to recover and compensate for lost P_N due drought limitation than the northern provenances. Correlation between compensation of I_H in post-drought period and latitude was statistically significant.

KEYWORDS: *QUERCUS ROBUR*, DROUGHT STRESS, PHOTOSYNTHESIS, VEGETATIVE GROWTH

MAPPING AND PREPARATION OF MONITORING PROTOCOLS FOR PRIORITY/MINOR FOREST HABITAT TYPES (NATURA 2000) IN SLOVENIA

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Questions: Under Art. 17 of the EU Habitats Directive countries are obligated to monitor and assess the conservation status of Annex I habitat types, but there are no common monitoring protocols for the assessment on EU level. Focusing on priority and minor forest habitat types of Natura 2000 in Slovenia, such as 9180*, 91D0*, 91E0*, 9530* 91R0, and 9420, the monitoring protocols will be developed. In first phase our aim is to provide maps in large scale for these habitat types and monitoring protocol that will serve as stepping stone towards harmonised national monitoring program of all habitat types.

Location: Slovenia.

Methods: On the basis of relevés stored in different databases, and various maps, e. g. maps of Physis habitat types and maps based on national forest database, we developed habitat suitability models of targeted habitat types. In model building we used variety of environmental variables that we have gained from raster data on terrain, geological, soil and climate characteristics. We used variety of regression models, as well as machine learning methods. The adequacy of the models were evaluated by cross-validation methods. The model prediction was performed on the 50x50m raster grid on the entire Slovenian forest territory. Methodologies from other European countries and existing forest inventory system in Slovenia were used for creation of the monitoring protocol for assessment of forest habitat types.

Results and conclusions: Based on the selected models we produced habitat suitability maps of studied habitat types. Further verification in the field will be needed to make the final distribution maps for certain types (*Tilio-Acerion*, pine forests) while for others maps are already useful and credible. Field test of the monitoring protocol in alluvial and riparian forests (and also on alluvial meadows) indicated more accurate estimations of conservation status that was provided by expert opinion using existing information on forests.

KEYWORDS: FOREST, MONITORING, MAPPING, HABITAT TYPES, NATURA 2000, SLOVENIA

LONG-TERM MONITORING OF SPECIES-RICH SEMI-NATURAL GRASSLAND OF EUROPEAN HABITAT 6210 IN THE BIELE KARPATY MTS (SLOVAKIA)

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A stand of species-rich semi-dry grassland of the *Bromion erecti* alliance was studied on a permanent plot in the Nature Reserve Nebrová in the Biele Karpaty Mts in 1993, 1996, 1997 and 2014. The aim was to assess changes in frequency and distribution of vascular plant species within the plot in a regularly managed habitat. The presence of species was recorded on small subplots of 20x20 cm, and the size of the whole plot was 9 m². Species dynamics was described by significant changes in species frequency and by persistence (species tendency to remain in the same subplot). Species presence/absence in subplots was compared. Detrended correspondence analysis and Ellenberg indicator values were used for ecological interpretation of the main gradients and changes in the vegetation.

Altogether, 108 vascular plants were recorded in the permanent plot. For the whole-term period (1993–2014), significant changes were recorded in 32 species (increase in 17 species, decrease in 15 species), for the 4 year-period (1993–1997) in 23 species (increase in 14 species, decrease in 9 species), for the 3 year-period (1993–1996) in 21 species (increase in 10 species, decrease in 11) and for the 1 year-period (1996–1997) in 9 species (7 species increased and 2 decreased).

Results of gradient analysis show that during the 21 years the species composition was shifted along the moisture, nutrient and soil reaction gradients. The strongest decrease in frequency was recorded in *Arrhenatherum elatius*, *Leontodon hispidus* and *Ranunculus polyanthemos*. Frequency of *Veronica chamaedrys*, *Carex tomentosa*, *Fragaria viridis*, *Holcus lanatus* and *Equisetum telmateia* increased considerably. The persistence was the highest for *Salvia pratensis*, *Cirsium pannonicum* and *Primula veris*. We conclude that in spite of a stable and regular management of the studied grassland stand the species representation has changed considerably during the observation period. This contribution was supported by grant VEGA 2/0099/13.

KEYWORDS: *BROMION ERECTI*, DYNAMICS, PERMANENT PLOT, SPECIES FREQUENCY

COENOLOGY OF *ACER CAPPADOCICUM* SUBSP. *LOBELII* IN ITALY

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Acer cappadocicum susbp. *lobelii* is nowadays regarded as one of the most eminent endemisms of the Italian dendroflora. However, this *taxon* has been, until now, almost excluded from the scientific debate, causing a deep lack in the knowledge of its genetics, ecology, and coenology.

According to current systematics, *Acer cappadocicum* s.l. belongs to section *Platanoidea*, which in West Eurasia encompasses *A. campestre* L. and *A. platanoides* L..

In the Italian peninsula, the range of *A. cappadocicum* subsp. *lobelii* is restricted to the south, where it is usually scattered between 750 m and 1700 m a.s.l. in mesophilous broad-leaved forests and in mixed *Fagus-Abies* forests.

At present, this *taxon* is considered as a subspecies of *Acer cappadocicum* Gled. (=*Acer laetum*), a major representative of the species-rich mixed Colchic broad-leaved forests of the Euxinian domain.

Here the coenology of the *taxon* in the whole peninsular range is outlined using a dataset of 173 phytosociological relevés extracted from the Georeferenced Vegetation Database - Sapienza University of Roma. A formal classification has been performed using Flexible Beta clustering,operated by the program JUICE.

Results point out the successional character of the species since it mostly clusters in topographically heterogeneous stands or sites where non-nemoral species reveal earlier disturbance events.

KEYWORDS: *Acer cappadocicum* subsp. *lobelii*, coenology, phytogeography, Apennine forests

COEXISTENCE OF ANCIENT FOREST SPECIES AS AN INDICATOR OF HIGH SPECIES RICHNESS

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Questions: Ancient forest species (AFS) constitute a specific group of plants associated with forest vegetation. Can groups of coexisting species be identified among the ancient forest species and which of them show tendency to co-occur in forest plant communities? Does the coexistence of species of ancient forests indicate high species richness of communities and what is the 'quality' of this richness?

Location: Poland (Central Europe).

Methods: We used the Polish Vegetation Database, from which we selected forest relevés containing at least one ancient forest species. Then, we examined which AFS are most often found together. We determined species relations using the phi coefficient of fidelity and finally we created the groups of coexisting ancient forest species (CAFS groups).

Results: Eleven coexisting ancient forest species groups were created including 51 ancient forest species. The average species richness of forests, in which at least one CAFS group was present, was significantly higher than the average in the forests, where there were no CAFS groups. These forests also differed significantly in the total number of ancient forest species and the number of closed forest species. We consider the members of CAFS groups as true ancient forest species. The CAFS groups occurred most often in zonal types of forest vegetation including the oak-hornbeam forests, species-rich beech forests and ravine forests, in contrast to azonal vegetation types like bog Scots pine woodlands, acidophilous spruce forests, alder carrs and willow-poplar forests of lowland rivers where they were rarely found.

Conclusion: The coexistence of AFS emphasise then the role of deciduous forest as the refugia of primary species composition and constitutes a basis to maintain and preserve such forests as models of natural temperate vegetation on the European scale.

Keywords: species functional groups, biodiversity, plant indicators, ancient woodland

HABITATS CONDITIONS OF THE SUMMER RIVERSIDE TEROPHYTES COMMUNITIES (*BIDENTETEA TIPARTITAE*) IN RIVER VALLEYS OF THE WESTERN POMERANIA

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Questions: Summer terophytes belonging to the class *Bidentetea tripartitae* are natural components of the vegetation of river valleys. The habitat of riverside terophytes is protected as part of the Natura 2000 network. For the full understanding and protection it is necessary to examine the influence of habitat conditions on their state and species composition.

Location: North-western part of Poland.

Methods: The studies were conducted over growing seasons in the years 2009-2015. The investigated area encompassed the selected river valleys flowing across the area of the north-western part of Poland. 376 phytosociological releves (according to the system of Braun-Blanquet) were made and soil samples were collected. The hierarchy classification with the MVSP package was used in order to arrange and group phytosociological data and to distinguish plant communities. DCA and CCA using the CANOCO 4.5 software package were applied to identify environmental gradients to define vegetation distribution. Monte Carlo permutation test was used to evaluate the statistical significance of the relationship between the species diversity of communities and the environmental variables.

Results: Seven plant communities belonging to alliance *Bidention tripartitae*, and eight plant communities belonging to alliance *Chenopodion fluviatile* were identified. The size of the river and the intensity of human pressure influenced the occurrence and physiognomy of plant communities. The following parameters affected species composition of studied patches: pH (the longest gradient along the first CCA axis), organic matter content, salinity, sand fraction.

Conclusion: The size of the river, habitat conditions and the degree of anthropogenic transformations had an impact on the occurrence and character of communities of summer therophytes.

VEGETATION COMPARISON OF DECIDUOUS WOODLAND KEY HABITATS IN MANAGED FORESTS AND PROTECTED NATURE TERRITORIES IN SOUTHERN LATVIA

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Southern part of Latvia historically was covered by broadleaved forests which were destroyed or transformed by agriculture and forestry through centuries. Now these forests remain as fragments of their previous extent. Due to several types of disturbances in these patches forest stands have been replaced by pioneer tree species - *Betula* spp. L., *Populus tremula* L., *Alnus incana* (L.) Moench and *Alnus glutinosa* (L.) Gaertn. A part of deciduous stands have been designated as Woodland Key Habitats (WKH) and also European Union Protected Habitats.

The main task of the study is to compare forest structural elements and vegetation of the deciduous WKH in managed forests and Natura 2000 areas – Nature Park "Tervete" and Nature Reserve "Ukru garsa". In total twelve sampling plots (with area of 0.1 ha each) were established in Aegopodiosa type of forest in southern Latvia. The accounting of growing trees and dead wood as well as the assessment of vegetation (using Braun–Blanquet method) was done in every sampling plot. The degree of decomposition of dead wood was documented too.

Study shows that in deciduous WKH in managed forests the average volume of growing trees is 310.2 m^3ha^{-1}, but in protected nature territories – 321.4 m^3ha^{-1} (in "Tervete") and 195.4 m^3ha^{-1} (in "Ukru garsa"). The average amount of dead wood constitutes accordingly 78.7 m3ha-1 in managed forests and 133 m^3ha^{-1} in protected forests. The vegetation in managed forests consists of 50 species of vascular plants and mosses, but in Natura 2000 sites - in "Tervete" - 42 and in "Ukru garsa" - 56 species.

Despite the negative influence of fragmentation on biodiversity in deciduous WKH which increases isolation and enhances edge effect, in our study we did not find strong influence of the edge on structural elements and vegetation of deciduous WKH: they are important in the maintaining of biodiversity in forest ecosystems in general.

Keywords: woodland key habitats, deciduous forest stands, forest vegetation, forest structural elements

GENERATIVE REPRODUCTION SUCCESS OF DWARF BIRCH (*BETULA NANA* L.) ON THE SOUTH-WESTERN LIMIT OF SPECIES DISTRIBUTION AREA

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Aim: The aim of the study was to find out the seed germination success of a dwarf birch (*Betula nana* L.). This species is included in 2nd category of the Red Data Book of Latvia and is listed as vulnerable species decreasing in number.

Methods: Seeds from 4 localities on the south-western limit and 1 locality close to the south-western limit of *B. nana* distribution area were tested. These localities represent such habitat types as raised bog and bog woodland, and vary in size from 6 m^2 to approx. 1 hectare. Seeds were collected in 2014 and 2015. Two treatments of seeds were used – without stratification and with stratification for 15 days at +2 °C in the darkness. From each locality 30 seeds in 4 replicates were set up. A 16 h photoperiod was used and +23°C/+18 °C day/night temperature was maintained during the germination. After 20 incubation days the ungerminated seeds within each replicate were stained with 0.5% 2,3,5-triphenyl-24-tetrazolium chloride for 24 hours at 22 °C to assess the viability. Seeds were cut and studied under a stereomicroscope to observe the development of seed structures.

Results: Experiments showed that the germination of *B. nana* seeds in all samples from 5 localities collected both in 2014 and 2015 was equal to 0. During the seed viability test undeveloped seed structures including cotyledons were found.

Conclusions: According to this research and literature citations, *B. nana* probably do not produce viable seeds on the limit of species distribution area. As this species has a high potential of vegetative reproduction, generative reproduction plays a small role in population regeneration.

SAUDIVEG ECOINFORMATICS: IMPACT OF ALIEN INVASIVE SPECIES ON HABITATS AND SPECIES RICHNESS IN SAUDI ARABIA

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Aim: To assess the distressing impacts of invasive species on the diversity of native biota and ecosystem.

Location: Saudi Arabia native ecosystem.

Results: A total of 48 exotic species have been recorded from Saudi Arabia, of which 9 are recorded for the first time from Saudi Arabia. Among these, the species that potentially damaging the biodiversity or altering the ecosystems in general are: *Argemone ochrolecuca*, *Nicotiana glauca*, *Opuntia dellenii*, *Opuntia ficus-indica*, *Prosopis juliflora* and *Trianthema portulacastrum*. Among these, *P. juliflora* has been observed in lower altitudes with a density of more than 6%/hectare followed by *O. dellenii* and *N. glauca* in areas above 1000 m. Analysis showed that environmental and diversity variables have high significant variation between habitats. Invasive and other exotic species are correlated positively with altitude and most diversity indices except with species dominance are correlated negatively. Mountains and wadis have the highest values in terms of species richness, cover and exotic species impact.

Conclusion: The invasive alien species have distressing impacts on native biota, causing decline or even extinctions of native species, and negatively affecting ecosystems which led to numerous problems. Therefore, many of Saudi Arabia's important ecosystems such as mountains and wadis that shelter of many native, endemic and endangered species are now under stress of these invasive species.

KEYWORDS: ALIEN SPECIES, HABITATS, INVASIONS, NEOPHYTES, SAUDI ARABIA, SPECIES RICHNESS

ASSESSING THE SPATIAL COMPLEXITY IN A COASTAL WETLAND SITE (SOUTHERN ITALY) ACCORDING TO DIFFERENT HABITAT AND LAND COVER CLASSIFICATION SCHEMES

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Aim: Object of this work was to compare different habitat and land cover classification schemes, applied to a specific coastal wetland landscape, with a defined thematic resolution level.

Location and Methods: Study area is the SCI IT9110005, one of the most extensive wetlands of the Italian peninsula and one of the largest components of the Mediterranean wetland system, located in the Northeastern part of the Puglia Region (Southern Italy). The natural vegetation is represented mostly by halophytic scrub, reed thickets and by annual pioneer salt marsh communities. Natural and semi-natural landscape elements were described as phytosociological units and represented on a vegetation map at a 1:5,000 scale. Vegetation units were then reclassified in habitat types according to Annex I of the EEC 92/43 Directive and EUNIS habitat classification schemes and in land cover types according to different land cover schemes. For each scheme a thematic map was produced and, for each map, various landscape metrics were calculated.

Results and Conclusions: The selection of a specific class scheme affects the spatial pattern of the derived landscapes and consequently the landscape metrics, especially at class level. The presence of various vegetation types and mosaics increases the complexity of the spatial pattern, which varies greatly according to the classification system considered, based on how the different types are aggregated. Our results confirm that the choice of specific classification schemes produces important effects on the spatial composition of the derived patch-mosaic landscape, and therefore can significantly affect the derived landscape metrics values.

KEYWORDS: HABITAT, LAND COVER, CLASSIFICATION SCHEMES, COASTAL WETLAND, SOUTHERN ITALY

FUNCTIONAL TRAITS VARIATION IN SNOWBED PLANTS ALONG A SNOW COVER GRADIENT AS A PREDICTION OF ADAPTATION TO CLIMATE WARMING

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Snowbed habitats, i.e. topographical depressions or slopes covered by snow for most of the year and colonized by species adapted to short growing season, can be considered as model systems for research addressing the effects of climate change on alpine vegetation. Their particular environmental conditions allow the growth of plant species highly sensitive to warmer temperatures.

Currently, great attention is given to functional traits as important carriers of ecological information for vascular plant species. Functional traits also vary within species, reflecting phenotypic adaptations to specific environmental conditions. The quantification of this phenotypic plasticity gives insight on how plants respond to environmental variation such as the reduction of the period of snow cover under climate warming.

The aim of this study was to analyze the phenotypic plasticity of functional traits of key snowbed species (specialists and generalists) along a snow cover gradient. We considered leaf and seed traits. We investigated one siliceous and one calcareous snowbed, the first located at Gavia Pass (ca. 2700 m a.s.l., Lombardy region), the second located close to Forcella Travenanzes in the eastern Dolomites (ca. 2680 m a.s.l., Veneto region). In each snowbed, we randomly chose five to six plots in early and late snowmelt areas respectively. We identified five key species on the siliceous bedrock and six on the calcareous ones. For each key species in each snowmelt area we sampled the functional trait attributes of 20 individuals. For leaf nutrient content, the samples were pooled within each plot.

We will report the effect of snow cover duration on specific leaf area (SLA), leaf dry matter content (LDMC), leaf phosphorus content (LPC), leaf nitrogen content (LNC) and seed mass of selected snowbed species. The findings on the adaptation potential of functional traits will be discussed against the background of predicted climate warming and consequent reduction of snow cover duration.

Keywords: Alpine vegetation, snowbed, functional traits, climate change

GRASSLAND VEGETATION IN URBAN HABITATS

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Questions: During the past millennia urbanization considerably changed natural vegetation. Habitat loss and changes in the abiotic environment are seriously affecting urban biodiversity. We tested the following hypotheses: (i) species numbers increase with increasing patch area in fragmented urban landscapes (ii) lower species numbers, and higher ratio of weeds and disturbance-tolerant species is present in the city centre, (iii) the ratio of warm- and nutrient-demanding species increases, while the ratio of and moisture-demanding species decreases towards city centre, (iv) there is an increase in cosmopolitan and alien species and a decrease in species of the natural flora towards the city centre.

Location and methods: We surveyed the natural and spontaneous vegetation along an urbanisation gradient in altogether 15 sites of urban parks, vacant lots and peri-urban areas in the city of Debrecen, East-Hungary. We used vegetation records of five plots of 5×5 meters in every site.

Results and Conclusion: We found a positive species-area relationship for the permanent habitats (urban parks and peri-urban areas), while no relationship was found for vacant lots. The urban parks harboured the lowest number of species. The ratio of weeds and disturbance-tolerants was the highest in the city centre (urban parks and vacant lots) likely due to the high-intensity trampling and soil disturbances. Plant species of city centre were more drought-tolerant compared to peri-urban areas due to the increased level of drainage. The ratio of nutrient-demanding species was the lowest in the urban parks and the highest in the peri-urban areas due to the high nutrient deposit in the cities. The ratio of alien species were high both in vacant lots and peri-urban areas. Ratio of cosmopolitan species was significantly higher in urban parks compared to vacant lots and peri-urban areas. The ratio of native species was the lowest in the city centre.

Keywords: urbanisation gradient, alien species, cosmopolitan species, urban flora

FLORA AND VEGETATION DIVERSITY OF KÜRE MOUNTAINS IN BARTIN, TURKEY

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Küre Mountains National Park, which is located on the Western Black Sea Region of Turkey, has characteristics of a plateau and also known as Isfendiyar Mountains. The National Park starts from Bartın River on the west and extends approximately 300 kilometers to the Kızılırmak River on the east. The study area covers Bartın section (19.000 ha) of the Küre Mountains (37.753 ha). Soil type of the region are grey-brown podzolic soil and red-yellow podzolic soil. Bed rock is mostly limestone. The annual precipitation is about 1040.2 mm and mean annual temperature is 12.9°C. The National Park was identified as one of the 100 Forest Hot Spots of Europe which should be protected. However, it has attracted a number of researches until today.

In this study, flora and vegetation diversity of the National Park will be presented from Flora surveys and 41 relevés which were taken from rupicol, maquis and forest areas so far. The vegetation was collected and classified according to Braun-Blanquet methods. All of vegetation relevés of the region were stored into TURBOVEG. The mapping was developed by means of ArcGIS software.

The forest vegetation of the region is mainly composed of pure and mixed forests of Beech and Fir. Also, pseudomaquis vegetation is found between planar and hill zones in the study area. The elevation of the forest areas from which vegetation samples have been taken vary between 500-919 m, the elevation of maquis vegetation is between 480-550m, and the elevation of grassland vegetation is between 500-920 m. In vegetation sampling, 249 species have been determined from 41 points. A total of 6 endemic taxa were identified, which are *Seseli resinosum* Freyn & Sint., *Phlomis russeliana* (Sims) Lag. ex Benth., *Centaurea cadmea* Boiss. subsp. *pontica* Wagenitz ex Y.B. Köse & Ocak, *Crocus ancyrensis* (Herb.) Maw, *Delphinium fissum* subsp. *anatolicum* Chowdhuri & P.H.Davis, *Sideritis dichotoma* Huter.

KEYWORDS: FLORA, VEGETATION, DIVERSITY, ENDEMIC, KÜRE MOUNTAINS, TURKEY

MAPPING OF HABITATS ACCORDING TO THE CLASSIFICATION OF EUNIS IN CENTRAL BALKAN RANGE, BULGARIA

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Questions: Central Balkan Range is the most representative highest part of the Balkan Range Mountain. The great biodiversity of the area is preserved in three important protected areas – "Central Balkan" National Park, "Bulgarka" Natural Park and "Kamenshtitsa" Reserve. The aim of this study is the mapping of habitats of these protected areas using EUNIS habitat classification.

Location: Central Balkan Range and related protected areas are located in the middle part of Bulgaria. The total mapped territory is 100362 ha.

Method: The mapping of habitats is according to EUNIS habitat classification (Davies & al. 2004) and using specialized GIS software. The maps have been done for management plans of the protected areas.

Results: Almost 90 habitat types (including habitat complexes) were established on the whole mapped area. It includes mostly natural vegetation types like beech and coniferous forests, heathland, subalpine and alpine grassland dominated even by some Balkan endemics, rocky and scree vegetation, etc. But also many forest plantations and some artificial habitats were mapped especially in the lower parts of the area. The largest areas are covered by neutrophile beech forests (34203 ha), *Juniperus sibirica* communities (10870 ha); Bent-Fescue grasslands (4190 ha), etc. Very rare but important habitats are some small lakes, mires and alkaline fens.

Conclusion: The mapping confirmed the great conservation importance of the Central Balkan Range and the habitat diversity as a basis for the rich flora and fauna of the region.

Keywords: maps, habitat classification, protected areas

DOMINANT TREE SPECIES AND STAND DENSITY ARE THE MAIN DRIVERS OF PLANT DIVERSITY IN MANAGED FIR-BEECH FORESTS

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Plant communities of primary and secondary forests with natural or changed tree-species composition are usually compared using parallel plots in mature stands. However, such stands cover only a minor area in the complexes of commercial forests. Real effect of forest management on the species diversity should be, therefore, studied with respect to the stage of tree-stand development.

We addressed this issue in montane fir-beech forests in the volcanic Poľana Mts (Western Carpathians, Slovakia). Series of 230 circular plots (314 m2) in comparable habitats about 1100 m a.s.l. was analysed. Understorey species frequencies, dendrometric measures and environmental properties were sampled. Random plot selection was restricted by geostratification to represent 3 stand types: secondary managed spruce and beech stands, unmanaged primary mixed fir-beech forests (with *Fagus sylvatica*, *Abies alba*, *Acer pseudoplatanus*, *Fraxinus excelsior* and *Picea abies*); and 7 age classes in the managed forests (clear-cuts to 120-year stands).

Mean species diversity and richness was significantly lower in the spruce stands compared to the primary ones according to Kruskal-Wallis test (H´ 1.7/2.4), whereas in the beech managed stands not. Diversity measures varied significantly among age classes in all managed forests. The highest range of diversity indices was in the spruce stands (H´ 0.7–2.9) with a rapid decline from rich clear-cut stages to the age about 40 with the richness close to zero. It contrasts with a stable understorey in the mixed natural stands with a complex stand structure.

Management-controlled tree-stem density related to stand age was found the most important factor affecting the understorey diversity and species frequency. Light is significant only when clear-cuts and closed stands are compared. Litter amount was significant as negative factor for understorey diversity only in the beech dominated forests according to the Spearman´s rank coefficient.

KEYWORDS: ANTHROPOGENIC CHANGES, *FAGUS SYLVATICA*, FOREST COMMUNITIES, *PICEA ABIES*, SLOVAKIA, UNDERSTOREY, WESTERN CARPATHIANS

FESTUCO-BROMETEA ERECTI COMMUNITIES ON THE EDGE OF THE NORTHWESTERN RANGE

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Background: The class *Festuco-Brometea* includes the vegetation of the Eurosiberian steppes and related dry grasslands occurring in warm regions with low rainfall in temperate zone of Europe. According to national grassland review, six associations of *Festuco-Brometea* were found in Lithuania. These communities are of extrazonal type and reach the northwestern border of their distribution area, causing most of them to obtain mesophilic indications.

As there were no relevés from the north part of Lithuania, the main aim of the research was to find out which communities occur in the country's north and which characteristics are specific to *Festuco-Brometea* communities.

Location: Lithuania

Methods: All relevés were collected according to the classical Braun-Blanquet school methods. Environmental conditions were evaluated using Elenberg indicator values and soil chemical analysis (N, P_2O_5, K_2O, pH, humus). Data analysis was done using Juice 7.0, R-project and Past 3.1 software.

Results: Phytosociological data analysis shows that all relevés may belong to *Medicagini-Avenetum pubescentis, Poetum compressae* and phytocoenon similar to the association *Filipendula vulgaris-Helictotrichon pratensis*, which was found in Latvia. The main difference between phytocoenon and *Filipendula vulgaris-Helictotrichon pratensis* is less characteristic species. In the north of Lithuania, we did not *find Helictotrichon pratensis* and *Sesleria caerulea.*

The soil data analysis (PCA) shows that the most important are first two components (explain 43 % and 32 % of data variation). The first component is related to soil fertility, because nitrogen (N) and humus strongly correlated (r = 0.92 and r = 0.90) with the first component, in addition, potassium (K_2O) correlated moderately and phosphorus (P_2O_5) showed low correlation with that component. The second component could be related to soil alkalinity, because soil reaction strongly correlated (r = 0.81) with the second component.

KEYWORDS: *FESTUCO-BROMETEA*, CLASSIFICATION, DISTRIBUTION, LITHUANIA

ROMANIAN GRASSLAND DATABASE (EU-RO-008): THE NATIONAL DATABASE FOR NON-FOREST VEGETATION OF ROMANIA

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Aims: To present the status of the Romanian Grassland Database (RGD) and to attract scientists both to contribute and use data from it.

Location: Romania.

Methods: We started to compile a vegetation-plot database, with the aim to ultimately cover all grassland vegetation types and other herbaceous communities from the territory of Romania. Work on the database started in 2002, and all vegetation plots (relevés) are stored in TURBOVEG program. The Romanian Grassland Database (RGD) is a collaborative effort of the RGD Consortium, has implemented data property and governance rules and elected a custodian and deputy custodian. RGD is registered in the Gobal Index of Vegetation-Plot Databases as EU-RO-008 and has contributed its data to the European Vegetation Archive (EVA) and the global vegetation database sPlot (https://www.idiv.de/splot).

Results: The RGD currently contains 5,195 relevés from various grassland communities recorded during the last 80 years, although there are two peaks of records during 1960's and after 2010. The majority of the data was digitized from literature sources (95%) and the rest comes from unpublished data (5%). The majority of relevés have information on coordinates (95%), plot size (84%), elevation (80%), aspect (68%) and total cover of vegetation (68%). On the other hand, data about cover of herbs, cryptogams and land use type are available only for 13%, 9% and 16% of relevés, respectively.

Conclusions: We have created a valuable resource for vegetation scientists to improve knowledge on Romanian grasslands ecology and we encourage researchers to both make use of, and contribute to, this database. We have identified gaps in the grassland data, for example in records from the period 1970–2000, and we particularly welcome additional data to improve the coverage of the RGD. In the near future we plan to publish a Long Database Report in Phytocoenologia, in which all data contributors by then will become co-authors.

Keywords: collaborative; ecoinformatics; European Vegetation Archive (EVA); grassland; herbaceous; phytosociology; Romania; sPlot; vegetation-plot database

METHOD OF ESTIMATING PLANT SPECIES NUMBER USING SPECIES ENERGY THEORY

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The application of fractal geometry principles for energy optimisation of vertical structure in vascular plants allows accepting the hypothesis of energy equivalence across vascular plant species. The principle of energy equivalence between the species and use of fractal theory for the description of habitat occupation by vegetation in the horizontal direction makes it possible to suggest a physically-based model of vegetation diversity. The model describes the species-energy relationship in direct form and not via non-linear regressions. It takes into account seasonality and inter-annual variability. Despite its simple form in comparison with recent models of biodiversity, the model reproduces very successfully global patterns of vegetation diversity for scales 10000 and 100000 sq.km.
It works well across scales from 100 to 10 000 000 sq.km., i.e. has a range of applicability equal to six orders. The simple form makes it possible an immediate application of the model in practical field work.

We analysed coincidence of computed values of species number of vascular plants (SNVP) with the data observed for different area sizes in Europe, ranging from 100 to 4000 sq.km. The data were collected in vegetation surveys literature and included areas from all ecological zones of Europe starting from forest tundra zone in Norway to genuine steppe zone in Romania.
Despite of variety of vegetation zones and area sizes the values of SNVP are computed very well ($r^2=0.79$, F=114, $P<0.1*10^{-10}$). The slope of calculated against observed SNVP is 1.03, so one can say that for Europe the model works very successful for different scales

KEYWORDS: VASCULAR PLANT DIVERSITY, SPECIES-ENERGY THEORY, MODELLING OF SPECIES NUMBERS

NOTE ON SYNTAXONOMY OF *BROMUS ERECTUS* GRASSLANDS OF EUGANEAN HILLS (NE-ITALY)

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Questions: Previous classical numerical classification studies about *Bromus erectus*-dominated grasslands on calcareous substrate of Euganean Hills revealed the existence of at least three different communities, supported by floristic and ecological features. However the syntaxonomic position of the xeric communities is still unresolved. This contribution aims at verifying the autonomy of these communities, to identify diagnostic species and assign them to the proper syntaxa.

Location: Euganean Hills (NE-Italy)

Methods: A set of published phytosociological relevés belonging to *Brometalia* and *Scorzoneretalia* from northern and central Italy has been analysed together with unpublished relevés from Euganean Hills. In a first step unsupervised (cluster analysis) and supervised (Cocktail method) methods have been used to check and refine the classification of the published relevés. A semi-supervised classification based on K-means algorithm has been used to assign the unclassified relevés to the traditionally recognized units and identify the new ones. Characteristic species of each syntaxon have been identified through the *phi* coefficient.

Results: The difficulties in syntaxonomic interpretation of our relevés reflect the particular geographic position of Euganen Hills. On one hand they are in a transitional connection area among the Mediterranean, the Alpine and the South-Eastern European phytogeographical regions, on the other they appear as islands in the Po plain. The isolation played an important role in the selection of the floristic patterns, influenced by ancient plant migration from Central Europe, from Eastern Europe and from Mediterranean Basin. Numerical analysis provide a contribution to better understanding phytosociological position of our grasslands and to set a proper correspondence within Nature 2000 classification.

KEYWORDS: SYNTAXONOMY, DRY GRASSLANDS, EUGANEAN HILLS, NUMERICAL CLASSIFICATION

CHANGES IN ECOSYSTEM CARBON STOCKS IN RELATION TO NATURAL SUCCESSION: FROM SEMI-NATURAL GRASSLANDS TO ANCIENT WOODLANDS

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The abandonment of pastures and meadows and the consequent succession toward woody vegetation is taking place massively in Europe. This process acts through changes in vegetation that in turn alter litter inputs to soil and the overall carbon (C) dynamics at the ecosystem level. Few studies assessed the direction and the extent of these changes, in particular in southern Europe.

We aimed to quantify the variation of three C pools (above-ground biomass, litter/humus, soil) during the natural succession from abandoned grasslands to woodlands. The study was developed in a hilly area of central Italy in eight chronosequences composed by a grassland, two sites abandoned at different times and occupied by shrublands, a newly formed woodland and an ancient woodland (already present in 1944). All sites shared the same macroclimatic and lithological features, and were equally distributed across two types of natural potential vegetation, both dominated by *Quercus cerris*. The C pools were evaluated according to IPCC methodology.

The C pools changed to a different degree across the chronosequences depending on the type of potential vegetation. The increase in soil and humus C stocks during the natural succession is greater in sites having the warmer vegetation type. These results are particularly relevant for mapping and modeling the C stocks of natural systems; indeed the strong differences that occur at the local scale should be considered in C accounting at the national level.

KEYWORDS: Soil Organic Carbon, Chronosequence, Potential Vegetation, Humus, Biomass

PLANT COMMUNITIES OF TRADITIONAL ORCHARDS IN MYJAVSKÁ PAHORKATINA HILL LAND AND IN BIELE KARPATY MTS (SLOVAKIA)

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Traditional orchards are a valuable feature of our rural landscape and are special for regions with scattered settlements. The permanent flower-rich grasslands beneath trees are usually regularly traditionally managed. In studied region there were 183 phytosociological relevés from orchards recorded during the years 2011 – 2015. The main aim was 1) Syntaxonomical classification of grassland communities in orchards, 2) Comparing species composition and their biological and ecological traits in traditionally managed and large-plot abandoned orchards, 3) Analysis of the main gradients in species composition.

The vegetation description was carried out according to the Braun-Blanquet method. Beta-flexible classification method was used for classification of all dataset. The main environmental gradients of species composition were analysed by Non-metric multidimensional scaling. For the ecological interpretation of ordination axes, the average Ellenberg indicator values for the relevés were plotted onto the ordination diagram as supplementary variables. For functional analysis the BiolFlor - the database on biological and ecological traits was used.

Traditionally managed orchards were classified to four grassland types: 1. *Pastinaco sativae-Arrhenatheretum elatioris* variant with *Briza media*, 2. *Pastinaco sativae-Arrhenatheretum elatioris* 3. *Ranunculo bulbosi-Arrhenatheretum elatioris*, 4. *Onobrychido viciifoliae-Brometum* transitional variant 4. *Brachypodio pinnati-Molinietum arundinaceae* transitional variant. The main environmental gradient in our data set was related to moisture and nutrients. Abandoned and ruderalised orchards were separated in numerical classification in the first level of division. Functional analysis points out specific composition of orchard grassland communities. This contribution was supported by the grants VEGA 1/0103/14 and VEGA 2/0099/13.

KEYWORDS: ORCHARD MEADOWS, SYNTAXONOMY, FUNCTIONAL ANALYSIS

DIVERSITY OF THE EUROPEAN RAVINE AND NOBLE-HARDWOOD FORESTS

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Noble-hardwood forests include mesophilous and xerothermophilous broad-leaved forests occurring mainly in ravines, on steep slopes, on the foot of slopes and cliffs. These habitats are characterized by unstable soil conditions preventing the succesion towards climax communities, especially oak forests in lower altitudes and beech forests in higher altitudes. Instead, nutrient- and moisture-demanding tree species prevail: maples (*Acer platanoides*, *A. pseudoplatanus*), ash (*Fraxinus excelsior*), limes (*Tilia cordata*, *T. platyphyllos*) and elm (*Ulmus glabra*).

In general, noble-hardwood forests are rich in species and often contain relict and endemic species which survived Quaternary glaciations in southern European refugia. In most of the European continent, these forests represent azonal vegetation. However, outside the range of beech and hornbeam (in North-western and Eastern Europe) they can also be found on plains. Except the northernmost parts, noble-hardwood forests can be found in most of the Europe. Generally, they are absent only in flat lowland regions and on mountain summits.

Noble-hardwood forests of central Europe are classified within the alliance *Tilio-Acerion*. However, decision about inclusion of similar stands from different parts of Europe within this alliance is a subject of discussions. Moreover, association-level syntaxonomy on the supranational scale is even more inconsistent. Therefore, syntaxonomical revision based on numerical analysis of international data sets would be beneficial.

Aim of this project is to prepare a data set of phytosociological relevés of noble-hardwood forests from the whole Europe. Relevés would be obtained mainly from the European Vegetation Archive (EVA). Insufficiently explored regions would be visited in order to record new relevés. Subsequently, numerical analyses of variability would be performed and revisited syntaxonomical system of noble-hardwood forests will be proposed based on the results of analyses.

KEYWORDS: SYNTAXONOMY, CLASSIFICATION, PHYTOSOCIOLOGY, VEGETATION ARCHIVE, FOREST VEGETATION

WHERE WE KNOW (AND WE DON'T KNOW) THE FORESTS: THE CASE STUDY OF FORESTE CASENTINESI NATIONAL PARK (ITALY).

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What we know about forest vegetation dynamic is related to temporal data availability.

In addition, where we know forests is related to the distribution of these data in space and time.

Here we present the first results of a research regarding the spatial and temporal knowledge of forestry areas inside the Foreste Casentinesi National Park.

The park is located in the south-eastern part of the northern Apennines, covering an area of about 36.000 ha, with an altitudinal range between 400 m amsl and 1.658 m amsl.

This protected area represents a good source of information about the mountainous forests of the northern Apennines, at least for two reasons.

First, almost the 90% of the national park area is covered by woods and, due to its altitudinal range and its geomorphologic heterogeneity, the spectrum of forest types in the park can be considered representative for the northern Apennines.

Second, a huge number of historical plot data is available for the forest vegetation in this area. In fact, more than 600 phytosociological relevés where conducted in the past, covering a temporal window of the last 70 years. This means that we have available a lot of temporal and spatial information about species composition of different forest communities inside the park.

The first step of this research consisted in the collection of both published and unpublished relevés, from various sources. We digitized and georeferenced the plot data. Then, we added these data to a shared database (anArchive), with the aim to make them available also for other studies.

To fill the gaps in the knowledge, first we have to know what we know.

So, we mapped the historical series of data and we analyzed the distribution of knowledge (sample data) in space and time. We found some relevant relationships with abiotic factors too. Moreover, we found some "dark zones" never sampled in the past that could be interesting to investigate.

We analyzed the data using QGis, GRASS and R.

Starting from these results, the next steps of our research include the study of dynamism of diversity inside and between forest communities, in time and space (even with resurveys) and at different levels (from species to communities).

KEYWORDS: Forests, spatial analysis, historical plot data, Foreste Casentinesi National Park, GIS, biodiversity

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