

Eastern Alpine and Dinaric Society for Vegetation Ecology

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37<sup>th</sup> Meeting

Prizren (Kosovo), 13 –16 July 2017

## *Book of Abstracts*



*Tulipa kosovarica*

37<sup>th</sup> Meeting of Eastern Alpine and Dinaric Society for Vegetation Ecology

BOOK OF ABSTRACTS

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# Plenary lectures



*Tulipa kosovarica*



## European Red List of Habitats – presentation of the project results

Andraž Čarni<sup>1,2,4</sup>, Nina Juvan Mastnak<sup>1</sup>, Vlado Matevski<sup>3,4</sup>, Đordije Milanović<sup>5</sup>, Fadil Millaku<sup>6</sup>, Daniela Stešević<sup>7</sup>, Vladimir Stupar<sup>5</sup>, Željko Škvorc<sup>8</sup>

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The results of the Project European red list of terrestrial and freshwater habitats have recently become available. In the Project many researchers from the whole Europe, including researchers from Southeastern Europe have been involved. This is the first Red List of habitats that reviews the current status of natural and semi-natural habitats in Europe and gives an information about the major pressures on them. The information about habitats have been collected from all over Europe and the evaluation have been done according to modified version of IUCN criteria. The assessment provides the evaluation of 233 habitats with detailed description, distribution maps, identification of typical habitats for biogeographic region, list of threats, conservation measures and restorability.

Among habitats with the highest percentage of threatened types (categories: Critically endangered, Endangered, Vulnerable) we can find mires and bogs (54%), followed by grasslands (49%), freshwater habitats (38%) and costal habitats (43%). Relatively low percentages of heathland and scrub, forests, and sparsely vegetated habitats were assessed to be threatened.

### Reference:

Janssen, A.M., Rodwell, J.S., García Criado, M., Gubbay, S., Haynes, T., Nieto, A., Sanders, N., Landucci, F., Loidi, J., Ssysmak, A., Tahvanainen, T., Valderrabano, M. et al. 2016. *European Red List of Habitats - Part 2. Terrestrial and freshwater habitats*. Publication office of EU, Luxembourg.

## Vegetation that develops in the neighboring area of abandoned mines on antimony and arsenic bedrock in the southern part of the Republic of Macedonia

Vlado Matevski<sup>1,2</sup>, Andraž Čarni<sup>1,3</sup>, Mitko Kostadinovski<sup>2</sup>, Renata Čušterevska<sup>2</sup>, Olivera Matevska<sup>4</sup>, Katerina Bačeva Andonovska<sup>5</sup>, Trajče Stafilov<sup>6</sup>,

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The object of our investigation is vegetation on antimony and arsenic bedrock that develops in southern part of the Republic of Macedonia. As it is known that the abandoned mines and mining areas are a great important issue because they can be a major source of environmental pollution. The Allchar mine is an abandoned mine located in the north-western part of Kožuf Mt.

On this locality develops specific vegetation on arsenic and antimony bedrock, with several stenoendemic species such as *Asyneuma canescens* subsp. *cordifolium*, *Centaurea leucomala*, *Onobrychis degenii*, *Thymus alsarensis*, *Viola allchariensis*, *Viola arsenica*, *Viola frondosa*, *Knautia caroli-rechingeri* and others. Some of these endemic species are adapting and accumulate elements that are in extremely high content in the soil, like As, Sb and Tl that are naturally present in this region. Species growing on antimony and arsenic soils possess a range of adaptations to these severe ecological conditions, such as ability to hyper accumulate heavy metals in their tissues.

In this work two new associations are presented - ass. *Onobrychido-Violetum allcharensis* and *Peucedano schotti - Violetum arsenicae*, as well as some discussion about their syntaxonomic position will be given.

## Recovery of a grassland community invaded by *Brachypodium rupestre* after multi-annual mowing treatment

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In the last decades, wide grassland areas of central Apennines underwent grazing cessation or decrease in livestock pressure below the theoretical carrying capacity. This triggered the spread of *Brachypodium rupestre*, a competitive stress-tolerant species, which plays a dominant role in grassland ecosystems, affecting species composition and diversity. The research aim was to understand the recovery mechanisms in a grassland community invaded by *B. rupestre*, after repeated mowing events. In a homogeneous calcareous area in central Apennines, undergrazed since about thirty years ago, we fenced an area invaded by *B. rupestre*, inside which we randomly selected 30 plots (0.5 x 0.5 m). Within each plot we collected species cover (%) in late June for six years. The area was mown every year in July and October. Litter and hay were removed after each mowing event. We assessed the trends of diversity indices, *B. rupestre* cover, cover of indicator species of each year (as determined by Indicator species analysis), and examined the change of the relation between diversity indices and *B. rupestre* cover, using linear regression.

We found that *B. rupestre* decreased significantly its cover; conversely, other species, especially some leguminous species and caespitose grasses, showed the opposite trend. Species richness, Shannon and Gini-Simpson indices increased significantly, especially after the first year of treatment. *B. rupestre* cover explained evenness variation among plots only before the treatment, suggesting the importance of the initial intervention of litter removal in triggering the start of a change in community structure. Shannon and Gini-Simpson indices were influenced up to the third year, indicating a marked change in community structure from the fourth year. Richness was not significantly related to *B. rupestre* cover neither before nor during the treatment, indicating that *B. rupestre* spread had not affected community's species pool before the start of the experimentation.

## **Vegetation and flora of 10 natural forest reserves in the Federal Province of Salzburg (Austria)**

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Between 2011 and 2016 10 natural forest reserves in the Federal Province of Salzburg were investigated: Gaisberg (17,5 ha), Saalach (10,5 ha; both in the District of Flachgau), Biederer Alpswald (28 ha; Tennengau), Kesselfall (80 ha), Vorderweisstürchlwald (6,5 ha), Rosswald (4,2 ha), Stoissen (71,5 ha), Mitterkaser (425,5 ha), Hutterwald (30 ha) as well as Wiedrechtshausenwald (10,5 ha; all in the District of Pinzgau). The natural forest reserves belong to the Austrian Federal Forestry Office but to private landowners as well; they are protected through long lasting bilateral contracts made between the Federal Province government and the landowners.

For all of the natural forest reserves the following works were done: determination of all forest and shrub communities regarding the system of WILLNER & GRABHERR (2007) using relevés following the Braun-Blanquet approach; an area-wide vegetation mapping; at least one permanent plot with relevé for all found forest communities (area of a circle with radius 13 m); dead wood proportion, regeneration survey and browsing damage following standard methods of forest inventory for all permanent plots; vascular plant checklist. The present work represents the first systematic investigation on flora and vegetation of nearly all natural forest reserves in the Federal Province of Salzburg. Comparisons to single former investigations show more or less stable communities with only slight floristic shifts over the last 20-30 years.

# Oral presentations



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

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Pedunculate oak (*Quercus robur* L.) is economically one of the most valuable hardwood tree species, which due to its wide ecological niche forms different types of forests widespread in Europe. The aim of this study was to investigate the floristic and ecological characteristics of the pedunculate oak forests in Europe. For this purpose, a data set of 14745 phytosociological relevés with pedunculate oak was used, obtained from the European phytosociological database (EVA - <http://euroveg.org/eva-database>) and the literature (for areas that were not included in the European database). After the stratification, the analysis was conducted on 3594 phytosociological relevés. Based on the hierarchical cluster analysis, we defined five basic groups of relevés, i.e., types of pedunculate oak forests in Europe, which differ in their floristic, ecological and geographical characteristics. On fine-scale division, they could be further divided into 17 different subtypes, so the data was observed and analyzed on two levels. For each of these five forests types, the area of distribution and diagnostic plant species were determined, a DCA ordination analysis of relevés based on floristic composition was performed with passive projection of syntaxonomic affiliation of species. The results show clear differences in floristical and ecological features among the groups obtained from the cluster analysis. The atlantic and subatlantic groups of relevés could be clearly separated from the continental group. Within the latter thermophilous and mesic forests, as well as extrazonal forests in alluvial river areas could be distinguished. At finer scale of 17 different forest subtypes, the differentiation is based on ecological differentiation of site conditions evaluated by Ellenberg indicator values and distribution reflected in change of chorological spectrum.

## Forest Communities of Küre Mountains in Bartın, Turkey

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The object of this study is to analyse the forest communities of Küre Mountains in Bartın (Turkey). Küre Mountains National Park, which is located on the Western Black Sea Region of Turkey. The altitude of the relevés varies between 48 m to 1098 m. The vegetation was collected and classified according to Braun-Blanquet methods. All of the relevés were stored into TURBOVEG and the classification was done within JUICE software. Forest vegetation data consists of 121 relevés and 245 different taxa. As a result of the classification using TWINSpan, it occurs a structure from thermophile forests through hygrophilous forests. Based on the classification and ordination following classification scheme was proposed:

Upper Class: Querco-Fagea Fukarek-Fabijanik 1968

Class: Querco-Fagetea Br. Bl. et Vlieger ex Vlieger 1937

Order: Populetalia albae Br. Bl. ex Tchou 1948

Alliance: Alno-Quercion roboris Horvat 1950

Association: **Acerio campestri ass. nova**

Alliance: Salici-Platanetum orientalis Kutbay & Kilinc 1995.

Association: **Salicio-Platanetum orientale ass. nova**

Order: Rhododendro-Fagetalia orientalis Quezel et al. 1980

Alliance: Castaneo carpinion Quezel et al. 1980

Association: **Vaccinio arctostaphyli-Rhododendretum pontici Vural 1987**

Order: Rhododendro pontici- Fagetalia orientalis Quezel, Barbero & Akman 1980

Alliance: Crataego pentagynae-Fagion orientalis Quezel, Barbero & Akman 1980

Association: **Ilici colchicae-Fagetum orientalis Quezel, Barbero & Akman 1980**

Class: Quercetea pubescentis (Ober, 1948) Doing Kraft. 1955

Order: Querco-Carpinetalia orientalis Akman et al. 1980

Alliance: Buxo-Staphylon Quezel et al. 1978

Association: Buxo sempervirens- Carpinetum betuli N. Aksoy 2006

Association: **Rubo hirtus-Abietum bornmuelleriana N. Aksoy 2006**

Order: Querco Cerridis-Carpinetalia Orientalis Akman, Barbero & Quézel 1980

Alliance: Carpino Betuli-Acerion Hyrcani Quézel, Barbero & Akman 1978

Association: **Carpino-Quercetum petraeae Yurdakulol, Demirörs & Yildiz 2002**

Class: Quercetea ilicis Br. Bl. 1947 ex A. & O. Bolos Y Vayreda 1950.

Order: Quercetalia ilicis Br. Bl. 1936 em. R. M. 1974.

Alliance: Quercion ilicis Br. Bl. (1931) 1936 em. R. M. 1974

Association: **Phillyreo latifoliae- Pinetum brutiae Schwarz 1936**

**Acknowledgements:** This study is supported by TÜBİTAK, Project number: 114O660

**Keywords:** Forest Vegetation, Küre Mountains, National parks, Turkey

## Association Ramondo – *Ostryetum carpinifoliae* ass. nova. prov.

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Genus *Ramonda* in Europe is represented with three species: *Ramonda nathaliae* Pančić & Petrovič, *Ramonda serbica* Pančić and *Ramonda myconi* (L.) Rchb. The two first species are endemic Balkan species that are distributed also in Kosovo. These species grow in limestone as well as serpentine substrates, forming that way chasmophytic vegetation. Species *Ramonda nathaliae* is distributed in the Northern and Central parts of Macedonia, in Northern Greece, in South-Eastern Serbia and in Kosovo in two localities within Sharri Mountains (Luboten and Gotovushë). *R. nathaliae* in serpentines of Macedonia forms the following plant Associations: Asplenio-Ramondetum *nathaliae* and Scorzonero-Ramondetum *nathaliae*, while in limestone substrates forms the ass. Achilleo-Ramondetum *nathaliae*.

*Ostrya carpinifolia* Scop. within the order Quercetalia pubescenti-petraeae, alliance Fraxino orni-Ostryion forms the ass. Querco pubescentis-Ostryetum *carpinifoliae*. Within the order Fagetalia sylvaticae, alliance Aremonio-Fagion it forms the ass. Ostryo-Fagetum, while within the alliance Fraxino orni-Ostryion it forms the ass. Querco-Ostryetum *carpinifoliae* and ass. Corylo columnae-Ostryetum *carpinifoliae*.

The phytocoenological research studies were made using the principles and methods of the Zürich-Montpellier School. This paper presents plant communities of *R. nathaliae* and *Ostrya carpinifolia* on limestone habitat, where the new proposed plant association named Ramondo – *Ostryetum carpinifoliae* ass. nova. prov. is described. This plant community belongs to the class Querco – Fagetea, order Quercetalia pubescentis and alliance Fraxino orni-Ostryion. This plant community was found and described on the limestone substrate in Luboteni Mt. (960 - 982 m. a.s.l.), in Republic of Kosovo, close to the border with Republic of Macedonia.

## Relationships between soil and vegetation in Ancares Mountains (Lugo-León, Spain). II. Geomorphology, soil and vegetation

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The climatic vegetation of the Sierra de Ancares (Lugo-León) corresponds to deciduous forests (oak, black-oaks, birches, beeches, hazelnuts, alders, alders, alders and willows), although due to the exploitation since time immemorial, part of the same is occupied by shrubs and pasture lands. The main communities are included in Cytisetea scopario-striati, Calluno-Ulicetea, Pino-Juniperetea, Molinio-Arrhenatheretea and Nardetea strictae phytosociological clusters, as well as hygro-altered communities; in highest point, upper 1.700 m, some subalpine communities are growing. This paper presents the results of a total of 24 pit-soils and mean soil samples corresponding to the different communities in the area, ranging from the mountain and subalpine belts, between 440 and 1980 m altitude. The different horizons are described and the physical and chemical properties of the soils are given. The soils correspond to different types of regosol, cambisol, histosol, lithosol and phaeozem. The types of soil and vegetation are related to the geomorphological characteristics of the area, where we find some relationships such as cambisoles-*Luzulo carpetanae-Pedicularietum sylvaticae*-peatlands, lithosols-*Cryptogram-crispae-Silenetum herminii*-scree, leptosols, leptosols-*Teesdaliopsis confertae-Festucetum indigestae*-crests and cryoturbated slopes, leptosol limicos-*Junipero nanae-Vaccinetum uliginosi*-places of temporal snow, etc.

Keywords: Edaphology, fitosociology, slates, granites, ecology, subalpine

## Overview of the flora and vegetation of the Albanian Alps - the degree of conservation and threats

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The Albanian Alps are the southernmost part of the Dinaric Alps, a mountain range that extends from northern Albania to Kosovo and eastern Montenegro. The peak Jezerca in Albania (2,694 m) is the highest of the entire high mountain massifs, all with a pronounced steep and rugged topography, complex geomorphology and glacial features. About 2010 km<sup>2</sup> extend within Albania, composed of three main subregions: Vermoshi, Thethi and Valbona.

The flora and vegetation of the Albanian Alps is among the richest on the Balkan Peninsula. To date, more than 1630 plant species have been described; about 50 of them are endemic, sub-endemic and endangered plant species at the Albanian Red List (2013). Four Albanian endemic species, *Wulfenia baldaccii*, *Alchemilla albanica*, *Ligusticum albanicum* and *Gentianella albanica*, occurs only in Alps. Six other species are sub endemics with a very narrow distribution range in between two countries, Albania-Kosovo or Albania-Montenegro, *Centaurea alba* subsp. *ipeccensis*, *Edraianthus serpyllifolius*, *Plantago reniformis*, *Pedicularis ernesti-mayeri*, *Melampyrum doerfleri* and *Stachys beckeana*; four species with quite international or global conservation interest, *Heliosperma macrantha*, *Orobancha krylowii*, *Lunaria telekiana* and *Sesleria wettsteinii* occur in the Alps and also elsewhere in Albania. More than 20 habitat types with conservation interest are identified within the Albanian Alps; five are priority habitats that require special conservation measures, i.e. bushes with *Pinus mugo* and *Rhododendron hirsutum*; species-rich *Nardus* grasslands, on siliceous substrates; active raised bogs; limestone pavements and *Tilio-Acerion* forests of slopes, screes and ravines.

Due to their high biodiversity and other pristine natural values, the areas around Thethi and Valbona constitute two separate National Parks. Nowadays, there are plans to create the enlarged Albanian Alps NP, which would embrace a massive area of 860 km<sup>2</sup> of Vermoshi, Thethi, Valbona and Gashi River. However, two major Moratoria are in vigor in Albania, one on Forests and the other on Hunting, due to illegal deforestation and hunting, where to some extent even the two Alpine NPs are affected. Unsustainable and poor harvesting practices of medicinal aromatic plants are also used. Moreover, Hydro Power Plants are contracted for construction within the Albanian Alps, 8 of which are wholly within existing Valbona Valley NP, and 2 within Thethi NP, endangering the integrity of the whole area, either separately or in synergy, and changing biodiversity and other natural values.

## Changes in species and functional composition in not managed (by more than 40 years) *Ostrya carpinifolia* coppiced woods

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In temperate and sub-Mediterranean climate, management is a key factor driving the temporal pattern of species in forest ecosystems, because it alters ecological parameters such as light, temperature, humidity and soil properties. Considering the susceptibility of plants to stress and disturbance, we investigated the species and functional responses of the herbaceous layer of sub-Mediterranean coppiced woods of Umbria-Marche Apennines (central Italy), dominated by *Ostrya carpinifolia* (mature forest stands). Our hypothesis was that species and functional composition of the herbaceous layer exhibits significant shifts after the end of coppice rotation cycle.

We selected 38 plots (20 x 20 m) in *Ostrya carpinifolia* coppiced woods, half of which at the end of the coppicing rotation cycle (20-25 years since the last coppicing), and the other half after its end (more than 40 years). We collected species cover (%) and species categorical traits (storage organ, vegetative propagation, leaf anatomy and persistence, flowering phenology and seed weight), tree, shrub and herb layers cover (%), topographic variables (altitude, aspect and slope angle), outcropping rock and debris cover (%). We calculated the cover-weighted abundance values of trait attributes. The species and traits data sets were analysed using Indicator Species Analysis, Redundancy Analysis and variation partitioning.

We found that species composition was mainly influenced by the membership in one of the two groups of plots (at the end or after the end of coppice rotation cycle) and by the cover percentage of the vegetation layers, which together explained about the 70% of variance.

Woods beyond the end of coppice rotation cycle had more mesophilous and nitrophilous indicator herb species, besides summer green leaves, tap root as storage organ, and heavy seeds as indicator trait states, while woods at the end of coppice rotation cycle had persistent green leaves, rhizome fragmentation and absence of storage organs as indicators.

## Evidence for climatic drivers and phylogenetic diversity corelation of dry grasslands in Republic of Macedonia

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**Questions:** By sampling dry grassland plant communities in the Republic of Macedonia, southern Balkans, calculating their phylogenetic diversity, and relating it to climatic variables, we aimed to answer three questions: (1) Does evolutionary history decrease towards colder, drier, and more seasonal climatic conditions? (2) Is environmental filtering more important in colder, drier, and more seasonal climatic conditions? (3) Are there nodes on the phylogenetic tree that identify evolutionary divergences associated with spatial segregation?

**Location:** We used a database consisting of 575 plots, 259 of which on carbonaceous rock and 316 on siliceous rock, placed on dry grasslands all over the Republic of Macedonia located in the southern portion of the Balkan Peninsula. Each plot had 100 m<sup>2</sup>, because of the relatively homogenous vegetation at this scale.

**Methods:** We built a phylogenetic tree for the species, using Bell et al. In each plot, we recorded the coordinates and, based on them, extracted altitude and the 19 climatic variables available on WorldClim. We applied Spearman correlation analyses to test whether altitude and the climatic variables were correlated, excluding from further analyses variables highly correlated to others ( $\rho > |0.7|$ ). To answer the first question, we calculated Phylogenetic Species Richness per plot, using the community matrix and the phylogenetic tree. To answer the second question, we calculated Phylogenetic Species Variability per plot. To answer the third question, we calculated the Specific Overrepresentation Scores for all nodes in the phylogenetic tree as a measure of clade overrepresentation, with 999 randomisations. We carried out all analyses in R (R Development Core Team 2016).

**Results:** In the 575 plots, we found 767 species, belonging to 59 families, for which we built a phylogenetic tree. Phylogenetic Species Richness varied from 3.9 to 37.1, with a mean of 18.7 and a standard deviation of 5.2. Phylogenetic Species Richness decreased towards warmer in the driest period, drier, and more seasonal climates. Phylogenetic Species Variability varied from 0.33 to 0.43, with a mean of 0.35 and a standard deviation of 0.01. Phylogenetic Species Variability decreased towards warmer climates with less seasonal temperatures. Four nodes in the phylogenetic tree presented scores higher than 0.55, corresponding to major distributional divergences in Macedonian dry grassland communities.

**Discussion:** We found a strong signature of evolutionary history in species sorting across a gradient driven by climate in Macedonian dry grasslands. First, the amount of evolutionary history decreased towards drier and more seasonal climates, suggesting a phylogenetic niche conservatism. Second, there appear to be an air temperature filter and a temperature seasonality filter, acting in opposite directions and leading to phylogenetic clustering. Third, there were few nodes in the phylogenetic tree with high degree of allopatry, associated with clades that differed not only in their geographic distribution, but also in their climatic preferences.

## Habitat mapping and preliminary habitat map (1:5000) of the City of Slatina, Croatia

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As part of botanical research in the City of Slatina, habitat mapping was conducted over its entire area of 168 km<sup>2</sup> during the period of March to October in 2016. A preliminary habitat map has therefore been created, scaled at 1:5000, as a result of the first attempt at detailed habitat mapping of Slatina. Almost the entire research area has been physically surveyed, the habitat types recognized, photographed and approximately delineated on site by using a handheld GPS device. All data gathered in the field were then transferred to GIS environment where delineations have been corrected through photo-interpretation of available maps, mostly CNES/Astrium satellite imagery. In order to define the encountered habitat types, the latest version of National habitat classification (NHC) has been followed. In view of the current results, with a total of 175 habitat types on different levels of the NHC, the City of Slatina has a notable habitat diversity consisting of various aquatic/marshland, grassland, forest and ruderal habitats, including a number of man-made land types such as arable fields, orchards and vineyards. As a general rule, which is a consequence of geographic position and terrain dynamics, the northern lowland part of Slatina is predominantly agricultural with the forest cover largely belonging to vegetation of pedunculate oak (*Carpino betuli-Quercetum roboris*). The majority of southern colline range, going up to 260 m of elevation, is covered by sessile oak (*Epimedio-Carpinetum betuli*) interspersed by villages and the accompanying land use. Grassland vegetation mostly belongs to associations *Bromo-Cynosuretum* and *Arrhenatheretum elatioris*, with the total areas of 145 ha and 84 ha, respectively. Classes *Lemnetea* and *Phragmito-Magnocaricetea* are main constituents of aquatic and marshland vegetation, while *Solidaginetum serotinae-canadensis* takes up the largest total area within ruderal habitats. The current data is undergoing a number of follow-up surveys to improve accuracy of the habitat map before the final map version is produced.

## Syntaxonomical diversity of grassland vegetation of Haskovo and Mineralni Bani municipalities, south-eastern Bulgaria

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**Aim:** The main aim of the study is revealing the syntaxonomical diversity of grassland vegetation on the territory of Haskovo and Mineralni Bani municipalities (Bulgaria).

**Material and methods:** During 2015-2016 vegetational seasons years were collected 87 relevés applying the Braun-Blanquet approach, which were stored in Balkan Dry Grassland Database and (EU-BG-001) and Balkan Vegetation Database (EU-00-013). We used numerical methods for analyzing (TWINSPAN Modified, PC-ORD, European Expert system). Later on we tested results from different methods. Mapping of vegetation units were done using ArcGis 10.0 software.

**Results:** Syntaxonomical diversity is represented by 7 classes (*Festuco-Brometea*, *Helianthemetea guttati*, *Galio-Urticetea*, *Phragmito-Magnocaricetea*, *Artemisietea vulgaris*, *Koelerio-Coryneporetea*, *Stellarietea mediae*), 8 orders, 9 alliances, 6 association and 9 communities. Dry grassland vegetation types of *Festuco-Brometea* and *Helianthemetea guttati* classes have widest distribution and are used as pastures. Ruderal vegetation is found close to villages and belong to *Artemisietea vulgaris*, *Galio-Urticetea* and *Stellarietea mediae* classes. *Phragmito-Magnocaricetea* class includes phytocoenoses of *Typha angustifolia*, *Bolboschoenus maritimus* and *Eleocharis palustris*. It is located along streams, rivers and around dams in the study area.

**Conclusions:** This is the first study of syntaxonomical diversity of grassland vegetation on the territory of Haskovo and Mineralni Bani municipalities according to the Braun-Blanquet approach. It is characterized by dominance of xerophytic and xero-mesophytic vegetation types.

**Keywords:** Braun-Blanquet approach, classification, numerical methods, mapping,

## Development of a national vegetation database for Turkey: a preliminary study

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Vegetation databases play a crucial role for a consistent vegetation classification and analysis using the most recent numerical methods. In Turkey, phytosociological studies started increasingly from the 1960ies and most were confined to small areas (*i.e.*, valleys, mountains or national parks). Until now, large numbers of sample plots (relevés) were collected from important forests areas by individual researches but vegetation database were only formed for some forests types like Beech and Oak forests. The aim of this study is to make a regional vegetation database including all vegetation types and thus contribute to national vegetation database. At this step, Euro-Siberian phytogeographic which has been intensively studied were selected. In the context of the study, all published and unpublished vegetation data were compiled and most of them were stored into TURBOVEG program. As a result, it was found that about 4181 plots are available from mostly forest areas as well as maquis and alpine grasslands. Among these data, a total of 2638 plots (1817 taxa) were stored in TURBOVEG which cover coniferous and deciduous-mixed forests. Also, maquis or grassland vegetation were also represented with lower ratio in the dataset (90 relevés). Main forest types in the dataset composed of *Abies nordmanniana* ssp. *bornmülleriana* and ssp. *nordmanniana*, *Pinus nigra*, *P. sylvestris*, *P. brutia*, *Fagus orientalis*, *Castanea sativa*, *Quercus petraea*, *Q. pubescens*, *Q. frainetto*, *Q. hartwissiana* and also *Picea orientalis* forests in the colchic zone. In this study, it was seen that some technical issues must be solved with a common agreement among collaborators of a national-scale project. Firstly, data management and input must be organized with a standard protocol. In addition; managing taxonomic lists and synonyms, data sharing agreements and ethical issues must be determined.

## The heliophilous herbaceous edge communities of the *Trifolio-Geranietea* class in Italian peninsula: syntaxonomy biogeography, syndinamics and managements implications

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A synthesis on the heliophilous herbaceous edge syntaxa of the *Asphodeletalia macrocarpi* Biondi & Allegrezza 2014 order (*Trifolio-Geranietea* class) recognized in Italian peninsula and update by recent published studies (Biondi et al. 2015, Allegrezza et al. 2016) is presented. 181 published relevés conducted in different areas of the central-southern Apennines were used to define the syntaxonomy, the vegetation dynamics, and the plant landscape. Three suborders of the order *Asphodeletalia macrocarpi* are recognized for central and southern Italy: *Asphodelenalia macrocarpi* (suborder *typus*), *Senecio scopolii-Brachypodienalia genuensis* and *Dorycnio herbacei-Brachypodienalia rupestris*. The indications of the environmental features and preferential dynamic relationships of each syntaxa considered (at alliance level) contribute, in the present state of knowledge, as well as to define and clarify the ecological and landscape range of the order *Asphodeletalia macrocarpi*, to complete the main landscape units described for the central-southern Italy. At plant community level, the plant biondicators carry out by vegetation dynamics studies are fundamental to following the abandonment of the traditional anthropic practices on the grasslands, especially in the early stages that characterize it. Together with detailed ecological integrated studies on permanent experimental areas, this is the basis for monitoring and for the planning of conservation, recovery and/or restoration actions of the grassland habitats.

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## Alpine and subalpine Heaths on Balkan Peninsula with emphasis on Macedonian mountains

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Phytocoenological and ecological structure as well as the syndinamics and synsystematics has been compared in heaths on Balkan Peninsula. A total of 775 relevés from literature and 24 own relevés made on Galičica and Jablanica Mountains (R. Macedonia) were compared and analyzed. The data were stored in Turboveg, and then process in Juice software. We determined a chorological spectrum and life forms of all groups of relevés. To confirm the influence of the major environmental conditions on the vegetation were used average of Ellenberg indication values.

The analysis show that formation dominated with *Erica carnea* and *Genista radiata* with their floristically composition and environmental conditions are obviously much different and so far undescribed communities. The communities are registered at several sites at the upper forest border, in the belt of mountain pasture distributed at the altitudes between 1800-2050 m. However, we have to mention that in these communities are found species of other classes, especially taxa characteristic for the classes *Elyno-Seslerietea* and *Daphno-Festucetea*. indicating on the fact that it is a transitional stage in the successive development of vegetation. Because of topographical conditions, geological substrate, the continuing destruction of the vegetation cover and other environmental factors, it will take a longer time period especially on Galičitsa Mt., while on Jablanica Mt. it is in an advanced stage.

These communities are located at the timberline in subalpine belt on Galičica Mt., and higher on Jablanica Mt. Syndinamically they are connected with the oromediteranean forest of Macedonian pine (*Pinus peuce*) in subalpine area on Jablanica, while on Galichica Mt. which refer to the belt of beech or beech-pine forests –the belt which was destroyed under the pressure of establishing of pasture in the past. Solitary appearances of Bosnian pine (*Pinus heldreichii*) indicated existing of such forest in the past on both mountains in subalpine belt on limestone near these communities.

Acording to preliminary made analyses we propose the following syntaxonomic scheme: *Trifolium piltzii* – *Erica carnea* community on Jablanica Mt. in Class *Erico- Pinetea*, Ordo *Rhododendro hirsuti* - *Ericetalia carnae*, Aliance *Ericion carnae*, and *Daphne oleoides-Genista radiata* community on Galičica Mt. in Class *Rhododendro hisruti* – *Ericetea carnae*, Ordo *Rhododendro hirsuti-Ericetalia carnae*, Aliance *Daphno blagayanae-Genistion radiatae*.

## Distribution and ecology of the epiphytic alliance *Lobarion pulmonariae* in Croatia

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The alliance *Lobarion pulmonariae* Ochsner 1928 is the major climax community of epiphytes on trees in undisturbed and old-growth forests in Europe. It includes large foliose lichens of the genera *Lobaria* and *Sticta*, smaller foliose lichens of the genera: *Fuscopannaria*, *Nephroma*, *Pannaria*, *Parmelia*, *Pectenaria*, *Peltigera*, many crustose lichens, and a number of bryophytes. Based on checked literature records and lichen collections at herbaria in Croatia and abroad, and field surveys undertaken since 1990s, a distribution map of the alliance *Lobarion pulmonariae* in Croatia has been created. It shows frequent distribution in the montane belt of the Dinaric Mountain chain, and in the Middle and southern Dalmatia (at higher elevation in hinterland, near the coast of the Adriatic Sea and on islands), with a disjunctive distribution in the montane belt in the Pannonian region. Main climate conditions required for growth of lichens from the alliance are moderate light, high air humidity and annual rainfall above 1,000 mm. It was found that distribution of *Lobarion pulmonariae* in Croatia overlaps with annual rainfall division, and is restricted by isohyet of 1,000 mm. Among 13 host trees recorded for epiphytic lichens, the main species are *Fagus sylvatica*, *Acer pseudoplatanus*, *Quercus pubescens*, *Quercus ilex*, *Picea abies* and *Abies alba*. Occurrence of lichens relates directly to the presence of old, large host trees and bark pH value. Mean tree circumference of host trees ranged from 106 cm to 179 cm; maximum in *Acer pseudoplatanus* (390 cm), and *Fagus sylvatica* (363 cm). Bark pH was in optimal range, between 5.8 and 6.9. Epiphytic lichens make an important component of the total biodiversity in many forest ecosystems. Conservation measures are mainly related to forest management practice. It is important to reduce habitat disturbance and secure substantial number of retention trees carrying the epiphytic lichens.

## Fungi in Kosovo – the Preliminary Data of their Diversity and Ecology

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Fungi of Kosovo are studied very scarcely and only few official data are available. There are also unpublished data for more than one hundred species collected mainly in the area of Geremia Mountain. In this study, an inventory of the macrofungi in Kosovo was performed through the collection of sporocarps of Basidiomycetes and Ascomycetes over a period of three months. Sampling was performed in selected localities of diverse climate and vegetation features, aimed at achieving greater variety of the collected fungi species, and different substrates both on deciduous and coniferous trees. Until now a total of 187 species were identified and a comprehensive analysis of macrofungal species richness, abundance and diversity was performed.

The purpose of the investigation of macrofungi will be to establish the qualitative - quantitative structure of terricolous and lignicolous fungi in different forest biocenoses. The collection of mycological material will be organized in order to prepare a collection of species growing in the forest associations, and also in meadows and mountain pastures. These research activities will cover localities of different climate and vegetation features so as to achieve greater variety of the structure of fungal species.

As a practical conservation outputs of this work will be to compile a Checklist of Kosovo fungi based on collection of fungi species in diverse habitats and their identification. A range of habitats (Macedonian and Bosnian pines, Norway spruce, silver fir, Italian oak, etc.) will be visited where rare fungi are likely to be found, along with two national parks, pristine forests and other protected areas in the country. This will contribute to producing a Preliminary Red List of Fungi of Kosovo, pursuant to IUCN categories and criteria. The List will be the source for preparation of legislative acts on fungi protection.

## **Effect of climatic and topographic variables on NDVI variation in a sub-Mediterranean mountain pastoral system**

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Pastoral systems have to face climate changes, since the increasing drought will affect herbage features, carrying capacity and animal welfare, representing a threat to biodiversity conservation and livestock rearing. As part of the CLIMAPP project (Climate changes, grasslands and livestock management: a multidisciplinary study to improve the sustainable development of Apennine pastoral systems), funded by the University Research Funds (FAR 2014-2015), using Remote Sensing multispectral images and a Digital Elevation Model (30 m pixel resolution), we examined the effect of climatic and topographic variables on the variation of the Normalized Difference Vegetation Index (NDVI) in a sub-Mediterranean pastoral system (central Apennines, Italy) in the period 2003-2015. NDVI is an indicator obtained from a spectral transformation of the Red and Near Infrared bands, which can be used to estimate many vegetation properties, such as grassland productivity, since these bands are closely related to the absorption of photosynthetically active radiation by green vegetation. We mapped the NDVI of our study area and randomly extracted 10,000 pixels falling on grasslands. We collected topographic parameters for each pixel (altitude, aspect, slope and land form) and climatic variables (average monthly temperatures and monthly precipitation), and calculated bioclimatic indices. We used Redundancy analysis, variation partitioning and generalized linear modelling to investigate and model the influence of the set of explanatory variables on the NDVI data set.

The considered variables explained about the 40% of the total NDVI variability, most of which was related to climatic parameters, while topographic variables (especially aspect) mostly acted in intensifying the effects of climate variations.

The next research step will be the establishment of a monitoring system based on ground-truth data (geo-referenced samples of above-ground phytomass), which will be related to NDVI and other vegetation indices obtained from Remote Sensing images, in order to build a predictive model of pastures productivity.

## High Mountain Steppe Vegetation of the Argözü Valley in Kibriscik, Bolu/Turkey

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The object of this study is to analyse the high mountain steppe vegetation of Argözü Valley in K (Turkey). Argözü Valley is situated on the southern slopes of Köroğlu Mountains. The research area is in the province of Euro-Siberian Region. The climate of the region changes from less rainy Mediterranean type. Annual precipitation varies from 700 mm to 1200 mm depending on altitude. The mean annual temperature is 11°C. Volcanic with andesite characteristic rocks occur in the area. 10 sample plots were taken from high mountain steppe vegetation of the study area. Vegetation data were analysed using TWINSpan (Hill, 1979) under JUICE software and indirect ordination analysis were applied. As a result of classification and ordination, two associations under different two alliances were determined.

Class: DAPHNETO-FESTUCETEA Quézel 1964

Order: DAPHNO-FESTUCETALES Quézel 1972

Alliance: HYPERICO-VERBASCION

Association: *Hordeo-Alopecuretum arundinacei* ass.nova

Class: ASTRAGALO-BROMETEA Quézel 1973

Order: HYPERICO-THYMETALIA SCORPILII Akman, Quézel, Ketenoğlu, Yurdakulol, Demirörs 1987

Alliance: FESTUCO CYLLENICAE-VERBASCION OCCIDENTALE Akman, Quézel, Ketenoğlu, Yurdakulol, Demirörs 1987 Quercus-Pinetum

Association: *Astragalo-Festucetum cyllenicae* ass.nova

High mountain steppe communities are important in the region, because the most endangered endemic taxa distribute in these communities. In the study area high mountain steppe ecosystem is under pressure by grazing activity. And in this area, most of the endemic species distribute where exposed to grazing. Human activities must be reduced or performed in controlled manner, should minimize the damage in such sensitive ecosystems.

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## Why phytocoenological databases are so important for studying of flora, vegetation and habitats on Balkan peninsula?

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During last 15 years phytocoenological databases have developed very fast as the best way to store vegetation plots (relevés). The establishment and growth of vegetation databases was promoted by the release of TURBOVEG software.

The Balkan Peninsula was divided by wars, political confrontations and conflicts until the end of 1990s. This atmosphere negatively influenced also the development of phytocoenology and botany in the region. On the other hand this part of Europe is well known for its rich flora and great number of endemic and rare plants. The vascular flora of the peninsula comprises 6,530 species of which 2,600-2,700 species and subspecies are endemic. Similar to taxa a lot of syntaxa are also endemic for the Balkan Peninsula.

Nowadays about 100 000 plots (relevés) from the Balkan peninsula belonging to 14 phytocoenological databases are registered in the Global Index of Vegetation-Plot Databases (GIVD) and the European Vegetation Archive (EVA). This data is a good starting point for various studies of regional flora, vegetation, habitats and ecosystem types and services. This data will be useful for wide range of researchers (botanists, phytocoenologists, etc), nature conservation administrations and Non-government organisations in the region.

In this presentation we demonstrated how data from 3 databases (Balkan Dry Grassland Database (EU-00-013), Balkan Vegetation Database (EU-00-019) and Romanian Grassland Database (EU-RO-008) might be used for different kind of ecological analysis. We show different kind of exports and selection procedures using data from those the databases.

**Keywords:** ecoinformatics, Braun-Blanquet approach, classification, TURBOVEG

## Bioaccumulation of metals in three plant species of genus *Tulipa* (*T. albanica*, *T. kosovarica* and *T. luanica*) in their natural habitats

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The purpose of this study was to analyze the concentration of metals in soil of serpentine and limestone localities and their impact on the accumulation of them in the tissue of *T. kosovarica*, *T. albanica* and *T. luanica*. Concentration of metals (**Mg, Ca, Fe, Cu, B, Mn, Zn, Ni, Pb, Cd, Sb, Cr, Co, Al** and **Pt**), were analyzed by ICP-OES technique in the soil of two serpentine localities (Mrasor - Republic of Kosovo and Surroi - Republic of Albania), and in one limestone locality Pashtrik (Kosovo), and a concentration of **Mg, Ca, Fe, S, Al, B, Cu, Mn, Ni, Se, Si** and **Zn** in the bulb, leaves, and seeds of *T. kosovarica* and *T. albanica* (Mrasor and Surroi), and *T. luanica* (Pashtrik). Concentration of **Mg, Fe, Mn, Zn, Ni, Cd, Cr, Co** and **Pt** in the soil of Mrasor and Surroi were significantly higher in comparison with these metals in the soil of Pashtrik, while the concentration of **Ca, B, Pb, S, Al** and **Si** were significantly higher in the soil of Pashtrik in comparison with Mrasor and Surroi. Concentration of **Mg, Ca**, in the bulb, leaves and seeds of *T. kosovarica* and *T. albanica* were significantly higher than in the *T. luanica*, while the concentration of **Fe, Al** and **Si** in the bulb and leaves of *T. kosovarica* and *T. albanica* were significantly higher in comparison with *T. luanica*. **Zn** concentration was significantly higher in the bulb and leaves and significantly lower in the seeds of *T. kosovarica* and *T. albanica* in comparison with concentration in *T. luanica*. The concentration of **Mn** was significantly higher in leaves and seeds of *T. kosovarica* and *T. albanica* in comparison with *T. luanica*, while the concentration of **Ni** was below the limit of detection in the tissue of *T. luanica*, while in *T. kosovarica* and *T. albanica* was higher in seeds than in leaves of them. In the comments of our findings it is necessary to stress out that the target organ (tissue) for accumulation of above analyzed metals in three Tulips species appears leaves (leaves > seeds > bulb).

**Key words:** Tulips, metals, accumulation, serpentine, limestone.

# Poster presentations



*Tulipa kosovarica*



## The wall vegetation (*Cymbalario-Parietarietea diffusae* Oberdorfer 1969) of the Croatian historical coastal cities (NE Mediterranean)

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The aim of this study is to classify and describe the plant communities found on the city walls in eight Croatian historical cities situated along the eastern Adriatic Sea: Pula, Rijeka, Zadar, Šibenik, Trogir, Split, Ston and Dubrovnik. The research was carried out in the period 2015-2016 using the Braun-Blanquet approach. Based on the 152 phytosociological relevés and using TWINSpan, we identified and described 10 floristically and ecologically distinctive vegetation communities within the two alliances: *Cymbalario-Asplenion* Segal 1969 and *Galio valantiae-Parietarion judaicae* Rivas Martínez ex O. de Bolòs 1967. Two associations were included within the *Cymbalario-Asplenion* (*Linario cymbalariae-Parietarium ramiflorae* Pignatti 1952 and *Erysimum cheiri* Segal 1962). The association *Linario cymbalariae-Parietarium ramiflorae* (= *Cymbalietum muralis* Görs ex Oberdorfer 1967) is a pioneer community of vertical wall surfaces. Other associations considered in the present study are grouped in the *Galio valantiae-Parietarion judaicae* alliance. They were *Asplenio trichomanis-Cotyledonetum horizontalis* Horvatić ex Birać 1973 (including both subassociations: *umbilicetosum horizontalis* Trinajstić ex Terzi et al. 2017 and *veronicetosum cymbalariae* Trinajstić ex Terzi et al. 2017), *Linario-Erigeronetum mucronati* Segal 1969, *Resedo albae-Antirrhinetum majoris* Trinajstić 2008, *Capparidetum rupestris* O. de Bolòs et Molinier 1958, *Hyoscyamo albi-Parietarium judaicae* Segal 1969, *Adianto-Parietarium judaicae* Segal 1969, *Oxalido-Parietarium judaicae* (Braun-Blanquet 1952) Segal 1969, and community with *Centranthus ruber*. In addition, the *Cymbalario-Crithmetum maritimi* Segal 1969 and *Centaureetum ragusinae* Horvat ex Terzi et al. 2017 associations were found on the city walls exposed to the sea in Dubrovnik and Split, respectively, participating in the formation of rupicolous vegetation of salt-sprayed coastal cliffs communities (*Crithmo-Staticetea* Braun-Blanquet in Braun-Blanquet et al. 1952), and of chasmophytic vegetation of the class *Asplenieta trichomanis* (Braun-Blanquet in Meier et Braun-Blanquet 1934) Oberdorfer 1977. Alongside the high cultural-historical values of the walls, these plant communities are also an important part of the region's natural heritage. In order to conserve local biodiversity, the managers need to consider limiting removal of existing plants from the walls.

***Nigritella kossutensis* W. Foelsche, Wüest, Dolinar, Dakskobler & Paušič spec. nov. and *Nigritella ravnikii* W. Foelsche, Wüest, Dolinar, Dakskobler & Paušič spec. nov., two new, diploid species on the Slovenian side of the Karavanks**

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We are trying to elucidate the hardly explored species composition of the genus *Nigritella* (*Orchidaceae*) in Košuta mountain range (Karavanks, Slovenia) as at least two still nameless species can be identified and named. Various illustrations of vanilla orchids with an unusual scarlet coloration of flowers, designated by their authors as *N. archiducis-joannis*, as *N. hygrophila*, and even as *N. minor*, probably belong to the "škrlatnordeči takson" ("scarlet-red taxon") sensu Ravnik. This apparently very variable group is distinguished both from a further, but dark-blooded clan, as well as from the next-similar *N. hygrophila* and is described as a new species under the name *N. kossutensis*. The above mentioned, probably less frequent dark-blooded clan, till now mistakenly attributed to *N. nigra* subsp. *austriaca* or *N. rhellicani*, is described as a new species under the name *N. ravnikii*. Contributions to the history of the findings, to the methods of investigation, to the distribution and to plant associations are complementary to our presentation. Brief descriptions of the ten *Nigritella* species detected so far in Slovenia should facilitate the determination of these taxa in the field.

**Keywords:** *Orchidaceae*, *Nigritella kossutensis*, *Nigritella ravnikii*, distribution, endangerment, protection.

## Phytosociological study of the wall vegetation in Dalmatian cities of Split and Dubrovnik, NE Mediterranean

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The aim of this study is to classify and describe the plant communities found on the city walls in two Dalmatian cities - Split and Dubrovnik, including neighbouring islands of Lokrum, Mrkan and Šipan. The walls were surveyed in the period 1980-2017 using the Braun-Blanquet approach. Based on the 75 phytosociological relevés available from the literature and our own, and using TWINSpan, we identified and described ten floristically and ecologically distinctive vegetation communities. According to the EuroVegChecklist, the plant associations were included within the two alliances: *Cymbalariae-Asplenion* Segal 1969 and *Galio valantiae-Parietaron judaicae* Rivas Martínez ex O. de Bolòs 1967. Two associations were included within the *Cymbalariae-Asplenion* (*Linario cymbalariae-Parietarium ramiflorae* Pignatti 1952 and *Erysimum cheiri* Segal 1962). Within the *Galio valantiae-Parietaron judaicae* alliance they were *Asplenio trichomanis-Cotyledonetum horizontalis* Horvatić ex Birać 1973, *Linario-Erigeronetum mucronati* Segal 1969, *Resedo albae-Antirrhinetum majoris* Trinajstić 2008, *Capparidetum rupestris* O. de Bolòs et Molinier 1958, *Hyoscyamo albi-Parietarium judaicae* Segal 1969, *Adianto-Parietarium judaicae* Segal 1969, *Oxalido-Parietarium judaicae* (Braun-Blanquet 1952) Segal 1969 and *Centranthus ruber* community. Some other plant associations were found (e.g. *Centaureetum ragusinae* Horvat ex Terzi et al. 2017, *Cymbalariae-Crithmetum maritimi* Segal 1969, etc.), but they have different ecological features and have been included within other vegetation types (e.g. the classes *Asplenetum trichomanis* (Braun-Blanquet in Meier et Braun-Blanquet 1934) Oberdorfer 1977, *Crithmo-Staticetum* Braun-Blanquet in Braun-Blanquet et al. 1952, etc.). In two coastal Dalmatian cities, the presence of the chasmophytic vegetation i) with a prevalently Mediterranean distribution (*Galio valantiae-Parietaron judaicae*), and ii) widespread in the Atlantic to subcontinental regions of cool-temperate Europe (*Cymbalariae-Asplenion*) were revealed.

## Literature and Database Records of Macrofungi of Shar Planina

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The Republic of Macedonia is mycological relatively well studied and until now approximately 2,000 macromycetes species are known. Four years of field trips for collecting fungal material during summer seasons on Shar Planina resulted in a list of 134 species published in 2 papers. 54 taxa were derived from the first half of the last century. A total of 188 fungi species are known for this area.

In the summer period during 1995-1998 mycological field research in various localities and habitats were carried out. A small number of data originates from spring and autumn months. Collected species were identified during the field trips, as well as in the Mycological Laboratory (Faculty of Natural Science and Mathematics, Skopje). Morphological analyses were performed based on macrochemical reactions on basidiomes (NH<sub>4</sub>OH, KOH, ferric sulfate, etc.), as well as by light microscopy. Taxonomically relevant microscopical characters (spores, basidia, cystidia, etc.) were visualized in KOH, Melzer's reagent, Cotton Blue or Congo Red.

According to the published papers and data base information a total number of 497 fungi species are listed for Shar Planina. The most of them belong to the phylum Basidiomycota (426), while the rest to Ascomycota (66) and Myxomycota (5). According to the substrate 244 species are terricolous, 248 lignicolous and one species is hypogeous. Material is collected from various types of habitats, such as: beech, oak, chestnut, fir, spruce or mixed forests, as well as meadows, high-mountain pastures, peat-bogs and azonal vegetations. 308 taxa represent a new data records for the fungal diversity of Shar Planina.

A significant number of exsiccates stored in the Macedonian National Collection of Fungi (MCF) will be a subject of further taxonomical analyses, which is expecting to result with enlarging the above mentioned list of fungi on Shara Mountain.

**Key words:** Shara Mountain, fungal diversity, Macedonia.

## Haustorial Parasitism in the Albanian Flora

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Little has been written for the parasitic flora of Albania, despite its importance and implications for the host plants. This paper represents one of the first published studies on the parasitic flora of Albania, making a complete summary of the diversity of this group of plants for Albania. In the meantime it has been realized a critical review of the published volumes of “Albanian Flora” (vol.I-IV), in order to point out the revisions that should be made, based on the last findings. The data have been gathered through visits in the National Herbarium at the Albanian Research Center of Flora and Fauna and through reviewing relevant literature and databases (such as Flora Europaea, MedChecklist, Euro+Med Plantbase). Unpublished information found through primary data collection by the authors has been also used to complete the results of this paper. Results show an interesting diversity of holoparasitic (27 species) and semi-parasitic (5 species) flora of Albania, from 4 different orders and 5 families (19 of which are root parasite and 13 stem parasite). Results on the critical review of the published volumes of the Albanian Flora show now the presence of a new genus - *Lathraea*, despite the *Orobanche* genus, for the *Orobanchaceae* family. *Orobanche crenata* found in the last years represents a new specie for Albania. The genus *Orobanche* has also undergone changes having 16 species now compared to 11 species described in the published volumes of Albanian Flora 1988-2000. Also two root holoparasitic species of *Aristolochiales* order and *Rafflesiaceae* family of Albania Flora (*Cytinus hypocistis* and *Cytinus ruber*) are now classified in the *Malvales* order and *Cytinaceae* family. As this paper includes summary of findings mainly from secondary data, more primary research in the future could bring even more interesting results in an area which is generally faintly explored and particularly for the parasitic plants.

**Key words:** Haustorial parasitism, new specie, Albania

## **Proposal of buffering action towards increasing drought stress effects on farm productivity in Central Italy Apennine**

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The increasing drought stress linked to climate change affects herbage features, carrying capacity and animal welfare, representing a threat to biodiversity conservation and livestock rearing. CLIMAPP is a project focused on the evaluation of different farming production (milk, wool, meat) and organization (shepherding, forage chains, flock composition) scenarios adopting an integrated, multidisciplinary approach, which tackles the conservation, socio-economic and cultural components of the decisional context. The project aim is to achieve a sustainable management of grassland productive ecosystems. In particular, concerning milk and cheese quality and production, a multidisciplinary team followed groups of sheep, reared in pastures with different drought stress intensities starting from the maximum pasture flowering (early July) until the maximum pasture dryness (early September); during the experimental period sheep were divided in two diet groups, one group grazed only in the pasture, while the other one was supplemented with 600 g/day/head of cereals. Researchers evaluated rumen (as epithelium keratinization degree) and mammary glands (as morphology and immunolocalization of Apelin and its receptor), animal Body Condition Score (BCS), forage composition, milk and cheese production and composition. Anatomical data showed modification of the rumen keratinization and of the Apelin/receptor presence between the sampling times, but not between different diet groups. BCS showed modification between both the sampling times and the two diet groups. Modifications were also observed in milk production, as well as in forage, milk and cheese chemical composition. In addition, the quality and peculiar features of cheese were evaluated by means of a sensory panel. A consumer test associated with an experimental auction was used to evaluate consumer preference and willingness-to-pay. Data integration gave interesting information, suggesting a possible strategy to be adopted by farmers to differentiate and certificate products obtained by a conservative management of natural grasslands, which may also allow to enhance farm economic performance.

## The vegetation dynamics in the association *Genisto elatae-Quercetum roboris* in Spačva basin, Croatia

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The Spačva basin is one of the largest coexisting lowland forests habitat areas in Europe, extending over 40,000 hectares. Pedunculate oak communities cover over 95% of the total surface area.

We assumed that changes like groundwater level sinking, the absence of floods, temperature increasing, etc, are responsible for the succession processes in the association *Genisto elatae-Quercetum roboris*, flooded pedunculate oak forests which can be confirmed by decreasing the cover and proportion of hygrophyllus species and by increasing the proportion or coverage of species adapted to the mesophilic and drier conditions.

This phytocenological research was performed in the *Genisto elatae-Quercetum roboris* association in order to compare the present state of the floral composition with those of Rauš from 1972 and Cestarić, 2008., since vegetation dynamics is one of the most important processes that take place in the forest community and is also associated with different characteristics of species that adapt to change. Changes in proportion and coverage of some indicator species describe more clearly the dynamics changes and also give the picture of the ecosystem favorable status. 50 releves of 30x30 or 20x50 m were made. The frequency of indicator species (humidity, light, nitrogen) in the time sequence (Rauš 1972, Cestarić 2008, Medak 2016) was compared for the estimation of vegetation dynamics.

The results showed that the floristic composition of the *Genisto elatae-Quercetum roboris* association has changed significantly. Although the frequency of humidity indicators correlates fairly with the Rauš (1972), it is important to emphasize the observed succession processes throughout the area. The observed trend (Rauš 1990) of reducing area under the humid subassociations (14% 1990, 31% 1972) is confirmed in this research (only 26% of releves represent *caricetosum remotae* subassociation).

## Variation of functional diversity of the herbaceous layer of beech woods along the Apennine ridge (Italy)

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Functional diversity (FD) of a plant community is expressed by different indices, such as functional richness (*FRic*), functional evenness (*FEve*), functional divergence (*FDiv*), functional dispersion (*FDis*) and Rao's quadratic entropy (*Rao's Q*). Each index provides specific information on the distribution-coexistence of species and defines changes in assembly processes along ecological gradients. We focused on the herbaceous layer of *Fagus sylvatica*-dominated woods along the calcareous Apennine ridge (central and southern Italy), since very little is known about their functional structure at biogeographical scale throughout the Italian peninsula. These woods are managed as high-forest or old coppiced woods, unmanaged since 30-40 years and evolving to high-forest type communities.

Our aim was to understand how biogeographical and elevation gradients interact in determining variations of the FD indices. In 164 plots (20 x 20 m) we recorded: plant species cover-abundance values, altitude, aspect and slope angle. For each species, we evaluated some categorical traits (occurrence and type of storage organ and vegetative propagation, leaf phenology, type of pollen/spore transfer); then we calculated FD indices for each trait in each plot. Principal Components Analysis (PCA) was run on the plots-by-species matrix and FD values were regressed on PCA object scores (axes 1 and 2).

Results highlighted that both biogeographical and elevation gradients affected the herbaceous layer species composition, mirroring some significant FD trends. *Rao's Q* and *FDis* showed a positive trend along the biogeographical gradient for leaf phenology and pollination and a negative one for vegetative propagation (as well as *FRic*). About storage organs, *FEve* was negatively related to the biogeographical gradient, instead *FDiv* showed a positive trend. Significant relations were found also between elevation and *FEve*, *Rao's Q*, *FDis* (decreasing with increase in altitude) concerning pollination. *Rao's Q* and *FDis* of storage organs were negatively related, while *FDiv* was positively related, to elevation gradient.

## Vegetation of Golesh and its surroundings – Republic of Kosovo

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Goleshi Mt. with its surroundings (600-1019 m) lies in the central part of the Republic of Kosovo, spreading in the administrative territory of three municipalities: Lipjan, Drenas and Fushë Kosovë. It belongs to the hilly-mountainous area with a continental climate at an average annual temperature rise of 100 °C while the annual average rainfall that is below 600 mm. According to recent years' research, Golesh presents on itself a very rich region in floral diversity, including endemic plant species from the Balkan floristic element, all of them being endangered plants taxa (categorized by the IUCN rules) and enlisted in the Red Book of Vascular Flora of the Republic of Kosovo. From the phytocenological relevès the presence of forest, shrub and pasture plant associations has been confirmed. According to the principles and methods of the Zurich-Montpellier school (Braun-Blanquet 1964), the following plant associations have been found: *Quercetum frainetto cerris scardicum*, *Quercetum pubescentis cerris*, *Polygalo-Forsythietum europaeae*, *Hyperico-Euphorbietum glabriflorae*, *Potentillo-Fumanetum bonapartei* and *Centaureo-Potentilletum Ass. nova. prov.* These phytocenoses belong to the orders *Quercetalia pubescentis* and *Halacsyetalia sendtneri*.

**Key words:** Goleshi, Vegetacioni, *Centaureo-Potentilletum Ass. nova. prov.*, Kosovo.

## Photosynthetic activity during dehydration and rehydration cycle of the resurrection plants of genus *Ramonda* in Kosovo

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The desiccation-tolerant plants of the *R. serbica* and *R. nathaliae* are resurrection plants which are able to fully recover their physiological function after anabiosis. A comparison of chlorophyll fluorescence imaging and photosynthetic pigment contents responses of *R. serbica* and, for the first time, *R. nathaliae* to dehydration and rehydration were investigated. For this purpose, plants after collection from their natural habitats were kept at fully watered for 14 days at natural condition. The experiment was conducted with mature leaves of both species. *R. serbica* and *R. nathaliae* plants were dehydrated to 5.88% and 7.87% relative water content (RWC) by withholding water for 15 days, afterwards the plants were rehydrated for 72 hours to 94.67% and 97.02% RWC. During desiccation, *R. serbica* plants preserved the chlorophyll content about 84%, while *R. nathaliae* about 90%. During dehydration when RWC were more than 40%, photochemical efficiency of PSII for photochemistry, the Fv/Fm ratio, decreased about 40% in *R. nathaliae* plants, but a strong reduction with 60% was recorded for *R. serbica*. Following rehydration, the Fv/Fm ratio recovered more rapidly at *R. nathaliae*. The higher photosynthetic rates could also be detected via imaging the chlorophyll fluorescence decrease ratio Rfd, which possessed higher values after rehydration leaves of *R. nathaliae* as compared to *R. serbica*. The results showed that the photosynthetic activity and chlorophyll contents after rehydration are recovered more rapidly in *R. nathaliae* in comparison to *R. serbica*.

**Key words:** resurrection plants, dehydration-rehydration, photosynthetic activity, chlorophyll fluorescence imaging.

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