



School of Biosciences and
Veterinary Medicine



Comune di Foligno



PARCO REGIONALE
DI COLFIORITO

Vzhodnoalpsko-dinarsko društvo za proučevanje vegetacije
Источноалпско-динарско друштво за проучување на вегетација
Istočnoalpsko-dinarsko društvo za istraživanje vegetacije
Ostalpin-dinarische Gesellschaft für Vegetationskunde
Società estalpino-dinarica di Fitosociologia
Shoqata për Hulumtimin e Vegjetacionit të Alpeve Lindore dhe Dinarikeve
Eastern Alpine and Dinaric Society for Vegetation Ecology

38th Meeting

Eastern Alpine and Dinaric Society for Vegetation Ecology

Colfiorito (Italy) - 8th-12th May 2019



Book of Abstracts

Catorci Andrea, Scocco Paola, Tardella Federico Maria

editors

Event realized under the patronage of Municipality of Foligno and University of Camerino

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Eastern Alpine and Dinaric Society for Vegetation
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MEETING PROGRAMME

Wednesday, May 8th

Pre-meeting session

14:00 – 15:30 Registration and poster hanging

15:30 – 15:45 Welcome addresses by a representative of the Colfiorito Regional Park

Presentation of the 38th meeting of the Eastern Alpine and Dinaric Society for Vegetation Ecology by Prof. Andrea Catorci, University of Camerino

Chairman: A. Catorci, University of Camerino

15:45 – 16:15 Magistral lecture: **F.M. Tardella**, University of Camerino
Flora, vegetation and dynamics of the “Altipiani di Colfiorito”

16:15 – 16:45 **D.Jablonská, P.P.Pierantoni, E.Tondi**
Geology and seismicity of the Colfiorito area (Umbria-Marche Apennine, Italy)

16:45 – 19:30 Pre-meeting excursion*

Thursday, May 9th

8:00 – 8:45 Registration and poster hanging

8:45 – 9:30 Opening ceremony and welcome addresses by UNICAM and EADSVE authorities

Prof. Claudio Pettinari, Rector of the University of Camerino

Prof. Guido Favia, Director of the School of Biosciences and Veterinary Medicine, University of Camerino

Dr. Christian Eichberger, President of EADSVE

Dr. Andraž Čarni, Vice-President of EADSVE

Session 1 Intra-specific variability of morphological and functional plant traits

Chairman: C. Eichberger, University of Salzburg

9:30 – 9:50 **F.J. Silva-Pando, M. Bustos-Vázquez**
Variability of the morphology of acorns and fruit production in various oak forests of Galicia (NW Spain)

9:50 – 10:10 **P. Fortini, P. Di Marzio, R. Di Pietro**
Morphometric and molecular studies on the *Quercus pubescens* complex in south-eastern Italy

10:10 – 10:30 **A. Bricca, F.M. Tardella, K. Piermarteri, N. Postiglione, A. Catorci**
Aboveground intraspecific functional variation of *Brachypodium genuense* (DC.) Roem. et Schult in sub-Mediterranean grasslands

10:30 – 10:50 **F.J. Silva-Pando, M. Alonso Santos**
Some comments about morphological, ecological and altitudinal variability of some Galician vascular species (NW Spain)

10:50 – 11:10 Coffee break

Session 2 Plant-animal interactions

Chairman: R. Custerevska, University of Ss. Cyril and Methodius, Skopje

11:10 – 11:30 **F. Mercati, M. Maranesi, P. Coliolo, G. Mancini, C. Dall’Aglio**

Apelin and resistin, new adipokines acting on the reproductive apparatus of the sheep: a molecular investigation as a supporting tool in the grassland ecosystem management

11:30 – 11:50 **E. De Felice, A. Malfatti, S. Rivaroli, M. Grandini, M. Canavari**

The effects of pasture dryness on sheep mammary gland and farm income

11:50 – 12:10 **P. Scocco, M. Trabalza-Marinucci, Acuti G.**

Effects of oregano aqueous extract on defence ability of pig gut

12:10 – 12:30 **P. Perna**

Birds communities as indicator of the conservation status in the forests of Sibillini National Park

Poster session

12:30 – 13:10 Chairman: A. Catorci, University of Camerino

13:10 – 14:30 Lunch

14:30 – 19:30 Excursion*

Friday, May 10th

Session 3 Vegetation: syntaxonomy and ecology

Chairman: D. Krstonošić, University of Zagreb

9:00 – 9:30 Magistral lecture: **R. Di Pietro**, Sapienza University of Rome

The main vegetation types of the central Apennines along an altitudinal gradient. A syntaxonomic overview

9:30 – 9:50 **I. Goia, A. Suteu, G. Groza, D. Gafta**

Syntaxonomic review of *Pinus nigra* ssp. *banatica* woodlands in the Romanian Carpathians

9:50 – 10:10 **E. Biondi, M. Allegrezza**

Syntaxonomy of the communities dominated by *Pinus nigra* s.l. in the *Apennine-Balkan biogeographical province*

10:10 – 10:30 **S. Montecchiari, C. Ottaviani, V. Pelliccia, G. Tesei, M. Allegrezza**

On the *Robinia pseudoacacia* communities in the Italian peninsula: a phytosociological synthesis

10:30 – 10:50 **B. Paura, M. Cutini, T. Panichella, A. Bertacchi, A. Catorci**

Thermophilous oak forests (*Carpinion orientalis*, *Teucrio siculi-Quercion cerridis*) of Molise (Southern Italy)

10:50 – 11:10 Coffee break

Session 4 Vegetation: syntaxonomy and ecology

Chairman: I. Goia, Babeş-Bolyai University of Cluj-Napoca

11:10 – 11:30 **D. Gigante, F. Bonini, G. La Porta**

New occurrence of rare and threatened wet montane ecosystems in Central Italy

11:30 – 11:50 **R. Venanzoni, G. Pirone, G. Ciaschetti**

Some Remarks on Rare Sedge Communities of Mountains Karstic Plateaus of Central-Southern Apennine (Abruzzo, Marche and Umbria Regions - Italy)

11:50 – 12:10 **D. Krstonošić, J. Franjić, A. Čarni, K. Sever, Ž. Škvorc**

Vegetation diversity and dynamic of forest communities in Mljet national park (Croatia)

12:10 – 13:00 General assembly

13:15 – 14:30 Lunch

14:45 – 19:30 Excursion*

21:00 Social dinner

Saturday, May 11th

Session 5 Vegetation: forest ecology, climate change and ecosystem services

Chairman: A. Čarni, Research Center of the Slovenian Academy of Sciences and Arts

9:00 – 9:20 **J. Kermavnar, A. Marinšek, K. Eler, L. Kutnar**

Dinaric fir-beech forests in Slovenia: geographical differentiation and response to forest management

9:20 – 9:40 **L. Kutnar, T.A. Nagel**

Understory vegetation dynamics across Slovenian forest ecosystems: 10 years of forest sites monitoring

9:40 – 10:00 **S. Chelli, E. Simonetti, G. Campetella, M. Cervellini, R. Canullo**

Intraspecific variability of specialist species drives SLA changes in the understory of beech coppice forests

10:00 – 10:20 **M. Cutini, F. Marzioletti, J.-P. Theurillat, G. Barbato, G. Rianna**

Do the Central Apennines exhibit Mediterranean or Temperate bioclimate patterns?

10:20 – 10:40 **G. Mei, J. Vukelić, D. Baričević, M. Orešković, F. Taffetani**

Ostrya carpinifolia forests in Europe. Preliminary results of the first multidisciplinary study at the whole distribution area level

10:40 – 11:00 Coffee break

Session 6 Vegetation: forest ecology, climate change and ecosystem services

Chairman: M. Osmani, University of Mitrovica

11:00 – 11:20 **L. Facioni, S. Burrascano, G. Capotorti, E. Carli, T. Chiti Tommaso, R. Copiz, E. Del Vico, R. Frondoni, E. Giarrizzo, M. Zanini, L. Zavattero, C. Blasi**

Plant diversity and carbon stocks patterns in the vegetation series of *Rubio peregrinae*-*Quercetum cerridis* and *Melico uniflorae*-*Quercetum cerridis*

11:20 – 11:40 **M. Tavaloni, E. Morri, R. Santolini, M. Tromboni**

Ecological-economic analysis and evaluation of the ecological functions of the forest areas of the Marche Region in the framework of the General Reclamation Plan and new governance perspectives

12:10 – 12:30 Meeting closing ceremony

12:30 – 14:00 Lunch

14:00 – 19:30 Excursion*

Sunday, May 12th

8:00 – 16:00 Post-meeting excursion

.

EXCURSIONS

Wednesday, May 8th - Pre-meeting excursion

Palude di Colfiorito (wetland vegetation)

Thursday, May 9th

Monte Saliere and Piani di Montelago (dry grasslands and humid meadows)

Friday, May 10th

Verchiano (Apennine forest and anthropogenic landscapes)

Saturday, May 11th

Col Falcone - Bocchetta della Scurosa (dry grasslands, *Ostrya carpinifolia* and *Fagus sylvatica* woods)

Sunday, May 12th - Post-meeting excursion

Sasso di Pale: Mediterranean thermophilous vegetation. Subasio Mountain Regional Park or Assisi (Giotto paintings)

The excursions programme may be subject to changes depending on the weather conditions

SIDE EVENTS

Practical training in the field on how to collect leaves for calculating leaf area, specific leaf area and leaf dry matter content, according to standardized international trait protocol

Thursday, May 9th - 14:30-19:30 **A. Bricca, F.M. Tardella**

Seminar: *Concept Mapping: a learning tool for higher education. Theoretical framework and applications within the ERASMUS+ “ENEPLAN” project*

Saturday, May 11th - 11:40 – 12:10 **S. Mugnoz, P. Scocco, F.M. Tardella, A. Catorci**



The Colfiorito Regional Park
Catorci A., Tardella F.M.

Geographic and environmental aspects

The Colfiorito Regional Park (Foligno, Umbria), instituted in 1995 (L.R. n. 9, 03/03/1995), is located in the Umbria-Marche Apennines (central Italy) and extends over 338 ha, ranging from 754 m (Palude di Colfiorito) to 926 m a.s.l. (M. Orve). It is extended in the central part of the “Altipiani di Colfiorito” catchment basin and hosts one of the most important wetlands of central Italy, representing a high conservation value area for its plant and animal biodiversity, as well as from an ecological and landscape viewpoint.

All these naturalistic aspects have been acknowledged at national and international level. In fact, this area includes one wetland protected by the Ramsar Convention, one Important Bird Area, three Special Areas of Conservation and one Special Protection Area of the Natura 2000 network.

The “Altipiani di Colfiorito” catchment basin is a system of seven depressions, ranging from 750 to 810 m a.s.l., which are partially separated by hills and low mountains (Orsomando and Pambianchi 2002).

From the bioclimatic viewpoint, the plateau is included in the Upper Mesotemperate bioclimatic belt (Ballelli et al. 2010).

The geological substratum is composed of limestones; the plains are covered by fluvio-lake and lake deposits, such as gravel, sand and clay, while peaty silt and clay prevail in the most depressed areas (Materazzi and Pieruccini 2001). Soils are deep, hydromorphic, subacid, rich in organic matter, with silty clayey texture and scarce or absent skeleton (Giovagnotti et al. 2003).

The plains had origin from extensional tectonic events in the upper Pliocene-lower Pleistocene, which caused the collapse of extended zones, led by faults, and the formation of depressions that had been filled by erosion processes of the upstanding ridge, climate changes and seismic activity characterizing the Quaternary period (Dramis 1986). During the Holocene, these depressions, covered by debris, hosted lakes that were completely drained by debris accumulation from the surrounding slopes and by anthropic activity, except for the “Palude di Colfiorito”, which was the only to remain permanently covered by water (Orsomando and Pambianchi 2002).

The water supply is mainly provided by rainfall, which shows a seasonal trend (maximum in autumn-winter-spring and minimum in summer), while only a small part derives from some torrent waterways and small springs. Such rainfall trend is linked to important water level fluctuations that occur in the plains that maintain a core area covered by wetland vegetation and consist of an increase of the water-covered areas for short periods, followed by an entire drainage in summer. The only form of natural drainage system is represented by swallow holes sited in correspondence of rifts along the borders of plains and represent a surface effect of underground karstic phenomena. Water is drained to swallow holes by a hydric system composed of artificial canals and ditches of moderate depth.

Flora and vegetation

The territory of the Altipiani di Colfiorito has been the destination of many botanic explorations in the last decades in order to gather more information about phytosociological and cartographic-vegetational aspects. A particular attention was addressed to Palude di Colfiorito where rare or of biogeographic importance floristic species are found (Pedrotti 1965; Pedrotti and Pettorossi 1968, 1969; Orsomando 1980).

The first floristic notes about the “Palude di Colfiorito” are reported in *Flora Italica* by Bertoloni (1833-54) and in *Flora Italiana* by Parlatore (1848-96), on the basis of the specimens collected by Vincenzo Ottaviani, Professor at the Universities of Camerino, where he founded the Botanic Garden in 1828, and Urbino. Barsali (1929-1933) reported some data coming from his own collections and the analysis of specimens collected by previous gatherers (Batelli and Cicioni). The set of knowledge in the last decades, from the beginning of 1950s (e.g. Messeri 1952; Pedrotti

1965, 1977; Orsomando 1980; Venanzoni 1985; Ballelli et al. 2010), comes from the work of botanists of the University of Camerino.

The analysis of literature data and herbarium collections, and the floristic field research carried out from 1999 to 2008, allowed to list 657 taxa at the species and subspecies level, belonging to 88 families and 320 genera (Ballelli et al. 2010), some of which are threatened in Umbria and Marche regions, such as *Alopecurus bulbosus*, *Carex tomentosa*, *Equisetum fluviatile*, *Juncus hybridus*, *Nymphaea alba*, *Ophioglossum vulgatum*, *Ranunculus flammula*, *R. ophioglossifolius*, *Trifolium patens*, and *Utricularia australis*. Some species, previously recorded for “Palude di Colfiorito”, such as *Eriophorum latifolium*, *Hippuris vulgaris*, *Hydrocotyle vulgaris*, *Menyanthes trifoliata*, *Potamogeton lucens*, *P. trichoides*, *Ranunculus lingua*, and *Triglochin palustre*, were not found and considered locally extinct.

The plains are mainly covered by aquatic and marsh vegetation, humid hay meadows and arable lands (cultivated mainly with wheat, barley, spelt, lentil, and potato), alternated with copses of woody hygrophilous vegetation. In the area of connection between plains and slopes of the surrounding reliefs, besides agricultural land, there are small mixed woodlands with *Quercus cerris* and *Ostrya carpinifolia*, hay meadows and dry grasslands (Orsomando and Pambianchi 2002). In particular, the vegetation composition of Palude di Colfiorito is characterized by numerous species of the humid environment whose distribution depend on water depth, soil humidity and flood duration.

Aquatic communities, only present in Palude di Colfiorito, develop where there is water throughout the year and are characterized by *Nymphaea alba*, *Myriophyllum spicatum*, *M. verticillatum*, *Ranunculus trichophyllus*, and *Callitriche* sp. pl.

Helophytic communities, with a dominance of *Phragmites australis*, *Schoenoplectus lacustris*, *Glyceria maxima*, *Typha latifolia*, *Phalaris arundinacea*, *Carex acuta* or *C. vesicaria*, are spread where the soils are humid and muddy also during summer.

Humid hay-meadows characterized by *Ranunculus velutinus* or *Deschampsia cespitosa* are distributed where the soil undergo periodic flooding until the beginning of spring and dries in summer.

The peaty meadows of Palude di Colfiorito, the last residue of the peat-bog that between 60s and 70s underwent drainage and peat removal, now occupy small strips and are characterized by *Carex panicea*.

Uncultivated and temporary flooded lands are much more spread but of reduced dimension and characterized by dominant ephemeral plant communities, characterized by annual (*Bidens tripartita*, *Persicaria lapathifolia*, *Xanthium orientale* subsp. *italicum*) or perennial (*Galega officinalis*) species.

Woody hygrophilous formations characterised by *Salix alba* and *Populus* sp. pl. or by shrubs of *Salix purpurea*, *S. triandra* and *S. apennina*, develop at the borders of the “Palude di Colfiorito”. Hedges of *Prunus spinosa* and *Rhamnus cathartica* and trees such as *Populus nigra*, *Salix alba* or *Quercus cerris* and sometimes the fruit trees *Prunus avium* and *Juglans regia* are very common.

The slopes are covered by xerophilous grasslands of the *Brometalia erecti* order, *Quercus cerris* and *Ostrya carpinifolia* woods of the *Aceri obtusati-Quercetum cerridis* association (*Carpinion orientalis* alliance), and reforestations with *Pinus nigra*.

In the last decades, the wetland ecosystems underwent significant changes in the composition and structure of the plant communities, mostly related to land use changes, including abandonment of the traditional management practices adopted by local communities until the end of 1960s, especially at the “Palude di Colfiorito”. This led to the spread of *Phragmites australis*-dominated community, which is substituting the previous mosaic of plant communities, composed of lacustrine vegetation, marsh and humid meadows (Catorci et al. 2010). In addition, the “Palude di Colfiorito” was partly subjected to drainage and destruction of a peat bog (Pedrotti 1975), which threatened its plant and animal biodiversity. As a result of anthropic pressures, 12 plant species are considered locally extinct and 46 are deemed endangered (Ballelli et al. 2010).

References

- Ballelli S., Tardella F.M., Orsomando E., Catorci A., 2010. The vascular flora of the « Altipiani di Colfiorito » (Umbria-Marches Apennines, Central Italy). *Webbia* 65(2): 241-290.
- Barsali E., 1929. Prodomo della flora umbra. *Nuovo Giorn. Bot. Ital.* 36(4): 548-623.
- Barsali E., 1931. Prodomo della flora umbra (continuazione). *Nuovo Giorn. Bot. Ital.* 38(4): 624-689.
- Barsali E., 1932. Prodomo della flora umbra (continuazione). *Nuovo Giorn. Bot. Ital.*, n.s., 39(2): 346-415.
- Barsali E., 1932a. Prodomo della flora umbra (continuazione e fine). *Nuovo Giorn. Bot. Ital.* 39(3): 549-602.
- Barsali E., 1933. Aggiunte al prodomo della flora umbra. II°. *Nuovo Giorn. Bot. Ital.* 40(3): 338-341.
- Bertoloni A., 1833-1854. *Flora italica*. Voll. 1-10. Bologna.
- Catorci A., Brusafferro A., Tardella F.M., 2010. Analisi preliminari finalizzate alla redazione di un piano di gestione per il canneto (*Phragmitetum vulgaris*) nella palude di Colfiorito (Umbria-Italia). Atti del Congresso "Ecologia del Paesaggio per la gestione delle zone umide". SIEP-IALE. Ravenna: 134-142.
- Dramis F., 1986. Aspetti geomorfologici del territorio marchigiano. In: Centamore E., Deiana G. (eds.). *La geologia delle Marche*, Studi Geologici Camerti. Dip. di Scienze della Terra. Università di Camerino. Numero speciale - 73° Congresso della Società Geologica Italiana, Roma 30 settembre - 4 ottobre 1986: 99-104.
- Giovagnotti C., Calandra R., Leccese A., Giovagnotti E., 2003. I Paesaggi Pedologici e la Carta dei Suoli dell'Umbria. Camera di Commercio, Industria, Artigianato e Agricoltura di Perugia.
- Materazzi M., Pieruccini P., 2001. Geolitologia. In: Catorci A. and Orsomando E. (eds.). *Note illustrative della Carta della vegetazione del Foglio Nocera Umbra (N. 312 - Carta d'Italia I.G.M. - 1: 50.000)*. Braun-Blanquetia, 23: 10-13.
- Messeri A., 1952. Appunti durante una gita al Padule di Colfiorito (Foligno). *Bollettino Società Eustachiana* 45(1): 7-10.
- Orsomando E., 1980. Palude di Colfiorito e Piano di Ricciano. In: *Parchi, Flora, Fauna, Ambiente*. Agenzia Regionale dell'Umbria, Terni 10(9): 2-12.
- Orsomando E., Pambianchi G., 2002. Carta del paesaggio vegetale del Bacino Imbrifero dell'Altopiano di Colfiorito. UNICAM, Università di Camerino.
- Parlatore F. 1848-1896. *Flora italiana*. 1-10. Firenze.
- Pedrotti F., 1965. Censimento degli ambienti umidi meritevoli di protezione: i piani carsici dell'Appennino Umbro-Marchigiano. *Att. Ist. Bot. Laborat. Critt. Univ. Pavia* 6(1): 141-158.
- Pedrotti F., 1975. Carta fitosociologica della vegetazione della palude di Colfiorito (Foligno). L.A.C., Firenze.
- Pedrotti F., 1977. Gli altopiani plestini. *Inform. Bot. Ital.* 9(3): 223-224.
- Pedrotti F., Pettorossi L., 1968. La Palude di Colfiorito: problemi fitogeografici e di conservazione dell'ambiente. *Natura e Montagna* 8(1): 19-27.
- Pedrotti F., Pettorossi L., 1969. Rilevamento cartografico della vegetazione della palude di Colfiorito. *Mitt. ostalp.-din. pflauzensoz. Arbeitsgem.*, 9: 153-159.
- Venanzoni R., 1985. La presenza di *Carex gracilis* Curt. e *Carex elata* All. nelle Marche e in Umbria. *Archivio Botanico Biogeografico Italiano* 61(3-4): 109-117.

Magistral lectures



The main vegetation types of the central Apennines along an altitudinal gradient. A syntaxonomic overview

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The Apennine mountainous range is known to be one of the centres of plant diversity in Europe. It is composed of three main sectors that are very different each other as regards flora, vegetation landscape and biogeographic relationships. The N-Apennine is relatively low in altitude (2165 m) and mainly composed of sandstones and marls. It is floristically related with the western Alps. The C-Apennines are characterized by the highest elevations (2912 m) with several peaks exceeding 2400 m. These are mainly composed of limestone rocks (with the only important exception of the pelithic-arenaceous substrate of the Laga Mountains) and are floristically related to the Dynarids and the western Balkans. The S-Apennines are mainly composed of limestone massifs with the highest peak located in the Pollino-Orsomarso range (2265 m) and are floristically related to the southern Balkans. Southwards of Orsomarso there is the Calabria-Peloritani Arc, which is composed of Paleozoic metamorphic rocks and floristically related to the W-Mediterranean mountains. Owing to their remarkable altitudinal extension, the C-Apennines are the Italian sector exhibiting the greatest cenological diversity in the whole Peninsula. In fact, the vegetation landscape ranges between the thermo-xerophilous primary Mediterranean maquis (*Rhamno-Euphorbietum dendroidis*) to the alpine tundra of the highest peaks of the inner areas (*Leontopodio-Elynetum*). From a syntaxonomic point of view, the C-Apennines exhibit a high rate of endemic syntaxa that concerns the ranks of association, alliance and even order, especially within the bioclimatic belts placed beyond the timberline where a high number of endemic diagnostic species occur. As regards the forest vegetation the central Apennines are characterized by strong similarities with the communities occurring in the eastern side of the Adriatic Sea. These similarities are ratified by the use of shared forest syntaxa, such as *Fraxino orni-Querion ilicis*, *Fraxino orni-Ostryon*, *Carpinion orientalis*, *Aremonio-Fagion*. The Apennine coenological independence is represented, at present, by the *Crataego-Querion cerridis* and partially by the *Physospermo-Querion petraeae*. In the hilly belt, the shrubland vegetation is characterized by the mixture of evergreen and deciduous communities mainly referable to *Oleo-Ceratonion*, *Cisto eriocephali-Ericion*, *Pruno-Rubion ulmifolii*, *Rhamno saxatilis-Paliurion* and *Cytisium sessilifolii* whereas in the montane belt the shrubland communities of *Berberidion vulgaris* are dominant. Very interesting are the secondary grasslands and micro-garrigues of the montane belt which are classified in two endemic alliances (*Cytiso-Bromion erecti* and *Cytiso-Saturejion montanae*). The subalpine belt is rich of endemic alliances both in the dwarf-shrub vegetation (*Daphno oleoidis-Juniperion nanae*; *Epipactido-Pinion mugo*) and in the primary and secondary grasslands (*Seslerion apenninae*, *Festuco italicae-Nardion*, *Festucion dimorphae*). In the alpine belt the Arctic-Alpine syntaxa *Salicion herbaceae*, and *Arabidion caeruleae* together with the C-Apennines endemic syntaxa *Leontopodio-Elynion*, and *Thlaspion stylosi* are the most important references.

Flora, vegetation and dynamics of the “Altipiani di Colfiorito” wetlands

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The “Altipiani di Colfiorito” catchment basin is located in the Umbria-Marche Apennines, (central Italy), and include seven plains, at altitudes ranging from 750 to 810 m a.s.l., hosting wetlands of high conservation interest which have been internationally protected through the institution of a Ramsar Site, an Important Bird Area, three Sites of Community Importance and a Special Protection Area.

The flora consists of 657 taxa at the species and subspecies level, belonging to 88 families and to 320 genera, including numerous threatened species in the flora of Umbria and Marche, such as *Alopecurus bulbosus*, *Carex tomentosa*, *Equisetum fluviatile*, *Juncus hybridus*, *Nymphaea alba*, *Ophioglossum vulgatum*, *Ranunculus flammula*, *R. ophioglossifolius*, *Trifolium patens*, and *Utricularia australis* (Ballelli et al. 2010). Some species, recorded for Palude di Colfiorito in the last century (*Eriophorum latifolium*, *Hippuris vulgaris*, *Hydrocotyle vulgaris*, *Menyanthes trifoliata*, *Potamogeton lucens*, *P. trichoides*, *Ranunculus lingua* and *Triglochin palustre*) were not found and are considered locally extinct; other taxa (e.g. *Mentha arvensis*, *Rosa andegavensis*, *Sporobolus alopecuroides*, and *Veronica catenata*) are considered rare in Umbria and/or Marche.

The phytosociological analysis allowed to identify 38 vegetation types, referred to *Potamogetonetea*, *Bidentetea*, *Phragmito-Magnocaricetea*, *Molinio-Arrhenatheretea*, and *Epilobietea angustifolii* classes. Some of them were very rare in central Italy: *Potamo pectinati-Myriophylletum spicati*, *Nymphaeetum albae*, *Caricetum vesicariae*, *Caricetum gracilis*, *Oenanthe aquatica-Rorippetum amphibiae*, *Helosciadietum nodiflori*, *Hordeo-Ranunculetum velutini*, and *Deschampsio-Caricetum distantis*. To highlight the ongoing dynamic trends, we compared 243 relevés gathered in the years 2005-2009 with a subsample of 122 relevés carried out in 2018 in the same locations of the previous ones, and analysed them using Social behaviour types. The analysis highlighted an ongoing vegetation dynamics, probably triggered by discontinuous management or lack of maintenance interventions, with the decrease in the relative contribution of the characteristic species of *Phragmito-Magnocaricetea* and the increase in species of *Molinio-Arrhenatheretea* in helophytic communities. *Phragmitetum australis* increased dominance of *Phragmites australis*, causing a relative decrease in abundance of *Epilobietea angustifolii* and *Molinio-Arrhenatheretea* species. To preserve wetland's biodiversity, we highlighted the need of urgent conservation actions, especially to limit the spread of reed and restore environmental heterogeneity, and of periodical maintenance activities (e.g. cleaning of ditches and mowing of the hay meadows).

References

Ballelli S., Tardella F.M., Orsomando E., Catorci A., 2010. The vascular flora of the « Altipiani di Colfiorito » (Umbria-Marches Apennines, Central Italy). *Webbia* 65(2): 241-290.

Oral presentations



Syntaxonomy of the communities dominated by *Pinus nigra* s.l. in the Apennine-Balkan biogeographical province

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Pinus nigra Arnold is a collective species with a vast area fragmented on the mountains of the Mediterranean basin and distributed from the north-western sector of Africa to the south of Europe up to Asia Minor, where sub-specific vicariants are found. In this context the relationships were examined among communities dominated by *Pinus nigra* s.l. in the Apennine-Balkan biogeographical province (Rivas-Martínez et al. 2001; Blasi & Biondi 2017).

The opportunity to deepen this argument was offered by the relevés of the *Pinus nigra* subsp. *nigra* communities present in the Campo Imperatore plateau (Gran Sasso d'Italia) in the supratemperate thermotype at an altitude range between 1500 and 1600 m a.s.l.

The data collected on the vegetation were elaborated with the phytosociological method, although in the choice of the higher order syntaxa, it was considered appropriate to broaden the approach to different tectonic, palaeobotanical, palaeogeographic and biogeographic analysis factors, to define the classes and reference orders. This led to the recognition that the black pine forests of the study area, together with those of the central-southern limestone Apennines, should be included in the class *Erico-Pinetea* Horvat 1959.

On the basis of a comparison between the *Pinus nigra* subsp. *nigra* community in the study area and the communities dominated by *Pinus nigra* s.l. described in the south-eastern Alps and the Balkan peninsula, currently referred to the *Erico-Pinetalia* Horvat 1959 *nom. conserv. propos.* order (Mucina et al. 2016) and *Erico-Pinetea* class, here it is proposed for the study area the new association *Junipero hemisphaericae-Pinetum nigrae* and the new Apennine alliance. *Junipero hemisphaericae-Pinion nigrae* (typus: *Junipero hemisphaericae-Pinetum nigrae*). The new alliance *Junipero hemisphaericae-Pinion nigrae* represents the central-southern Apennines vicariant of the *Fraxino orni-Pinion nigrae* Em 1978 alliance with central southern Balkans distribution.

References

- Blasi C., Biondi E., 2017. La flora in Italia. Ministero dell'Ambiente e della Tutela del Territorio e del Mare, pp. 704. Sapienza Università Editrice, Roma.
- Mucina L., Bultmann H., Dierßen K., Theurillat J.P., Raus T., Čarni A., et al. 2016. Vegetation of Europe: hierarchical floristic classification system of vascular plant, bryophyte, lichen, and algal communities. *Appl Veg Sci* 19 (Suppl. 1): 3-26.
- Rivas-Martínez S., Penas Á., Díaz T.E., 2001. Biogeographic map of Europe (scale 1:16.000.000). Cartographic Service, University of León, Spain.

Aboveground intraspecific functional variation of *Brachypodium genuense* (DC.) Roem. et Schult in sub-Mediterranean grasslands

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Cessation of traditional management practices and land abandonment are threatening pastoral landscapes and their biodiversity. This process typically involves the spread of coarse tall grass species able to dominate the grassland's community thanks to particular sets of traits. In this sense *Brachypodium genuense* (DC.) Roem. et Schult. is a cardinal species occurring in the mountain grassland along Italian peninsula over 1,200-1,400 m a.s.l. Its spread decreases the light irradiance reaching ground level, besides soil pH, temperature and water content as well as species diversity and richness. Additionally, *B. genuense* reduces the nutrient value of pastures negatively affecting both shepherding and habitat suitability for wild herbivores. Consequently, understanding the ecological factors allowing its spread, and the relationship between its functional features and environmental constraints, is a primary goal for biodiversity and socio-economic issues.

We hypothesized that *B. genuense* was able to spread and dominate the sub-Mediterranean grassland communities (Monti Sibillini, central Italy) subjected to a wide range of environmental conditions, thanks to its high intraspecific variability regarding its aboveground traits such as Specific Leaf Area (SLA) and plant height, and its high variation in the cover values.

We found that in more productive conditions (deeper soil, medium/high pH values, north-facing slopes, and "conservative" landforms) populations of *B. genuense* had higher SLA, plant height and cover values. This underlies a fast-growing strategy based on high resource rate of acquisition and use, as well as higher competitive ability for aboveground resources (e.g. light). In unproductive/dry conditions (south-facing slopes, shallow soils, lower pH values) *B. genuense* had lower SLA, plant height and cover values, underlying a slow-growing strategy with low rate of resource acquisition and high rate of resource conservation. In addition, we found that very high nitrogen amount might have a detrimental effect on *B. genuense* individuals decreasing the SLA values, thus requiring the plant to change the growth strategy.

Finally, the invasive/dominant behavior of competitive-stress tolerant tall grasses seems related not only to clonal integration strategy, and litter deposition, but also to the high intraspecific variation of leaves strategies, allowing to plants to maintain the coordination of multiple resource capture and, hence, to sustain dominance.

Intraspecific variability of specialist species drives SLA changes in the understory of beech coppice forests

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Logging activities are claimed to impact the component of sensitive understory plant species depending on structures and processes of old-growth forests, namely the forest specialist species (Sabatini et al. 2018). Trait-based approaches taking into account within species variation (i.e., intraspecific trait variability) for the entire community as well as for specific sets of species can shed light on mechanisms of functional changes in managed forests (Kermavnar et al. 2018; Garnier et al. 2018).

In this paper we used field measurements of specific leaf area (SLA) in the understory of beech forests along a succession (3 to 100 years logged stands) to test if (i) community level SLA varies along the gradient, (ii) this variation is mainly due to the contribution of beech forest specialist species, (iii) there is a niche differentiation in terms of SLA variability of specialist species toward the mature stage of forest succession, and (iv) SLA pattern of specialist species along the succession is due to intra- or interspecific trait variation.

We demonstrated that the increase in community level SLA along the stages of forest succession is mainly due to the component of forest specialist species. Indeed, they increased their abundance-weighted mean SLA and variability along the gradient, probably as consequence of the higher number and heterogeneity of small-scale suitable habitats. Intraspecific SLA variation of forest specialist species had a pervasive role in this functional pattern. On the contrary, generalist species did not show any significant trend and their variation depended on species turnover.

The fact that intraspecific adjustment of specialist species is the key driver of understory SLA along forest succession suggests that (i) focusing on different set of species is helpful to better understand community functioning; (ii) more detailed functional approaches on specialist species can be useful to identify appropriate indicators of understory response to disturbance; (iii) management practices should include conservation measures aimed at boosting trait variability through enhancing stand level heterogeneity.

References

- Garnier E., Vile D., Roumet C., et al., 2018. Inter-and intra-specific trait shifts among sites differing in drought conditions at the north western edge of the Mediterranean Region. *Flora*, <https://doi.org/10.1016/j.flora.2018.07.009>
- Kermavnar J., Eler K., Marinšek A., Kutnar L., 2018. Initial understory vegetation responses following different forest management intensities in Illyrian beech forests. *Applied Vegetation Science*, 22: 48-60.
- Sabatini F., Burrascano S., Keeton W.S., et al., 2018. Where are Europe's last primary forests? *Diversity and Distribution*, 24: 1426-1439.

Do the Central Apennines exhibit Mediterranean or Temperate bioclimate patterns?

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Different studies of bioclimatic classification at the national level have been conducted in the recent past in order to identify the limits of the Mediterranean and Temperate macrobioclimates in Italy. In the peninsular part, climatic parameters, vegetation, and chorological traits indicate that there is a complex vegetation mosaic. In fact, it ranges from sclerophyllous communities of the coasts to the deciduous communities in the hilly and mountain parts and also different examples of steppic vegetation at both low and high altitudes (Pirone 1995; Pirone and Cutini 2002; Blasi et al. 2003). Recently, a significant advancement in the bioclimatic studies was obtained with the mapping of Italy, carried out using the Rivas-Martínez indices (Pesaresi et al. 2014, 2017).

The present work shows the main weather patterns for the period 1981-2010 in the Italian Central Apennines, at a wide elevation range (260-1750 m a.s.l.), on the basis of analysis of temperature and precipitation data collected in 23 locations. We used cluster analysis to identify homogeneous areas and improve the effectiveness of the descriptors by crossing the results derived from the application of hierarchical and non-hierarchical classification techniques with categorization derived through the use of bioclimatic indices commonly used in plant ecology studies.

The results show a highly diversified picture, due to the range of latitudinal and elevational gradients and conditioned by the morphological variability expressed at the regional scale. They indicate that Mediterranean climatic features would better express the mixed floristical and vegetational characteristics of the Central Apennines. This result, considered in the context of current climate changes towards more highly variable conditions at high altitudes, emphasizes the need for climate monitoring at high altitudes to facilitate assessment of future changes and hopefully improve the management and conservation of mountain ecosystems (Rogora et al. 2018).

References

- Blasi et al., 2003. The main plant community types of the alpine belt of the Apennine chain. *Plant Biosystems* 137: 83-110.
- Pesaresi S. et al., 2014. Bioclimate of Italy: application of the worldwide bioclimatic classification system. *Journal of Maps* 10: 538-553.
- Pesaresi S. et al., 2017. Bioclimates of Italy. *Journal of Maps* 13: 955-960.
- Pirone G., 1995. Una nuova associazione vegetale di gariga a *Phlomis fruticosa* L. nella Marsica (Abruzzo, Italia). *Micologia e Vegetazione Mediterranea* 10: 147-158.
- Pirone G., Cutini M., 2002. *Juniperus oxycedrus* L. subsp. *oxycedrus* and *Paliurus spina-christi* Miller scrubs in the intermontane basins in the Abruzzo region (central Italy). *Fitosociologia* 39(1), suppl. 2: 81-95.
- Rogora M. et al., 2018. Assessment of climate change effects on mountain ecosystems through a cross-site analysis in the Alps and Apennines. *Science of Total Environment* 624: 1429-1442.

The effects of pasture dryness on sheep mammary gland and farm income

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Sheep is the most breed species in the Central Italy Apennine using natural pastures as trophic resource and grazing activity is also fundamental to maintain the grassland biodiversity. The increase in summer aridity causes a decrease in grasslands pastoral value: it is registering an anticipation of the moment of pasture maximum flowering and a shortening of the period between maximum flowering and maximum dryness of pastures. The increase in drought stress negatively effects forage quality and quantity and it is therefore detrimental to the sustainability of extensive sheep farms because it affects the morpho-functional features of the animals and greatly reduces milk production. The loss of farming sustainability shall lead to the disappearance of a pivotal cultural and natural heritage. This work aimed to find strategies buffering the effects of increasing summer drought stress ensuring an economical sustainability to the farmers. In this study we evaluated the effect of food supplementation on the apelin (APLN)/apelin receptor (APLNR) system in ovine mammary gland and on milk/cheese production. A flock of adult ewes was free to graze from June until pasture maximum flowering (MxF). Then until pasture maximum dryness, the flock was divided in two groups: control (Cnt), fed only on pasture, and experimental (Exp), also supplemented with 600 g/day/head of cereals. APLN and APLNR were assessed by Real-Time PCR and immunohistochemistry on the mammary glands of subjects pertaining to three groups. Quality and peculiar features of cheese were evaluated by means of sensory panel. Cheese consumer preference and willingness-to-pay were evaluated and analysis of the cost-benefit analysis was applied to assess the economic impact of food supplementation. APLN and APLNR were detected in alveolar and ductal epithelial cells. APLNR expression showed significant difference during pasture vegetative cycle. Also, milk production and composition showed significant difference among the three groups. The reduced APLNR expression during parenchyma involution enables us to hypothesize its modulating role in the system control. Economic analysis showed a positive effect of food supplementation. Food supplementation can play a fundamental role because is able to preserve the economic sustainability of farm, thus avoiding land abandonment.

References

- Mercati F., Maranesi M., Dall'Aglio C., Petrucci L., Pasquariello R., Tardella F.M., De Felice E., Scocco P., 2018. Apelin System in Mammary Gland of Sheep Reared in Semi-Natural Pastures of the Central Apennines. *Animals* 8: E223.
- Scocco P., Rivaroli S., Mercati F., Tardella F.M., Malfatti A., De Felice E., Catorci A., 2018. Anatomy for economy: starting from the rumen keratinization degree to enhance the farm income. *Food Economy* 20: 1-12.

Plant diversity and carbon stocks patterns in the vegetation series of *Rubio peregrinae-Quercetum cerridis* and *Melico uniflorae-Quercetum cerridis*

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The abandonment of extensive grazing has determined widespread secondary successions in Europe. This trend has positive effects on carbon accumulation in biomass and soil, but leads to the decline of semi-natural habitats. Understanding the relationship between carbon accumulation and plant diversity along successions is relevant for land management. We focused on submediterranean *Quercus cerris* woods of a hilly area of Central Italy (Di Pietro et al. 2010; Biondi et al. 2014). Our aims were to define the ecological and dynamics aspects of these woods and to model the patterns of plant diversity and carbon stocks along the succession following pasture abandonment.

We used the ecological land classification deductive approach to map the land units of *Rubio-Quercetum cerridis* and *Melico-Quercetum cerridis* (Blasi et al. 2014), and the phytosociological survey to identify the vegetation series. In each land unit, we selected chronosequences by comparing historical and recent aerial photos. We selected sites that in 1944 were occupied by grasslands and that now host different stages (grasslands, shrublands, new formed woods). We sampled 24 plots for plant species, soil and aboveground biomass. To test differences across stages, species richness and carbon pools were compared by means of analysis of variance. To test for the relationships between carbon pools and species richness and composition we used mixed models regression analyses.

We found a high variation in species richness between stages. Instead, the amount of carbon in biomass and soil increased continuously, even if soil carbon did not differ among stages. Species richness was not related to carbon pools, while the variation in species composition was significantly related to this variation (Facioni et al. 2019). Our results strongly support the need to manage semi-natural ecosystems through a multi-functional perspective that values carbon sequestration and their support to unique biological diversity.

References

- Biondi E., Blasi C., ..., Zivkovic L., 2014. Plant communities of Italy: The Vegetation Prodrôme. Plant Biosystems 148: 728-814.
- Blasi C., Capotorti G., ..., Zavattero L., 2014. Classification and mapping of the ecoregions of Italy. Plant Biosystems 148: 1255-1345.
- Di Pietro R., Azzella M.M., Facioni, L., 2010. The forest vegetation of the Tolfa-Ceriti mountains (northern Latium - central Italy). Hacquetia 9: 91-150.
- Facioni L., Burrascano S., et al., Blasi C., 2019. Shifts in plant diversity and carbon stocks along the succession towards submediterranean *Quercus cerris* L. woods in Central Italy. Phytocoenologia, in press.

Morphometric and molecular studies on the *Quercus pubescens* complex in south-eastern Italy

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Italy is the country showing the highest oak species diversity in Europe, although there is still not complete agreement on the exact number of oak taxa occurring in the territory. Most of the taxonomic uncertainty regarding the Italian (and European) oaks concerns the so-called white oaks (*robur*, *petraea*, *pubescens*, *frainetto*) and in particular the pubescent-oaks collective group (*Quercus pubescens* s.l. subgen. *Quercus*, Sect. *Quercus*). Under the name *Quercus pubescens* s.l. there is a complex of deciduous oak taxa, or presumed ones, with a mainly SE-European distribution and a large ecological niche. Apulia is the easternmost region of Italy and counts the highest number of oak species (10). In the taxonomical and phytosociological literature several species belonging to the *Quercus pubescens* collective group are reported for this region, namely *Q. pubescens* Willd., *Q. virgiliana* Ten., *Q. amplifolia* Guss. and *Q. dalechampii* Ten. In this paper are summarized the results a study concerning the morphometric and molecular genetic analysis of pubescent oak individuals collected within 24 populations located in different ecological-geographical areas of Apulia in order to verify possible occurrences of groups of diversity. For the morphometric analysis, 25 morphological characters regarding the oak's leaves and fruits were statistically treated using both univariate and multivariate analysis procedures. As regards the molecular studies, we analyzed genetic diversity, genetic structure and extent of gene flow among the afore-mentioned pubescent oak populations where each tree was genotyped at 11 polymorphic microsatellite markers. Polymerase chain reaction amplification was performed on leaf-derived DNA. The results showed that almost all the morphological characters analysed exhibited a continuous trend of variation so that none of them was suitable to be used as a discriminating character between populations (Di Pietro et al. 2016). From a molecular point of view, no differentiation was observed among the populations investigated. The genetic differentiation coefficient (F_{ST}) was low whereas the gene flow among populations was relatively high. Our overall results suggested that it is unlikely the coexistence of more than one species among the Apulian pubescent-oaks (Di Pietro et al submitted).

References

- Di Pietro R., Di Marzio P., Medagli P., Misano G., Silletti G.N., Wagensommer R.P., Fortini P., 2016. Evidence from multivariate morphometric study of the *Quercus pubescens* complex in southeast Italy. *Botanica Serbica* 40(1): 83-100.
- Di Pietro R., Di Marzio P., Antonicchia G., Fortini P. Characterization of *Quercus pubescens* complex in southern Italy using molecular markers (submitted)

New occurrence of rare and threatened wet montane ecosystems in Central Italy

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The montane karst plains, hosting peculiar types of wetland ecosystems, are represented in the Apennine by a small bunch of areas with a fragmented distribution. They have long time been a favoured study object for botanists and vegetation scientist (e.g. Cortini Pedrotti *et al.* 1973; Pedrotti 1976, 2008). The present study provides new insight on these ecosystems through the investigation of the little highland of Castel Santa Maria (Perugia), a totally neglected site excluded from any protected area or Natura 2000 Site and never investigated before. Located in Central Apennine (about 1,060 m a.s.l.), it is represented by a relatively small surface on limestone (<0.5 km²) affected by winter-spring flooding and disturbed only by early summer mowing in the driest parts. New occurrences of very rare species (e.g. the Circumboreal, Red-Listed Endangered *Carex buxbaumii* Wahlenb.) have been detected; uncommon plant communities with disjointed distribution have been sampled by way of 81 phytosociological relèves, and referred to the alliances *Magnocaricion elatae* Koch 1926, *Magnocaricion gracilis* Géhu 1961, *Alopecurion utriculati* Zeidler 1954, *Potentillion anserinae* Tüxen 1947. Although not attributable to single Annex I Habitats, these vegetation types provide evidences of a rich biodiversity mosaic, with relevant conservation value considering their biogeographic isolation. On this ground, and based on the eco-hydrologic features of the area, we propose here for the first time the identification of the Annex I Habitat 3180 "Turloughs", defined as "temporary lakes principally filled by subterranean waters and particular to karstic limestone areas", first described from Ireland (hosting the largest area of this habitat), later reported for Slovenia, Estonia, Germany and Wales, in the Alpine, Atlantic, Boreal, Continental Biogeographic Regions. This ecosystem corresponds to the habitat type described in the Red List of Habitats (Janssen *et al.* 2016) "C1.6a Temperate temporary water body".

References

- Cortini Pedrotti C., Orsomando E., Pedrotti F., Sanesi G., 1973. La vegetazione e i suoli del Pian Grande di Castelluccio di Norcia (Appennino centrale). Atti Ist. Bot. Lab. Critt. Univ. Pavia, 6: 155-249.
- Janssen J.A.M., Rodwell J.S., García Criado M. *et al.*, 2016. European Red List of Habitats. Part 2. Terrestrial and freshwater habitats. Luxembourg: Publications Office of the European Union. 38 pp. ISBN 978-92-79-61588-7, doi: 10.2779/091372
- Pedrotti F., 1976. Les prairies permanentes humides de l'Apennin Central: Phytosociologie et cartographie. Colloques Phytosociologiques 5: 181-187.
- Pedrotti F., 2008. La vegetazione delle marcite di Norcia (Italia centrale). Braun-Blanquetia 44: 1-31.

Syntaxonomic review of *Pinus nigra* ssp. *banatica* woodlands in the Romanian Carpathians

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Pinus nigra subsp. *banatica* (Endl. ex Borb.) Novak has a limited, relictual distribution in south-western Romania and Serbia. The stands occurring on limestones have a particular floristic composition compared with their counterparts from Serbia (Fekete, 1959) and therefore, were initially assigned to *Cariceto humilis* - *Pinetum nigrae cytisanthosum* Fekete 1959 and later to *Genisto radiatae-Pinetum nigrae* Resmeriţă 1972 em. Coldea 1991. To date, the sole phytosociological survey carried out in similar stands developed on acidic substrates resulted in 6 relevés, which were generically and provisionally assigned to *Pinetum pallasianae* (Matacă 2005).

The aim of the present study was to review and further extend the coenotaxonomic knowledge about the back pine woodlands within the Romanian Carpathians by reference to the new European syntaxonomical framework (Mucina et al., 2016). For this purpose, we employed several approaches, i.e. compositional analysis, detection of diagnostic species, synecological characterisation, synchorologic delimitation, syndynamic relationships, and phytogeographic interpretation.

Partitioning around medoids and NMDS based on Sørensen index of resemblance were used for the classification and ordination of the 46 relevés (of which four drawn from the literature). In addition, dB-RDA and Mann-Whitney test were employed to assess the importance and significance of environmental variables.

Two, very stable and relatively homogeneous clusters of relevés were retained as the optimal solution. The sharp separation of the two clusters is obvious along the first NMDS axis. All environmental variables have significant effects on the db-RDA scores, but the aspect is the only one featuring a larger loading on the (non-significant) axis 2. Moreover, significant differences in location between the distributions of elevation, slope and soil reaction by releve cluster were revealed. The cluster 1 corresponds to *Genisto radiatae-Pinetum nigrae*, whereas the cluster 2 was assigned to *Genisto pilosae-Pinetum nigrae* ass. nova hoc loco (*Quercetalia pubescentis* class, *Quercetalia pubescenti-petraeae* order, *Quercion petraeae* alliance), which is developed on slopes with shallow, skeletal, weakly acidic soils.

References

- Coldea G., 1991. Prodrome des associations végétales des Carpates du Sud-Ouest. Documents Phytosociologiques, 13:317-359.
- Matacă S.Ş., 2005. Parcul Natural Porţile de Fier. Floră, vegetaţie şi protecţia naturii. Ed. Universitaria Craiova, 2005.
- Mucina L., Bültmann H., Dierßen K., Theurillat J.-P., Raus T., Čarni A., Šumberová K., Willner W., Dengler J., ..., Hennekens S.M., 2016. Vegetation of Europe: Hierarchical floristic classification system of vascular plant, bryophyte, lichen, and algal communities. Applied Vegetation Science 19(Suppl. 1): 3–264.

Dinaric fir-beech forests in Slovenia: geographical differentiation and response to forest management¹

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Dinaric fir-beech forests (*Omphalodo-Fagetum* s. lat.) cover more than 10% of Slovenian forest area and are important in the context of timber production and biodiversity (Natura 2000: *Aremonio-Fagion*). However, little is known how these forests differ across relatively broad spatial range in Slovenia and about their response to disturbances induced by silvicultural measures. We analysed differences in taxonomical and functional composition of understory vegetation between three geographically distant Dinaric fir-beech forests, located in Trnovski gozd (TR), Snežnik (SN) and Kočevski Rog (KR). Sites are characterized by diverse karst terrain with numerous sinkholes. Sampling of vegetation took place in nine sinkholes per site in 2012. Five circular plots ($r = 2$ m) per sinkhole were established, 135 plots in total. To investigate the short-term effects of forest management, overstory trees were cut in one third of the sinkholes, creating circular canopy gaps of 0.4 ha in size. Post-treatment surveys were done two years after the cutting (in 2014). Plot-level Ellenberg indicator values (EIVs), complemented with Pignatti bioindicator values, and community-weighted mean abundances of some widely used plant functional traits were calculated. Overall, 133 different plant species were recorded in shrub and herb layer, out of which 40 species were present at all three sites. Differences in floristic composition among sites were associated with plant species, present only at one site but absent from the other two. Seventeen differential species were identified for TR (e.g. *Festuca altissima*, *Milium effusum*), 29 for SN (e.g. *Carex alba*, *Pulmonaria officinalis*) and 16 species for KR (e.g. *Scopolia carniolica*, *Phyllitis scolopendrium*). The largest differences in species composition and ecological conditions (estimated based on EIVs) were observed between TR and SN, whereas KR and SN tended to be more similar and shared the highest number of common species. In terms of functional composition, differences between sites were less pronounced. We found that plots with higher pre-treatment species (functional) richness exhibited smaller compositional (functional) shifts. At least to some extent, responses to cutting were site-specific, mostly related to different rates of species turnover in canopy gaps. Even though studied sites belong to the same phytosociological association, our results demonstrated non-negligible variation in understory communities and response to management.

References

- Dakskobler I., 2008. A review of beech sites in Slovenia. Research reports Forestry and Wood Science and Technology 87: 3-14.
- Ellenberg H., 1992. Indicator values of plants in Central Europe. Scripta Geobotanica 18: 1-258.
- Pignatti S., Menegoni P., Pietrosanti S., 2005. Bioindicator values of vascular plants of the Flora of Italy. Braun-Blanquetia 39: 3-95.

Vegetation diversity and dynamic of forest communities in Mljet national park (Croatia)

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The Mljet National Park stretches over 5375 hectares in the NW part of the island, which covers almost a third of the islands protected land and surrounding sea. It has typical Mediterranean climate and is covered by lush Mediterranean vegetation mostly consisting of Aleppo pine (*Pinus halepensis* Mill.) and the holly oak (*Quercus ilex* L.) forest communities, with some particularly well preserved old forest stands. There are also anthropogenically degraded forms of vegetation such as shrubland, garrigue and rocky grounds. Most of these forests were destroyed by uncontrolled management during the First World War (felling, grazing, fires), but also in a great fire in 1917. It significantly changed the appearance and structure of vegetation.

The vegetation was analysed on a set of 112 original phytosociological relevés and 43 relevés obtained from various literature sources, all relevés were made according to Braun-Blanquet method. After the numerical classification based on floral composition and comparisons with the relevés from relevant literature 6 following forest communities were determined: *Fraxino orno-Quercetum ilicis*, *Myrto-Quercetum ilicis*, *Ostryo-Quercetum ilicis*, *Pistacio-Juniperetum phoeniceae*, *Ceratonio siliquae–Pinetum halepensis* and *Phillyreo angustifoliae–Pinetum halepensis*.

Vegetation dynamics within the forest communities were studied with the chronosequence approach (space-for-time substitution). Generally, two successional series could be distinguished considering the presence of Aleppo pine, and within each serie it was possible to distinguish succession on more xerothermophilic and more mesic habitats.

The general trend showed a decrease in number of species by the progress of succession. The floristic composition of the analyzed plant communities is affected in a greater way by the influence of succession than the ecological characteristics of the habitat. The results indicate the strong influence of a very dense canopy on the habitat homogenization. By gradual closure of the canopy during the progress of succession the conditions in the stands become more mesic, the humidity of the habitat and the quantity of accessible soil nutrients increases, as well as the share of species with mesomorphic leaves increases.

Today's appearance, structure, distribution and interaction of the Aleppo pine and holly oak are the result of the long-lasting influence of man, and to a lesser extent the result of their natural dynamics.

Understory vegetation dynamics across Slovenian forest ecosystems: 10 years of forest sites monitoring

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Between 2004/05 and 2014/15, plant species diversity and composition were studied in representative Slovenian forest ecosystems. In total, 60 plots were placed across different managed forests and are part of a comprehensive international network of sites launched within the ICP Forests Programme aimed to assess the influence of various factors on EU forests.

Over the 10-year monitoring period, substantial vascular plant species turn-over was observed; 46 species identified in 2004/05 were not confirmed in 2014/15, and 17 new species (not present in beginning) were recorded in 2014/15. Species richness across the 10 sites (gamma diversity) significantly decreased from 273 to 244 species (9.96% decrease) during the study period, while mean species richness per plot did not significantly change. However, the mean value of plot level diversity indices (Shannon and Simpson index) and evenness significantly increased. The frequency and cover of most common plant species changed during the study duration. *Fagus sylvatica*, which is the dominant tree species in Slovenia, significantly decreased in the upper-tree layer but increased in the herb layer. Several species significantly increased in cover in the herb layer, including *Anemone nemorosa*, *Viola reichenbachiana*, *Cyclamen purpurascens*, *Hedera helix*, *Daphne mezereum*, *Carex sylvatica*, *Galeobdolon flavidum*, *Salvia glutinosa*, and *Brachypodium sylvaticum*.

Disturbance impacts at the stand level caused reduction of total vegetation cover, including tree-layer cover. Although the studied plots are in managed forests, the cover of deadwood was significantly higher after tree damages caused by different disturbances followed by post-disturbance salvage logging. The frequency of disturbance events increased during the latter part of the monitoring period, such that vegetation cover and diversity may continue to change in the future.

References

- Canullo R., Starlinger F., Granke O., Fischer R., Aamlid D., Neville P., 2011. ICP Forests Manual on methods and criteria for harmonized sampling, assessment, monitoring and analysis of the effects of air pollution on forests, Part VII.1: Assessment of ground vegetation. UNECE ICP Forests Programme Co-ordinating Centre, Hamburg, 19 pp.
- Kutnar L., 2006. Intensive monitoring of vegetation of forest ecosystems in Slovenia. In: Hladnik D. (ed.). Monitoring the management of forests and forested landscapes, Studia Forestalia Slovenica. Ljubljana, Biotechnical Faculty, Department of Forestry and Renewable Forest Resources: 277-290.
- Nagel T.A., Mikac S., Dolinar M., Klopčič M., Keren S., Svoboda M., Diaci J., Boncina A., Paulić V., 2017. The natural disturbance regime in forests of the Dinaric Mountains: A synthesis of evidence. Forest Ecology and Management 388: 29-42.

***Ostrya carpinifolia* forests in Europe. Preliminary results of the first multidisciplinary study at the whole distribution area level**

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Having identified the *Ostrya carpinifolia* forests as one of the most widespread forest types in the Apennines-Balkan bio-geographical region (Horvat 1950; Puncer and Zupancic 1982; Tabacchi and Gasparini 2012) and having highlighted the shortage of studies, and the lack of inclusion of these coenoses in the habitats described at European level (EEA 2007), the main purpose of research project was to provide useful data to understand the ecological value, the dynamics, the potentiality and the threats of these coenoses. In order to provide an image as complete as possible, the project was articulated into two key points. (I) A census of these forest formations along the Italian and Balkan territories, carried out by collecting floristic-vegetational, pedological, structural and management data of these coenoses at the whole geographic distribution range. (II) The analysis of the dynamics related to traditional coppice management, its modification and abandonment. The main result of this large data collection campaign is the creation of datasets related to the ecological and management characteristics, regarding the entire distribution area and all the different management phases. The interpolation and reworking of these data allow to increase the understanding of these forest formations, making it possible to interpret dynamics and evaluate the real ecological value characterizing the *Ostrya carpinifolia* forests. These aspects are still difficult to deal with, given the data presently available in literature but fundamental to build dynamic forecast models. Models necessary for the drafting of real useful management and landscaping plans. The studies carried out show how these formations, commonly labelled as not very interesting under the ecological point of view, are instead characterized by a particularly rich flora, a very lively dynamism and highlight a strong resilience. Therefore, these coenoses should not be interpreted as transitory or recovery phases of more "mature" coenoses, but real stable semi-natural forest formations very rich in terms of biodiversity, now threatened by widespread abandonment, exactly like the secondary prairies habitats.

References

- EEA (European Environment Agency), 2007. European forest types. Categories and types for sustainable forest management reporting and policy. 2nd edition, 111pp.
- Horvat I., 1950 Šumske zajednice Jugoslavije. Inst. Za sumarska Istra (Zapareb), 1 – 73
- Puncer I., Zupancic M., 1982. Die Ökologische und Wirtschaftliche Bedeutung der *Ostrya carpinifolia* Scop. In Slowenien. Studia Geobotanica 2: 25-32
- Tabacchi G., Gasparini P., 2012. L'inventario nazionale delle foreste e dei serbatoi forestali di carbonio. INFC-2005. Secondo inventario forestale nazionale italiano. Metodi e risultati. Con CD-ROM. Edagricole-New Business Media, Bologna, 653pp.

Apelin and resistin, new adipokines acting on the reproductive apparatus of the sheep: a molecular investigation as a supporting tool in the grassland ecosystem management

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Adipokines represent a link between the subject's energy availability and a regular performance of the reproductive activity (1). Apelin (Apln) and resistin are newly discovered adipokines that have never been studied in sheep. Their investigation at the reproductive apparatus level is aimed at obtaining information on the effect of different nutrition states in grazing animals in specific climatic situations (e.g. summer), allowing to support the management of these animals in the areas of the central Apennines.

As Apln system regards, an extensive investigation was performed to observe its distribution in the organs of the reproductive apparatus. Instead, the study of resistin was focused on uterus comparing ewes subjected to different nutritional level. Investigation was carried out on 15 adult female ewes in dry stage reared in a semi-natural pasture and fed with fresh hay from June to the pasture maximum flowering (MxF). From this period to maximum dryness, the control group (Cnt) was fed with fresh hay while, the experimental group (Exp) was fed with fresh hay supplemented with 600g/day/head of barely and corn (1:1). Apln and Apln receptor (AplnR) were analysed by RT-PCR and immunohistochemistry (IHC) in the ovary, oviduct and uterus. In addition, concentrations of plasma Apln were evaluated on 5 animals from the MxF to MxD period. Resistin was evaluated in the uterus by means of IHC and western blotting comparing Cnt and Exp groups.

Apln system was observed in the corpus luteum, in the lining epithelium of the oviduct and uterus and in the uterine glands. The highest levels of Apln and AplnR mRNAs were detected in the MxD group ewes in the luteal phase of the estrous cycle compared to the MxF group in the anestrous phase. Plasma Apln levels was fairly constants during the period evaluated. Resistin was observed in the lining epithelium of uterus and in the uterine glands where Exp group showed a stronger immunohistochemical staining.

Our findings support the existence of a peripheral Apln and resistin system in the sheep reproductive apparatus. Molecular expression differences could be related to the tissue cyclic activity and seem to be also affected by the diet.

Data obtained in this study may support the decisional processes about the management of semi-natural pastures in the central Apennines also considering the increasing summer aridity, preserving the agro-zootechnical activities.

References

Kurowska P., Barbe A., Różycka M., Chmieleńska J., Dupont J., Rak A., 2018. Apelin in Reproductive Physiology and Pathology of Different Species: A Critical Review. *International Journal of Endocrinology*, 2018: 9170480.

On the *Robinia pseudoacacia* communities in the Italian peninsula: a phytosociological synthesis

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Robinia pseudoacacia L. (black locust), a nitrogen fixing deciduous tree species belonging to the *Fabaceae* family, is native to the Appalachian region of North America. Imported to Europe at the beginning of seventeenth century is now naturalized in most temperate regions of the northern hemisphere and is considered one of the 100 most-widespread alien species in Europe. In Italy it finds its southern limit of distribution and it has been shown how it constitutes a disturbance element for the native plant communities, also replacing the potential vegetation. In literature there are evidences concerning the transformation mechanisms that this species operates on plants and entomological communities and on soil characteristics, however there are relatively few phytosociological studies of syntaxonomic nature, due to a lack of data.

Here we present the results of a floristic vegetational study, recently accepted in a peer reviewed journal, on the *Robinia pseudoacacia* neoformation forests in the peri-Adriatic sector of central Italy. This has allowed the ecological, biogeographic, syntaxonomical and landscape characterization of these coenoses. This currently represents the first syntaxonomic contribution of the *Robinietea* class in Europe for the Mediterranean biogeographical region and the southernmost syntaxa of this class described for the Italian peninsula. Here we propose the new alliance *Lauro nobilis–Robinion pseudoacaciae* of the order *Chelidonio–Robinietalia pseudoacaciae* and class *Robinietea*, with two new associations: *Melisso altissimae–Robinietum pseudoacaciae* and *Rubio peregrinae–Robinietum pseudoacaciae*.

On the basis of comparisons data with the European context, we propose a syntaxonomic scheme for the *Robinia pseudoacacia* communities in the Italian peninsula, as synthesis of the biogeographical, bioclimatic and biodiversity characterization of the recognized syntaxa.

Thermophilous oak forests (*Carpinion Orientalis*, *Crataego laevigatae-Quercion cerridis*) of Molise (Southern Italy)

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A phytosociological study of the *Carpinion orientalis* and *Crataego laevigatae-Quercion cerridis* thermophilous hilly woodland in Molise is herein presented. 99 relevés (published and unpublished) were analysed using the SYN-TAX 2000 software. Eight clusters are recognised, grouped in three associations. The first one refers to the *Lonicero xylostei-Quercetum cerridis* association (subass. *typicum*, subass. *festucetosum exaltatae*, var. with *Euphorbia amygdaloides*, var. with *Quercus ilex*) distributed in the Mediterranean areas of the region. The second one refers to the *Daphno laureolae-Quercetum cerridis* association (subass. *rosetosum arvense*, var. with *Brachypodium rupestre*, var. with *Festuca exaltata*) distributed in the central part of the region on sandy-clayey soils with temperate climate. The third association (*Echinopo siculi-Quercetum frainetto*) finds the north-eastern limit of its distribution in Molise. It occurs in temperate areas and is connected with level ground or gentle slopes with substrates mainly represented by sandy soils, showing a clear edaphic determinism. For more conservative sites the new subassociation *maletosum florentinae* is proposed. The *Lonicero xylostei-Quercetum cerridis* and *Daphno laureolae-Quercetum cerridis* associations are included in the *Carpinion orientalis* alliance; the *Echinopo siculi-Quercetum frainetto* association refers to the *Crataego laevigatae-Quercion cerridis* alliance.

References

- Abbate G., 1990. Le foreste della riserva MAB "Collemeluccio-Montedimezzo" (Molise – Italia Meridionale). Documents Phytosociologiques n.s. 12: 279-304.
- Biondi E., Gigante D., Pignattelli S., Venanzoni R., 2001. I boschi a *Quercus frainetto* Ten. presenti nei territori centro-meridionali della penisola italiana. Fitosociologia 38(2): 97-111.
- Blasi C., Di Pietro R., Filesi L., 2004. Syntaxonomical revision of *Quercetalia pubescenti-petraeae* in the Italian Peninsula. Fitosociologia 41(1): 87-164.
- Blasi C., Fortini P., Grossi C., Presti G., 2005. Faggete e cerrete mesofile dell'Alto-Molise. Fitosociologia 42(2): 67-81.
- Blasi C., Paura B., 1995. Su alcune stazioni a *Quercus frainetto* Ten. in Campania ed in Molise: analisi fitosociologica e fitogeografica. Studi sul Territorio, Ann.Bot. (Roma), vol. LI, suppl. 10: 353-366.
- Paura B., Abbate G., 1995. I querceti caducifogli del Molise: primo contributo sulla sintassonomia e corologia. Studi sul Territorio, Ann.Bot. (Roma), vol. LI, suppl. 10: 325-340.
- Taffetani F., Catorci A., Ciaschetti G., Cutini M., Di Martino L., Frattaroli A.R., Paura B., Pirone G., Rismondo M., Zitti S., 2012. The *Quercus cerris* woods of the alliance *Carpinion orientalis* Horvat 1958 in Italy. Plant Biosystems 146: 918-953.

Birds communities as indicators of the conservation status in the forests of Sibillini National Park

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Birds communities are widely used as indicators for assessment of the conservation status of the ecosystems and to monitor the possible impacts of human pressures (EEA 2014).

In 2014 and 2015, within a wider project of characterization of the forests of Sibillini National Park, a research has been carried out to evaluate the structure and composition of the birds communities and, through them, to contribute to highlight problems and opportunities created by the past and present management of the woods in the area.

To achieve this aim, a survey has been conducted using the point count method (Blondel et al. 1981) with 83 plots spread in all the main forest types surveyed in both years.

The research has tried to answer the following questions:

1. What is the composition of the birds community of the Marche's forests and what are the differences with the surrounding areas?
2. What are the differences between the birds community of the various types of Marche's forests?
3. Are the birds communities of the Sibillini National Park forests different from the communities of the other mountain areas of the Marche?

Data from previous research, conducted in all the Marche's territory with the same method, have been used to address the first two problems.

The analysis of the data allowed to reach the following conclusions.

- The main difference between the bird communities of the Umbria-Marche Apennines forests and those of the other mountain systems is the nearly complete absence in the former one of the species typical of the old-growth forests.
- Usually, the communities are dominated by widespread and generalist taxa, in many cases common and abundant also in rural landscapes.
- Even if the system of the Sibillini forests is one of the widest and the most diversified in the Marche, it has not particular positive features respect to the other mountain areas of the region.
- To increase the quality of the biodiversity of the Sibillini forests, a change in the silviculture management system is needed. The target has to be an increase in the structural diversity of the forests, both at local and at landscape scale, and a greater availability of dead wood and of standing dead trees.

References

- Blondel J., Ferry C., Frochot B., 1981. Point counts with unlimited distance. *Studies in Avian Biology* 6: 414-420.
- EEA, 2014. Developing a Forest Naturalness Indicator for Europe-Concept and methodology for a High Nature Value Forest indicator, EEA Technical report No 13/2014.

Effects of oregano aqueous extract on defence ability of pig gut

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Different studies in the last years have focused on use of natural compounds from herbs and spices as an alternative to synthetic additives in order to avoid the growing problem of antibiotic resistance. Among officinal plants, *Origanum vulgare* L., belonging to Lamiaceae family, has been shown to possess antioxidant, antibacterial, antifungal, anti-inflammatory, antitumor, antiparasitic, antiviral, anti-hyperglycemic, anti-cholinesterase, diaphoretic, carminative, antispasmodic and analgesic activities, which are mainly attributed to its components carvacrol, limonene, gamma-caryophyllene, rhocymenene, camphor, linalol, alpha-pinene and thymol. Among oregano properties, the antioxidant and the antibacterial ones are of special interest. Oregano is also able to induce a higher glycoconjugate production. Secreted glycoconjugates cover the intestinal mucosae creating a continuous gel layer, which performs various functions: lubrication, barrier for certain low molecular weight solutes, proteolytic degradation and a barrier against microorganisms and parasites. On the basis of above considerations, this work is aimed to evaluate the effects of oregano aqueous extract (OAE) dietary supplementation on pig gut complex carbohydrates, detected by conventional histochemistry, and oxidative stress, using as target molecule Bcl-2 Associate X protein (BAX). Glycohistochemical and immunohistochemical treatments were carried out on four gut tracts: duodenum, ileum, caecum and colon. Glycohistochemistry was performed by staining with Periodic acid-Schiff (PAS), Alcian blue (AB) pH 2.5, AB-PAS, AB pH 1, AB pH 0.5, low iron diamine, high iron diamine. Adjacent serial sections were pre-treated with Sialidase V before staining with AB pH 2.5 preceded or not by saponification with 1% KOH in 70% ethanol to remove the acetyl groups. Positive histochemical responses were found at goblet cell level in all examined gut tracts; duodenal glands were also reactive. The data analysis evidenced significant differences to the histochemical treatment reactivity between control and oregano supplemented groups. BAX immunostaining decreased in oregano supplemented group. Our results showed that oregano aqueous extract supplementation improves the production of the glycoconjugates able to enhance the protection of the pig intestinal mucosae; in addition, it reduced BAX immunostaining, suggesting an increased antioxidant action in oregano supplemented group. Finding from this experiment could be useful for carrying out studies aimed to reduce antibiotic use and prevent antimicrobial resistance enhancing endogenous defence ability.

References

Scocco P., Forte C., Franciosini M.P., Mercati F. Casagrande-Proietti P. Dall' Aglio C., Acuti G., Tardella F.M., Trabalza-Marinucci M., 2017. Gut complex carbohydrates and intestinal microflora in broiler chickens fed with oregano (*Origanum vulgare* L.) aqueous extract and vitamin E. Journal of Animal Physiology and Animal Nutrition 101: 676-684.

Some comments about morphological, ecological and altitudinal variability of some Galician vascular species (NW Spain)

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Plant species have a natural area as a result of their adaptation to the habitat where they are growing. In many cases, plants growing in one part of the area are different from those of another area; sometimes this variation is small and allows the identification of different populations, but in other cases the variability is such that, together with its own area and other attributes, these populations can be differentiated as different taxa. In the Northwest of the Iberian Peninsula there are populations of a group of species, some endemic and others of wider area, which have been varying more or less uniformly in relation to altitude and sometimes to the type of substrate. As a result of this there have been some new species *Arnica montana* /*A. montana* subsp. *atlantica*, *Eryngium durieui* /*E. juresianum*, *Cardamine raphanifolia* /*C. raphanifolia* subsp. *gallaecica*, *Thymus froelichianus* /*T. capeladensis* sp. nova, *Thymelaea coridifolia* /*T. dendryobyum*, *Silene acutifolia* /*S. foetida* subsp. *gayana*, which present clear morphological, ecological, altitudinal or biochemical differences. Others such as *Erysimum linifolium*, *Achillea millefolium*, *Solidago virgaurea* or *Anthyllis vulneraria* extend from the level of the sea until reaching 1,900-2,000 m altitude or occupying different rocky substrates (granites, slate, limestone, serpentine, etc.). In this paper, the morphological, ecological, altitudinal or biochemical differences of several antecited species are presented, highlighting their differential character -which some authors do not consider exists-, proposing to restore some combinations or describe some new species or subspecies of plants.

References

- Castroviejo Bolibar S., 1986- Flora iberica. 1-21. Real Jardín Botánico de Madrid-C.S.I.C. Madrid.
Merino y Román B., 1905-1909. Flora Descriptiva e Ilustrada de Galicia, I, II, III. Tipografía Regional. Tuy.
Silva-Pando F.J., 2008. Plantas endémicas y subendémicas de Galicia. Boletín BIGA 3: 9-150.

Variability of the morphology of acorns and fruit production in various oak forests of Galicia (NW Spain)

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Oak forests (*Quercus robur*) are considered the potential vegetation of a large part of the northwestern sector of the Iberian Peninsula, from the sea level to 1,000-1,200 m. The production of oak fruit and the morphological characters of the acorn will depend on both climatic and altitudinal conditions. To study the variability of these parameters, 8 fruit sampling plots were installed. These consisted of 6 baskets of 1 m diameter, in which the fallen fruits were collected every 15 days. Weight, length and width were measured for all the acorns collected. The 5 largest acorns collected in each locality were selected and measured. The results of the 2016-2018 collections showed that there was a notable variability in the different parameters, considering site of collection, year of collection and peak production period. In 2016, there was no production, while in 2017 and 2018, the production ranged between 1 and 96 acorns / m² and from 131 to 1,847 kg p.v./ha, with significant differences for only one or two sites of collection. As regards the morphological characteristics, the maximum length exceeded 30 mm, while the width reached 20 mm, being higher in 2017 than in 2018. The length / width ratio (form factor) was slightly higher in 2018. In general, weight, length and width exhibited a greater variability in 2018 than in 2017, while the form factor remained more or less constant. A negative correlation was found between altitude of the sites of collection and the weight of the acorn, especially at altitudes higher than 400 m. Finally, we provided some considerations about the possible role played by the meteorological conditions on these results, making comparisons between our results and data already published by other authors from similar studies.

References

Silva-Pando F.J., Alonso Santos M., Bustos Vázquez M., Ignacio Quinteiro M.F., 2018. Silva-Early results of the effect of 2 varying celtic pig stocking densities on ibero-atlantic oakwoods (A Coruña, Spain). In: N. Ferreiro & M.R. Mosuqrea (eds.), *Proceedings 4th European Agroforestry Conference "Agroforestry as Sustainable Land Use"*. European Agroforestry Federation-USC. Lugo. 28-30 May 2018. Nijmegen, The Netherlands.

Ecological-economic analysis and evaluation of the ecological functions of the forest areas of the Marche Region in the framework of the General Reclamation Plan and new governance perspectives

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The Italian legislation (LN221/2015) provides for a specific payment system of the environmental ecosystem services, which can be a significant lever for the economy of the forest areas and a relevant tool in the strategy for the protection of ecosystems, the fight against instability and the management of water resources. This represents an innovative approach for the Reclamation Plan that supports implementation plans, operating on a three-year basis, able to identify the necessary interventions in a timely manner to the functional quality of the territory. If at the basis of the Reclamation Plan is the management of the water resource, the hydraulic safety and the reorganization of the hydrogeological instability, it is extremely important to evaluate the role of the forest cover with respect to the functions linked to the water cycle and failure. However, with some local exceptions (Goio et al. 2008) and in-depth studies aimed at certain geographical areas (Santolini et al. 2015), the ecological functions of forest systems and their ESs have not been the subject of a sufficiently thorough evaluation, despite this quantification may have the effect of orienting the planning and programming choices of the cultivation interventions, as well as verifying their rationality, giving an economic value to the environmental protection policies.

Our research aims to investigate the role of forest cover and forest management and their Ecosystem Services (ES) on the water balance, the protection of hydrogeological instability and soil erosion of the Marche Region - according to the objectives of the Reclamation Plan and the Helsinki Resolution (FOREST EUROPE, UNECE and FAO 2011) - to better define an action strategy for the correct use of water resources and their priority use, in order to improve the management of water resources, in current and future conditions, and to increase hydraulic safety and the prevention of hydrogeological risk. Another aim is to estimate the ecological-economic value of the ESs and environmental clusters (SEA, article 70, LN221/15) relating to the water cycle and the instability, provided by forest cover, in order to express values of indirect use, associated with protective functions, also to assess environmental and resource costs, as established by Decree n. 39, 24/02/2015.

Preliminary results of the study, carried out on the entire territory of the Marche Region, show how the forest areas have a decisive influence on water balance, in its production and in storage, depending also on the forest management type. In general, the sub-basins and the basins with a greater surface area covered by forests show a greater capacity of water storage and regulation. In the same way, the forest areas contribute to preventing hydraulic and hydro-geological risks (soil erosion), as opposed to the more populated areas.

References

- FOREST EUROPE, UNECE and FAO, 2011. State of Europe's Forests 2011. Status and Trends in Sustainable Forest Management in Europe.
- Goio I., Gios G., Pollini C., 2008. The development of forest accounting in the province of Trento (Italy). *Journal of Forest Economics* 14(3): 177-196.
- Santolini R., Morri E., Pasini G., Giovagnoli G., Morolli C., Salmoiraghi G., 2015. Assessing the quality of riparian areas: the case of River Ecosystem Quality Index applied to the Marecchia River (Italy). *International Journal of River Basin Management* 13(1): 1-16.

Some remarks on rare sedge communities of High mountains Karstic plains of Central-Southern Apennine (Abruzzo, Marche and Umbria Regions - Italy)

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The karstic highlands are important sites for biodiversity of marsh vegetation of the *Phragmito-Magnocaricetea* Class in the central-southern Apennines. Disjunct by last glaciations, this vegetation now day plays a special role as a fragile vegetation relict. Due to the difficulty of reclamation and the low mountain-mountain bioclimate (altitudinal range vary between 700-1200 m a.s.l.), the use of natural vegetation such as meadows and pastures has prevailed, while the agricultural activity has been, with few exceptions, limited. From the landscape point of view, these are vast plateaus completely or partially submerged during the winter up to the spring season, which dry up progressively in summer with a vegetal bandage distributed in concentric bands with alternation of typical and ecotonal plant communities.

The beginning of phytosociological study of these ecosystems in Central Italy coincides and is marked by the IX Annual Conference of the Section for Eastern and Dinaric Alps (Ostalpin-Dinarischen Pflanzensoziologischen Arbeitsgemeinschaft) of the International Association for Vegetation Science (IAVS) which was held and organized by Prof. Franco Pedrotti and Prof. Carmela Cortini Pedrotti, at the headquarters of the University of Camerino between 23 and 27 June 1968. On this occasion, the organizers Pedrotti presented the first floristic, vegetational, cartographic and ecological monographs of Montelago highlands (1966), the Colfiorito marsh Vegetation Maps (1968) followed in 1973 by the monograph on vegetation and soils of the Pian Grande of Castelluccio. Since then, numerous studies have taken place throughout the central southern Apennines.

The present report deals with recent contributions and field work that have made possible to clarify some aspects, still confused, about distribution and syntaxonomy of some vegetation types described both for Central Europe and Apennines characterized by rare segdes as *Carex buxbaumi*, *Carex disticha*, *Carex vulpina* and other significant species.

References

- Cortini Pedrotti C., Orsomando E., Pedrotti F., Sanesi G., 1973. La vegetazione e i suoli del Pian Grande di Castelluccio di Norcia (Appennino centrale). Atti Ist. Bot. Lab. Critt. Univ. Pavia, 1973, IX (serie 6):155–249
- Landucci F., Gigante D., Venanzoni R., Chytrý M., 2013. Wetland vegetation of the class *Phragmito-Magno-Caricetea* in central Italy. Phytocoenologia 43(1–2):67–100
- Pedrotti F., Pettorossi L., 1969. Rilevamento cartografico della vegetazione della palude di Colfiorito. Mitt. ostalp. din. pflanzensoz. Arbeitsgem., 9:153–159
- Venanzoni R., Gigante D., 2000. Contributo alla conoscenza della vegetazione degli ambienti umidi dell'Umbria. Fitosociologia 37(2):13–63
- Venanzoni R., Properzi A., Bricchi E., Landucci F., Gigante D., 2018. The *Magnocaricetalia* Pignatti 1953 (*Phragmito-Magnocaricetea* Klika in Klika et Novák 1941) Plant Communities of Italy. In: Pedrotti F. (ed.). Climate Gradients and Biodiversity in Mountains of Italy. Geobotany Studies, vol. Climate Gradients and Biodiversity in Mountains of Italy, p. 135-173, Springer International Publishing AG., ISSN: 2198-2562, doi: 10.1007/978-3-319-67967-9_8

Posters



Variation of functional traits along elevation gradient: the case of sub-Mediterranean mountain grasslands

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According to niche theory environmental factors operate like a filter promoting the coexistence of species with similar ecological niches. Contrary, competitive interactions promote niche differentiation increasing functional traits dissimilarity of co-occurring species. These two processes act simultaneously but given a small study scale, the predominance of one over the other should depend on the intensity of environmental restrictions. Elevation gradients have been extensively used to test these assumptions, as environmental constraints increase along elevation, mainly due to temperature decrease. However, in the Mediterranean region precipitation increases along elevation determining an overall humped-back gradient of environmental restriction, with higher restriction at the lower and higher elevation. We analysed changes in functional trait patterns relative to Leaf-Height-Seed scheme along a sub-Mediterranean elevation gradient to test whether community functional patterns responded to this particular environmental gradient. We hypothesized that trait dispersion is higher at middle elevations and that trait means reflected the communities' response to environmental restrictions. The study area was carried out on dry grassland of the Velino massif (Central Apennines). We collected species cover for 45 environmentally homogeneous plots (4 m²) along an elevation gradient from 1325 to 2375 m a.s.l. To explain changes in functional patterns at community level, we performed generalized least square models with elevation as explanatory variable, choosing the most appropriate variance structure by the minimum AIC criteria. We found that all functional indices responded to elevation changes, except for mean values of specific leaf area. We found at lower and higher elevations, communities displayed adaptation to more environmentally restricted conditions, i.e. low plant height and low seed mass. Moreover, lower trait diversity values at low and high elevations indicate that climatic conditions restricted the number of strategies in the community. On the contrary, more favorable environmental conditions in the intermediate part of the elevation gradient seems to lead to higher trait diversity. Our results are in accordance with both niche theory and the stress gradient hypothesis. Nevertheless, they also pinpoint the necessity of considering the specific climatic context when trying to generalize the elevation-functional patterns relationships.

Initial attempts to manage the reed belt in the Europe's oldest lake Ohrid

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The Ohrid Lake, one of the oldest lakes in the world, is located in the south-western part of the Republic of N. Macedonia. One of the largest marsh that stretched along the coast of Ohrid Lake was the Struga marsh that was dried up after the 1960s and was transformed into arable land. Today there are only remnants of this marsh, which abounded mainly with the relic community *Caricetum elatae* subsp. *lysimachietosum* (Micevski 1963). Reed (*Phragmites australis* L.) is a characteristic species of marsh vegetation and has a diverse role. It is a food, habitat and shelter for many invertebrates, fish, waterfowl and other organisms. In addition, the reed appears as an important producer of oxygen and enriches the soil with organic matter, especially in the period of extinction and decomposition of organic matter. It is also a natural bio filter for various pollutants coming from the mainland and reduces wind and waves, which prevents the erosion of the lake shore. Precisely because of the multifunctionality, it is necessary to manage its discontinuous belt along the Ohrid Lake in order to strengthen the reed population, as well as the significant marshlands in which it participates. The cutting of the reed belt as a management technique according to Hawke and Jose 1996, is determined by 3 parameters: annual time, frequency and degree. The reed belt management will be performed for the first time in the Republic of Macedonia. To this end, a detailed Reed Belt Management Plan was developed. The belt is mainly divided into 3 control zones, namely:

- zone A for summer cutting (it is the most effective way to eliminate nutrients that are concentrated on the upper parts of the plant. In summer, the dry matter of the reeds contains about 1% nitrogen, which means that 50 kg of nitrogen per hectare will be removed, while the phosphorus in the dry matter contains about 0.9 g / kg, ie. on 1 ha will remove about 4.5 kg of phosphorus (Komulainen 2008)),
- zone B for winter cutting (with winter cutting, the stands with reeds improve. Research has shown that if the space is mosaic, there are mowed and unmowed plots and occasionally rotating them, there will be no negative effects on the eggs and food of the birds that live in the reed belt (Trnka et al. 2014). and
- zone C for monitoring (in the last few years, the fragmentation of the community with the yellow lotus is noticeable and it is necessary to undertake some activities for its protection. Monitoring should be during the vegetative period).

Various tools such as trimmers, an amphibious machine and other tools will be used for the management, which will make it easier to remove the reed that is mowing. A plan for proper sustainable utilization of the mowed material is made depending on whether it is green (summer cutting) or dry (winter cutting). With proper management, in addition to the reed, great benefits will be given to animals and plants that live and / or use those spaces.

References

- Hawke C.J., José P.V. 1996. Reedbed Management for Commercial and Wildlife Interests. Royal Society for the Protection of Birds.
- Komulainen M., Simi, Hagelberg E., Ikonen I., Lyytinen S., 2008. Reed energy. Possibilities of using the Common Reed for energy generation in Southern Finland. Reports from Turku University of Applied Sciences 6, Turku 2008.
- Micevski K., 1963. Tipološki istraživanja na blatnata vegetacija vo Makedonija. Skopje: 79-130.
- Trnka A., Peterkova V., Prokop P., Batary P., 2014. Management of reed beds: mosaic reed cutting does not affect prey abundance and nest predation rate of reed passerine birds. Wetlands Ecology and Management 22: 227-234.

Preservation of rare and endemic plants through *in vitro* conservation methods: A case study of genus *Ramonda* from Balkan Peninsula!

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Genus *Ramonda* L.C.M. Richard is represented only by three species. *Ramonda serbica* and *R. nathaliae* are rare and endemo relict plant species from Balkan Peninsula and the only representative in Iberian Peninsula is *R. myconi*. *R. serbica* and *R. nathaliae* are included in the Red Book of Vascular Plants of the Republic of Kosovo, whereas only *R. serbica* is listed in the European Red List of Vascular Plants. An efficient micro propagation and *in vitro* conservation method via direct and indirect organogenesis from seed and leaf explants, respectively, was established in this study. The seed of both *Ramonda* species were collected from different populations in Kosovo, and were germinated in nutrient media JG-B without any phytohormone. The highest number of shoots and multiplication rate was observed on JG-B medium supplemented with BAP and IAA (0.5 mg l⁻¹ each), whereas the highest number of leaves per plantlets was found on WPM and RA medium supplemented with BAP and IAA (0.1 mg l⁻¹ each). During this stage of micro propagation some significant differences were observed in plantlets from different populations. The indirect organogenesis from parts of leaves of natural plants was not successful due to unavailability of established protocol for disinfections of the plant material. On other hand, parts of leaves from micro propagated plantlets, cultured on MS medium supplemented with different ratio of BAP and NAA, resulted in the highest efficiency for shoot regeneration. In vitro conservation of micro propagated plants at the lower temperature (4 °C) had a significantly positive effect for storage of more than 12 months. Conservation through *in vitro* methods of *R. serbica* and *R. nathaliae* plants showed a very effective technique for preservation of these rare and endemic plants.

The coastal salt-marsh vegetation at three sites in South Croatia, NE Mediterranean

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The coastal salt-marsh vegetation was investigated at three sites along the Croatian coast: 1) in the Neretva River Delta, 2) Bay of Vlačići on the northern Adriatic island of Pag, and 3) Bay of Nin near the city of Zadar. The sites were recognized as ‘Important Plant Areas’ (IPA’s) in Croatia, and represents the most important areas for biodiversity conservation on the eastern Adriatic coast (Alegro et al. 2010). In addition, the areas are part of the NATURA 2000 European Ecological Network of sites important for the species and habitats, as well as for birds.

The study is based on a data-set consisting of 40 phytosociological relevés, carried out according to the Braun-Blanquet approach (Westhoff and van der Maarel 1978). The following associations were identified: *Suaeda maritima*-*Salicornietum patulae* Brullo et Furnari 1976 ex Géhu et Géhu-Franck 1984, *Limonio-Artemisietum coerulescentis* Horvatić (1933) 1934, *Puccinellio festuciformis-Arthrocnemetum fruticosi* (Br.-Bl. 1928) Géhu 1976 (= *Salicornietum fruticosae* Br.-Bl. 1928), *Juncetum maritimo-acuti* Horvatić 1934, and community dominated by *Salicornia procumbens* ssp. *procumbens* (= *S. emerici*).

We would like to encourage further phytosociological research on the basis of the taxonomic delineation of *Salicornia* taxa in Croatia (Šajna et al. 2013), enriched with environmental and functional data. Major efforts should also be addressed to further research of the biodiversity of these areas and for a design of the most efficient conservation strategy.

References

- Alegro A., Bogdanović S., Brana S., Jasprica N., Katalinić A., Kovačić S., Nikolić T., Milović M., Pandža M., Posavec-Vukelić V., Randić M., Ruščić M., Šegota V., Šincek D., Topić J., Vrbek M., Vuković N., 2010. Botanički važna područja Hrvatske [Important Plant Areas in Croatia], Školska knjiga Zagreb, 529 pp.
- Šajna N., Regvar M., Kaligarić S., Škvorc Ž., Kaligarić M., 2013. Germination characteristics of *Salicornia patula* Duval-Jouve, *S. emerici* Duval-Jouve, and *S. veneta* Pign. et Lausi and their occurrence in Croatia Acta Botanica Croatica, 72: 347–358
- Westhoff V., van der Maarel E., 1978. The Braun-Blanquet approach. 2nd ed. In: R. H. Whittaker (ed.), Classification of plant communities (pp. 287–399). The Hague, the Netherlands: Junk.

Invasive plant species in riparian zone in Croatia (Našice FA): current status and mapping

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Riparian forests along large rivers in Croatia represent unique forest ecosystem very important for the conservation of endangered animal and plant species and their habitats.

Climatic change together with diverse anthropogenic impact already endangered their structure, species composition and dynamic, but rather new serious threat represent invasive alien species (IAS). In such ecosystems, rivers function as vectors for transferring IAS and at the same time, occasional floods also help to spread IAS.

Within the Hungary-Croatia Interreg Co-operation Programme “Protection of the English oak in the cross-border area”, identifying and mapping of plant invasive species is one of the important goals.

In order to identify and map Invasive alien plant species, we investigated main Natura 2000 forest habitat types: 91F0 (riparian mixed oak forests of *Quercus robur*, *Ulmus laevis* and *Ulmus minor*, *Fraxinus excelsior* and *F. angustifolia*, along the great rivers) and 91E0 (willow, poplar alder and ash riparian forests *Salicetum albae*, *Populetum albae*, *Alnenion glutinoso incane*).

Results show that that different invasive plant species are present in both habitat types: *Acer negundo*, *Fraxinus pennsylvanica*, *Amorpha fruticosa*, *Echinocystis lobata*, *Asclepias siriaca*, *Solidago* sp., *Conyza canadensis*, *Erigeron annuum*, *Ambrosia artemisiifolia*.

Differences between the forest habitat types were expected due to different ecological conditions: flooding dynamics, altitude, amount of groundwater and soil water content. Stronger differences were observed due to light conditions, as FHT 91E0 is usually closest to waterbodies and not very dense and therefore far more endangered by invasive alien species.

Riparian and flooded forests are among the most threatened habitats by IAS, especially in sensitive phase of regeneration, when disturbances are on the highest level. Therefore, monitoring of the alien invasive species, including recognition and mapping, represent the first, very important step, in fighting and spread controlling IAS in riparian forest ecosystems.

A new pioneer association of detrital substrata of the hilly and low-mountain belts in Central Apennines

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We describe a new pioneer association of perennial plants. Such association is linked to detrital substrata of the hilly and low-mountain belts in the calcareous Central Apennines (Abruzzo – Italy). The Abruzzo plant communities show a substantial floristic autonomy compared to the Sicilian and Sardinian ones, so we propose the new association *Linario purpureae-Sedetum rupestre*. The species *Sedum rupestre* and *Cephalaria leucantha* are proposed as diagnostic ones, with a preeminent differential character.

The new association is included in the *Linarion purpureae* alliance (*Scrophulario bicoloris-Helichrysetalia italici* order, *Thlaspietea rotundifolii* class) which is endemic to Southern Italy and Sicily. Two sub-associations are recognized inside the association: a typical one named *sedetosum rupestre* and a thermophilous one named *teucrietosum flavi* that is related with the communities at lower altitude.

The structural analysis carried on through both normal and weighted biological spectra shows a co-dominance of Chamaephytes and Hemicryptophytes, while the chorological analysis reveals the predominance of Mediterranean species with high values of Orophytes, Eurasian and Endemic species.

Effects of recovery processes in the functional patterning of ground-layer vegetation of sub-Mediterranean deciduous forests (*Ostrya carpinifolia* coppiced woods)

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The research focused on how ecological parameters linked to soil characteristics and forest structure change along a chronosequence of *Ostrya carpinifolia*-dominated woods, by influencing ground-layer vegetation. Considering the susceptibility of plants to stress and disturbance, we investigated the species from a functional point of view.

The study area lies in the hilly sectors of the Umbria-Marche Apennines (central Italy). To reduce the number of environmental variables, we considered forest stands on limestone, north-facing slopes (from west to east, clockwise), with elevations ranging from about 400 to 900 m a.s.l. and slope angle of 15-35°. We identified stands managed as “coppice with standards” on the basis of time since last coppicing: young coppice; intermediate-aged coppice, mature coppice and abandoned coppice. We selected 32 10x10 m plots, one for every stand, where we recorded data about altitude, aspect and slope angle, forest structure (height and cover of tree, shrub and herb layers; height of bottom of tree layer canopy; cover of deadwood at ground; basal area of trees; number of dead stumps and standing dead trees) and soil characteristics (cover of outcropping rock and rock fragments, leaf litter, bare ground; depth of leaf litter and soil; pH; skeleton; texture; sand; silt; clay; organic matter; total nitrogen; carbon/nitrogen ratio; cation exchange capacity). Given that different traits can simultaneously converge and diverge along a chronosequence in response to changes in ecological parameters, as regards ground-layer species, we considered occurrence and type of storage organ and vegetative propagation, leaf anatomy, leaf persistence, flowering phenology, pollen vector and seed weight.

We performed non-parametric linear regression analyses, using time since last coppicing as predictor and calculated community-weighted means (CWMs) of traits and different functional diversity indices (*FRic*, *FEve*, *FDiv*, *FDIs*, and *Rao's Q*). We used Generalized Linear Modelling to understand what ecological parameters are predictive of the functional structure.

Results showed that time since last coppicing changed significantly some forest ecological parameters, concerning soil characteristics and vegetation structure. All of them acted as ecological filters by determining differences in the functional structure of ground-layer vegetation. However, during recovery processes, even though the shifts in ecological parameters as a whole lead to greater levels of naturalness and mature forest conditions, each of them only acts directly on some specific components of the functional structure, by influencing their variations along the chronosequence. In addition, each predicted change in CWM or FD indices is generally linked to variation of one specific ecological parameter.

Preliminary analysis of the relationship between the Bryophyte community and the forest characteristics in sub-Mediterranean beech woods

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Forest management influences biological diversity of a large number of taxonomic groups. It is a strong driver that determines forest structure and continuity, understory coenological composition and distribution, soil and light features, and therefore the availability of habitats for species. Bryophytes are organisms sensitive to environmental changes so that they can be used as indicators to assess conservation status of ecosystems and ecological impacts. Nevertheless, they are often left out during surveys of forest vegetation. In fact, there is still little knowledge about their occurring and distribution, in particular regarding sub-Mediterranean forests. To partially fill this gap, we collected data in the Monti Sibillini National Park, in the forest landscape surrounding the Piani di Castelluccio di Norcia (central Italy). To test the influence of management on the bryophyte community, three sites with different structure were selected: Uneven-aged stand with features of old-growth forest; Stand managed as high forest; Stand under conversion from coppice to high forest. To reduce the effect of the environmental variables, we selected woods on limestone and characterized by *Fagus sylvatica* L. with similar characteristics in altitude (1,400/1,500 m a.s.l.), aspect (north-west-facing) and slope angle (20-30°). For each site, we randomly selected one 20 x 20 m plot that was divided into four 10 x 10m plots. In these smaller plots, a “pre-survey” was done in order to observe the occurrence and distribution of bryophytes on every substrate (biotic and abiotic). Along the diagonal of every 10 x 10 m plot, we laid six 1 x 1 m sub-plots (72 subplots in total), in which we visually estimated cover percentage values of: all vascular flora; shrub and herb layers; decaying and not decaying deadwood on the ground, of small and large sizes; roots emerging from the soil; leaf litter; bare ground; outcropping rock and rock fragments. In addition, we recorded data on decaying and not decaying stumps area; trunks base area and diameter at breast height of standing trees. On each of these substrates, we visually estimated cover percentage values of the occurring bryophytes.

To understand which ecological factors (management, type of substrate, and topographic factors) drive the distribution pattern of bryophytes, we used Multivariate regression tree (MRT) analysis. To detect species linked to specific ecological factors, we used Indicator Species Analysis (ISA), which makes it possible to discern those items that show preferential distribution in a group of samples in comparison with other groups.

From the gathered data and the obtained results, it emerged that both the type of management and the type and area of substrate (in particular, the roots emerging from the soil and the not decaying stumps) drive the distribution pattern of bryophytes. Moreover, both showed to be linked to the occurring of some bryophytes that can sometimes be indicator species for that specific ecological factor. The aspects that seem to emerge as core elements in determining the composition and in fostering the biodiversity of the bryophyte community were: the occurrence of mature and large sized trees; the occurrence of decaying deadwood of large size on the ground; the occurrence of not decaying stumps. However, it was very difficult to distinguish the effect of the management from the effect of the substrate because the former can influence the occurring of the latter. Moreover, legacy of the past management and the strategies of space occupation of bryophytes could be other important factors.

Evaluation of relation between body parameters and autumn-winter food availability in roe deer (*Capreolus capreolus*) population in central Italy: a biometrical approach

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The numerical growth of roe deer has resulted in a noticeable increase in hunting activities (Becciolini et al. 2016) and the spreading of the practice of biometric analysis (Morellet et al. 2007). Biometric analysis allows to get information about the population by describing trends and variations and, then, plan the consequent management decisions (Vitanzi et al. 2010). We analysed biometric data of roe deer (*Capreolus capreolus*) belonging to Classes 0 and 2 in a population living in central Italy. To assess the relationship between body parameters and trophic resources available during the autumn-winter period, three environmental categories based on the carrying capacity were assessed and the specific environmental category was assigned to each sample. Several parameters were analysed: live weight (LW), head–trunk length (HTL), height at shoulders (HS), chest circumference (CC), length of hock (HL), total length of the cranium (TL), condilo-basal length (CBL), mastoid width (MW), zygomatic width (ZW), ectorbital width (ECW), entorbital width (ENW), teeth row length (TRL) and mandible length (ML). Statistical analysis was performed using generalized linear modelling, a rank-based estimate of regression coefficients, and the Wald test. In Class 0, only ZW showed significant differences both between sexes and among the environmental categories. In Class 2, the analysis showed significant differences between sexes for LW, HTL, HL and ZW while, among environmental categories, the analysis showed significant differences for LW, HTL, CC, HL, ECW, and TRL. This approach, applied to a broader database could be useful to identify suitable parameters to plan a better selective hunting of roe deer.

References

- Becciolini V., Bozzi R., Viliani M., Biffani S., Ponzetta M.P., 2016. Body measurements from selective hunting: biometric features of red deer (*Cervus elaphus*) from Northern Apennine, Italy. Italian Journal of Animal Science 15: 461-472.
- Morellet N., Gaillard J.M., Mark hewison A.J., Ballon P., Boscardin Y., Duncan P., Klein F., Maillard D., 2007. Indicators of ecological change: new tools for managing populations of large herbivores. Journal of Applied Ecology 44: 634-643.
- Vitanzi A., Brusaferro A., Nardi C., Sparvoli D., Catorci A., 2010. Approccio geosinfitosociologico alla definizione della carrying capacity potenziale degli ecosistemi forestali dell'Appennino centrale nei confronti del capriolo (*Capreolus capreolus* L.) [Geosynphytosociological approach to the definition of potential carrying capacity of central Apennines forest ecosystems in relation to the roe deer (*Capreolus capreolus* L.)]. Informatore botanico italiano 42: 443-449.

***Molinio-Arrhenatheretea* grasslands on the southern edge of the Pannonian plain**

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

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

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

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

In the eastern part of the research area, many ruderal species appear in mesic mown meadows on mineral rich soil appear. We could merge these communities within a new alliance *Salvio nemorosae-Arrhenatherion*. Sporadically such vegetation can also be found on dry and nutrient rich sites (e.g. road banks) in the western part of the area, but in the east this vegetation forms regularly mown grasslands and substitute the alliance *Arrhenatherion*. The other group recognized in the western part can be termed as *Alopecurion*. It appears in the transitional environmental conditions between mesic (*Arrhenatherion*) and temporarily wet meadows (*Deschampsion*). It appears in the western part of the area and is substituted by wet meadows of the *Trifolion pallidi* in the east.

Vegetation structure and species composition of grasslands in researched area is influenced by soil moisture and soil nutrient availability as well as by strong biogeographic and climatic gradient.

Interaction between reed spread and habitat suitability for bird species in the Palude di Colfiorito (Umbria, Italy)

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The Palude di Colfiorito is a wetland sited in the Umbria-Marche Apennine ridge (Umbria, Italy), at 754 m a.s.l., which has been subjected to changes in land mosaic composition and structure, during the last decades (Pedrotti 1975; Orsomando 2002). The natural silting of water bodies and the socio-economic processes that led to the abandonment of mowing in marshy meadows are causing a quick expansion of cane thicket (*Phragmitetum australis*) that is likely to determine heavy modifications to plant communities and bird populations. Actually, the marsh is the breeding site for various bird species of significant conservation interest, subject to national and international protection, such as *Botaurus stellaris*, *Ixobrychus minutus*, *Ardea purpurea*, *Rallus aquaticus*, *Porzana parva* and *Panurus biarmicus*. Another reason of interest is the wintering of other ornithic species such as *Ardea alba*, *Circus cyaneus* and *Gallinago gallinago* (Magrini & Gambaro 1997; Velatta 1997; Riccobelli 2006).

The research aim was to understand the effects of the cane thicket spread on bird populations. The protracted absence of regular cuttings and the non-removal of dead plant material are leading to the development of vegetation in recent years, with the accumulation of a considerable amount of plant necromass. This, together with the reduction in rainfall, is causing the raising of the reed bed, allowing predators (wandering dogs, foxes and wild boar) to reach the previously inaccessible nesting sites, and is causing also the rapid xericization of habitats, with dangerous repercussions on the balance of the ecosystem and on the survival of the target species. The clearings and channels that have been opened in 2000 are rapidly closing, causing a strong limitation in the circulation of water and fish fauna.

The progressive increase in floristic and vegetation homogeneity due to the expansion of the cane-thicket also causes a reduction in the availability of the food resources necessary for the avifauna (ardeidae, scolopids, etc.) and of sites suitable for nesting for a large number of bird species. The environment suitable for reproduction is represented, in fact, by a mosaic composed of *Phragmitetum australis*, *Scirpetum lacustris* and wet meadow vegetation of the *Ranunculus velutini*, which provides resources for nesting, resting and feeding the species present.

Our results emphasized the need to implement interventions aimed at halting the expansion of the reed bed and reducing its surface, identifying rational techniques for removing the swamp straw and disposing of the resulting plant material the cane-thicket and led to the formulation of a series of management guidelines.

References

- Magrini M., Gambaro C., 1997. Atlante ornitologico dell'Umbria (1988-1993). Regione dell'Umbria.
- Orsomando E., 2002. Carta della vegetazione della Palude di Colfiorito (Scala 1:2.000) S.EL.CA., Firenze.
- Pedrotti F., 1975. Carta fitosociologica della Palude di Colfiorito (Foligno). L.A.C., Firenze.
- Riccobelli M., 2006. Censimento degli aironi nella Palude di Colfiorito. Tesi Sperimentale di Laurea (relatore: Brusaferro A.). Università di Camerino.
- Velatta F., 1997. Censimento invernale degli uccelli acquatici. Risultati gennaio 1997. Provincia di Perugia.

Fine scale community functional response to iterative mowing and functional traits of *Brachypodium rupestre* in the “Montagna di Torricchio” Natural Reserve

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The cessation of semi-extensive farming or underutilization of grasslands is leading to vegetation changes throughout Europe, as well as in semi-natural sub-Mediterranean mountains. At the community level, these changes foster the invasion of unpalatable tall grasses, mostly with competitive stress-tolerant strategies (*Brachypodium* sp.pl in the Italian peninsula), affecting species diversity and decreasing the nutrient value of pastures ecosystem. Because of such deep impact on grassland ecosystem services and the great diffusion in the last decades of the *Brachypodium*-dominated communities restoration of pastures is becoming a paramount issue and one of the major international research topics. This research was aimed to understand how the functional composition of the community on a fine scale was affected by the variation of *B. rupestre*'s plant height and by recurrent mowing.

The study area were grasslands within the “Montagna di Torricchio” Natural Reserve (central Apennines). Half of a homogeneous area of 2 ha invaded by *B. rupestre* was mown twice a year since 2010, and hay and litter were removed after each mowing event; the other half was unmown and used as a control. We collected data on 20 plots (0.2 m × 0.2 m) for the mowed and unmowed area. In each plot we recorded: species occurrence, *B. rupestre*'s plant height and cover, and we clipped *B. rupestre*' phytomass and the phytomass of the rest of the community. Finally, for each species (excluded *B. rupestre*) we gathered traits related to space occupation, reproductive strategies, temporal niche exploitation.

We performed linear mixed-effects models using as response variables the number of species (excluding *B. rupestre*) sharing the same trait state in each plot and as fixed effects the *B. rupestre* plant height, *B. rupestre* aboveground phytomass and the type of management. We considered the sample identity as random effect and total phytomass amount as random slope.

Our results indicate that recurrent mowing alters the functional composition of community, fostering the spread of species characterized by avoidance strategy (e.g. annual life span) and tolerance strategies (e.g. clonal strategy). Increasing of *B. rupestre* height promotes temporal phenological shift of the rest of the community and foster the presence of taller species, more able to compete for light acquisition. In summary, recurrent mowing and changes of *Brachypodium* features affects the plant composition of the rest of the community at micro-scale leading to changes in their functional composition.

***Moehringia papulosa* Bertol.: biogeography, morphology and ecology of a chasmophytic endemic species (Marche, Italy)**

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Moehringia papulosa Bertol. was found in 1835 by Filippo Narducci, who however mistook it for another species (*M. sedifolia* DC., endemic to the Alpi Marittime). Later, in 1840, it was recognized and described as a new species by Bertoloni (1839-1842).

M. papulosa is the only endemic plant in Marche region living on the Adriatic side of central Apennines. It is known only in three sites: Gola del Furlo (*locus classicus*), Gola della Rossa, and Gola di Frasassi (Soriano et al. 2012). The species grows on vertical, calcareous rocks in rocky gorges, at altitudes ranging from 150 to 400 m a.s.l., in all exposures, with a preference for south and south-east-facing slopes. The pH, based on the analysis of the dripping water from one of the plant growth sites in the Gola del Furlo, is equal to 7.7 (Biondi and Bianchelli 2008; Soriano et al. 2012).

This perennial, suffrutescent plant looks like a small bush protruding from the cliffs; the stems are generally ascending. The leaves are very fleshy, narrow, mucronate and uninervious. Overall dimensions of the specimens range from 5 to 20 cm. The inflorescences mostly consist of 3-5 flowers each; flowers are tetramere, petals are usually long twice the calyx; the styles are two; pedicels are swollen below the calyx; sepals are lanceolate and acute. Flowering occurs between April and June, but secondary flowering has been observed up to November. The fruiting stage starts in June (Soriano et al. 2012). The fruit is a subglobose capsule; seeds are black, shiny and smooth, with a large V-shaped incision and white rubbing cloth (Biondi and Bianchelli 2008). The ants are the main dispersal agent for this species, promoting seed dispersal to favorable germination sites (Soriano et al. 2012).

M. papulosa enters in the composition of the pioneer association named *Moehringio papulosae-Potentilletum caulescentis* Biondi & Ballelli 1982 (*Saxifragion australis* Biondi & Ballelli ex Brullo 1984 alliance, *Potentilletalia caulescentis* Br.-Bl. in Br.-Bl. & Jenny 1926 order, *Asplenietea trichomanis* (Br.-Bl. in Meier & Br.-Bl. 1934) Oberdorfer 1977 class), in which it has the average cover of 20-30%. This association includes the thermophilous and heliophilous chasmophytic communities growing on the limestone cliffs (Gubellini 2016) and does not evolve towards more complex dynamic stages. The association is referred to the European habitat "8210 - Calcareous rocky slopes with chasmophytic vegetation" (Gubellini 2016).

Following the IUCN criteria, the conservation status of *M. papulosa* is "Critically endangered" (Soriano et al. 2012). It could be necessary regulating the use of rocky areas for climbing, mining activities and provide a prescription for the installation of nets and rockfall barriers, as well as deepen the knowledge on the distribution and conservation status of the habitat and monitor the floristic composition.

References

- Bertoloni A., 1839-1842. Flora Italica, 4-5. Tip. Masi, Bologna.
- Biondi E., Bianchelli M., 2008. *Moehringia papulosa* Bertol. Flora da conservare: implementazione delle categorie e dei criteri IUCN (2001) per la redazione di nuove Liste Rosse. Informatore Botanico Italiano 40(suppl. 1): 90-92.
- Gubellini L. (ed.) 2016. Misure di conservazione di specie e habitat, SIC IT5310016 – Gola del Furlo URL:http://www.provincia.pu.it/fileadmin/grpmnt/1197/Rete_Natura_2000/Misure_conservazione_FURLO_maggio1.pdf
- Soriano P., Estrelles E., Bianchinelli M., Galiè M., Biondi E., 2012. Conservation aspects for chasmophytic species: Phenological behavior and seed strategies of the Central Apennine threatened endemism *Moehringia papulosa* Bertol. Plant Biosystems 146(1): 143-152.

Analysis of landscape variation after land abandonment in Mediterranean mountain from 1954 to 2001

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Since ancient times, human activity has played a direct impact on the vegetation and landscape composition. Going back to the Roman's age, Mediterranean mountains faced an increase of human colonization and pastoralism became the prevalent human activity. This led to the formation of a typical "cultural landscape" characterized by a mosaic of sparse open areas (for agriculture and grazing purpose), and woodland patches (for charcoal purpose). The consistent rural exodus due to the socio-economic changes that followed the World War II, has triggered abandonment of these traditional management practices. Land abandonment and cessation of grazing activities fosters natural succession procession. This research aims at pointing out the landscape changes that took place in the Umbro-Marchigiano Apennine (Central Italy) since half of the XX century. Our questions were: i) what happened to the landscape?; ii) which was the direction of landscape changing?

The study area covers the three mountains Letegge, Ragnolo and Fiegni (Central Apennine), which extend for 8,000 hectares with an altitude ranging between 300 and 1590 m. (a.s.l.). The collected data referred to the period of 1954 and 2001. Data of 1954 were taken through aerial photographs, while data of 2001 were acquired through orthophotos and Marche Region's technical maps. The two cartographies related to 1954 and 2001 were spatially intersected in order to obtain transitional matrices, whose analysis allowed the better understanding of the changes occurred for the main land use landscape typologies over time.

In 1954, the landscape showed a large diffusion of cultivated areas and a considerable part covered by woods. Grasslands also played an important role leaving the remainders to shrublands and others. In 2001 the landscape showed instead a drastic reduction of cultivated areas. Woods and grasslands have become the most abundant habitats, while less shrublands are found.

Sixty years represent enough time to observe a significantly variation in the extension of land use typologies. In particular, the main results could be ascribed to the decrease in landscape heterogeneity, with the increasing of dominance of few typologies such as grasslands and woodlands. In a few decades, forests recovered widening their areas to those where they were already present a long time ago. Nevertheless, problems of biodiversity conservation might arise as consequence of tendency towards landscape homogeneity.

How different combinations of stress and disturbance affect the facilitation process

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Facilitation is a positive plant-plant interaction process and an important driving force of plant community assembly. Some plants ("nurse species") create favorable microhabitats for the survival of facilitated ("target") species, acting as a 'safety net' that sustains diversity. Nurse species are able to modify abiotic features, promoting an amelioration of unfavorable conditions, which increase towards their canopy center. According to stress gradient hypothesis, facilitative interactions are predominant under high stress condition, whilst competitive interactions are predominant under low stress condition. How disturbances might affect facilitation is still unknown. The aims of study were to examine 1) how combination of different intensity of stress and disturbance may influence the relative importance of positive interactions within the community; 2) to assess the functional strategies (i.e. plant traits) of target species.

Study area was "Salinas and Aguada Blanca National Reserve" located in the south Peruvian Andes. The selected area was characterized by three different communities reflecting different intensity of stress and disturbance (Confital: high water stress condition and low grazing pressure; Canllar: medium water stress condition and high grazing pressure; Pajonal: low water stress and low grazing pressure). In each community we laid linear transects (22 in Confital, 13 in Canllar, 25 in Pajonal) composed by 4 plots (0.5 x 0.5 m) distant 2 m from each other. To characterize for a functional point of view the nurse and target species, it has been considered traits related to life history, plant form and vegetative reproduction.

Under medium stress and higher disturbance (Canllar) there was lower species richness, lower number of nurse and target species, but percentage number of target species was higher. Under high stress and low disturbance (Confital) we found the highest value for species richness, similar number of nurse species, but higher number for target species. The percentage number of target species resulted lower. Finally, under low stress and low disturbance (Pajonal), we found an intermediate situation except for number of nurse species that resulted higher. Sedges, upright forbs, rosette/prostrate forbs, vegetative propagation, tap root and cushion, resulted traits indicator for target species.

What we can isolate in being the real driving force for facilitation is the disturbance regime and intensity. According to this, it is suggested that the result of moderate intensities, for both stress and disturbance, produces and increase in the species richness and in facilitation interactions whereas, at for the extremes intensities (lowest and highest), the number of co-existing species and facilitation declines. Finally, the shelter provided by nurse species allowed the application for target species of long-term strategies for resource exploitation.

Geology and seismicity of the Colfiorito area (Umbria-Marche Apennine, Italy)

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The Colfiorito area is characterized by mainly N-S trending and W-dipping major thrust planes within the regional arcuate shape of the Central Apennines thrust system, and by NNW-SSE trending high-angle normal faults. The former were generated during the principal shortening events (Neogene), while the latter are Quaternary in age. These structures involve a Meso-Cenozoic carbonate sequence which grades upward into Neogene synorogenic siliciclastic deposits.

Quaternary structures are generally grouped together giving rise to 15-40 km long fault systems, that are internally organized with an en échelon distribution. Single planes show maximum length of 10 km and displacements, with southwestern down-thrown blocks, not exceeding 400-500 m. The southern edge of some of these faults terminates against the above-mentioned thrust planes, while others clearly displace them.

The most evident faults in the Colfiorito area are those of San Martino-Costa, M. Tolagna and M. Le Scalette which display a main NNW-SSE trend and locally assume a N-S and E-W direction. These structures have a right-hand en échelon pattern, enveloped by the oblique ramp of a thrust with a NNE-SSW trend; they can therefore assume the meaning of transfer fault zones with a left-lateral transtensive component of motion during the Quaternary tectonics. They also constitute the border faults of the depressions filled with the deposits of the Lower Pleistocene-Holocene and are characterized by fault scarps both in the bedrock and Quaternary deposits (M. Tolagna), hence demonstrating their Holocene activity. At the base of the escarpments, continental deposits of middle/final Pleistocene-Holocene and sinkholes (Molinaccio sinkhole) can be observed.

At the time of the autumn 1997 seismic sequence, a few free-faces, 6-8 cm high, developed near pre-existing fault scarps, related to the movement of the fault itself (zones of discrete coseismic deformation at the surface) and to differential compaction due to coseismic shaking. Furthermore, during these seismic events, tension fractures with a N 100-120 direction developed in the Quaternary deposits within the tectonic depressions; along these fractures anomalous radon values (Colle Curti-Costa zone) were measured.

The structural analysis carried out along the fault scarps shows, that structures with clear evidence of Holocene activity are mainly normal faults with both NW-SE and ESE-WNW trends. The latter trend includes also faults with right-lateral transtensive kinematics, while the faults with a roughly N-S direction show a clear left-lateral oblique component of motion.

The above data are consistent with those relative to the more southern areas and confirm the extensional nature of the tectonic regime acting in the Colfiorito area (maximum principal axis of finite strain is oriented roughly NE-SW).

Addenda Oral Presentations

Side events



Concept Mapping: a learning tool for higher education. Theoretical framework and applications within the ERASMUS+ “ENEPLAN” project

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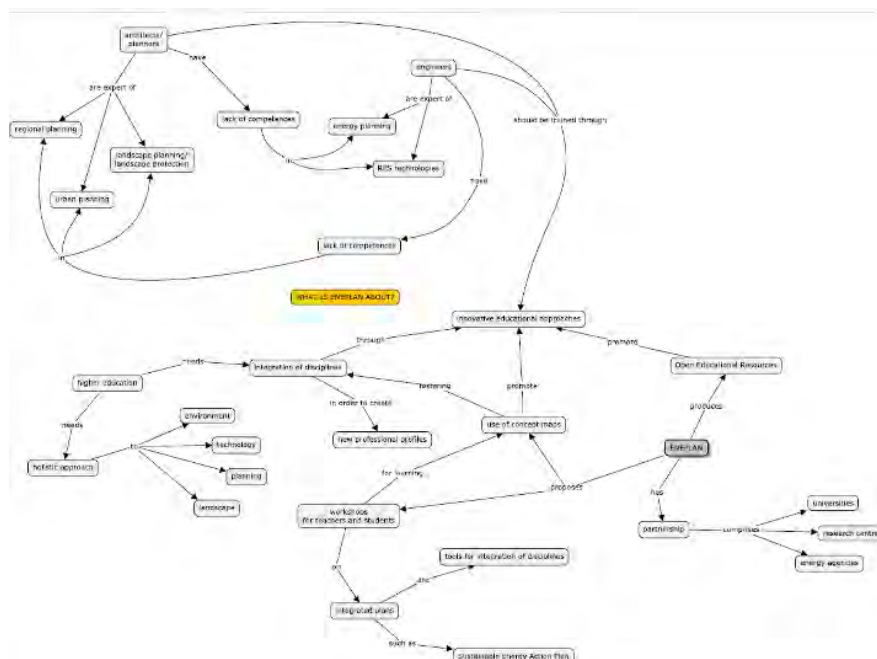
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The complexity of the processes connected to the sustainable management of territories and the evaluation of the generated impacts has produced the necessity in Higher Education to respond to the emerging need of interdisciplinary professional competences by increasing the skills and knowledge of teachers, researchers and students. This led to the construction of international projects that investigate and explore the opportunities promoted by the use of information technologies with innovative learning methods.

The ENEPLAN Project (<http://www.eneplan-erasmus.eu/>), co-funded by the Erasmus+ Programme of the European Union from 2016 to 2018, has allowed the University of Camerino, in partnership with 17 partners from Italy, Egypt, Jordan, Lebanon, Malta, Portugal and Spain to develop collaborative open education resources (OER) able to answer to this demand through the application of the meaningful learning methodology based on the use of concept mapping technique.

“Meaningful learning” is a type of learning where the new knowledge is acquired starting from the learner’s previous knowledge, based on interaction and creativity and capable of shaping a critical, proactive and sustainable approach. Concept mapping is an ICT tool that, starting from the definition of a “focus question”, helps to visualise relationships among concepts by identification of linking phrases and to represent knowledge graphically. This tool is particularly suitable for educational purposes, and professional upgrade, and is a stimulus for developing applied research, as well. As OER, CMap software (<https://cmap.ihmc.us/>) can be “customised” according to users’ needs and adapted to the research purposes and goals.

ENEPLAN focused on the processes connected to Territorial Integrated Energy Planning and how to improve the capacities of teachers, students and researchers in facing energy planning from a sustainability perspective. The realisation of an alternation of desk activities and workshops aimed at the collective production of concept maps innovates the instrumental frameworks in Higher Education that support teaching and training. By integrating flexible cognitive systems, able to facilitate the comprehension and development of technical and non-technical information with an interdisciplinary approach to processes, the results reached by ENEPLAN can be transferred to any field of investigation.



Practical training in the field on how to collect leaves for calculating leaf area, specific leaf area and leaf dry matter content, according to standardized international trait protocol

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Functional traits are any eco-physiological and morphological features informing on plant fitness in a given environment. Traits reflect species ecological strategies and determine how plants respond to environmental factors, affect other trophic levels and influence ecosystem properties. They have been widely used to understand plant-environmental relationship and also pattern of assembly rules (i.e. how species are able to co-exist).

The practical training aims to provide updated concepts and standardize methodologies on how collect in the field functional traits for ecological investigation, encompassing different levels of organization from species to ecosystem.

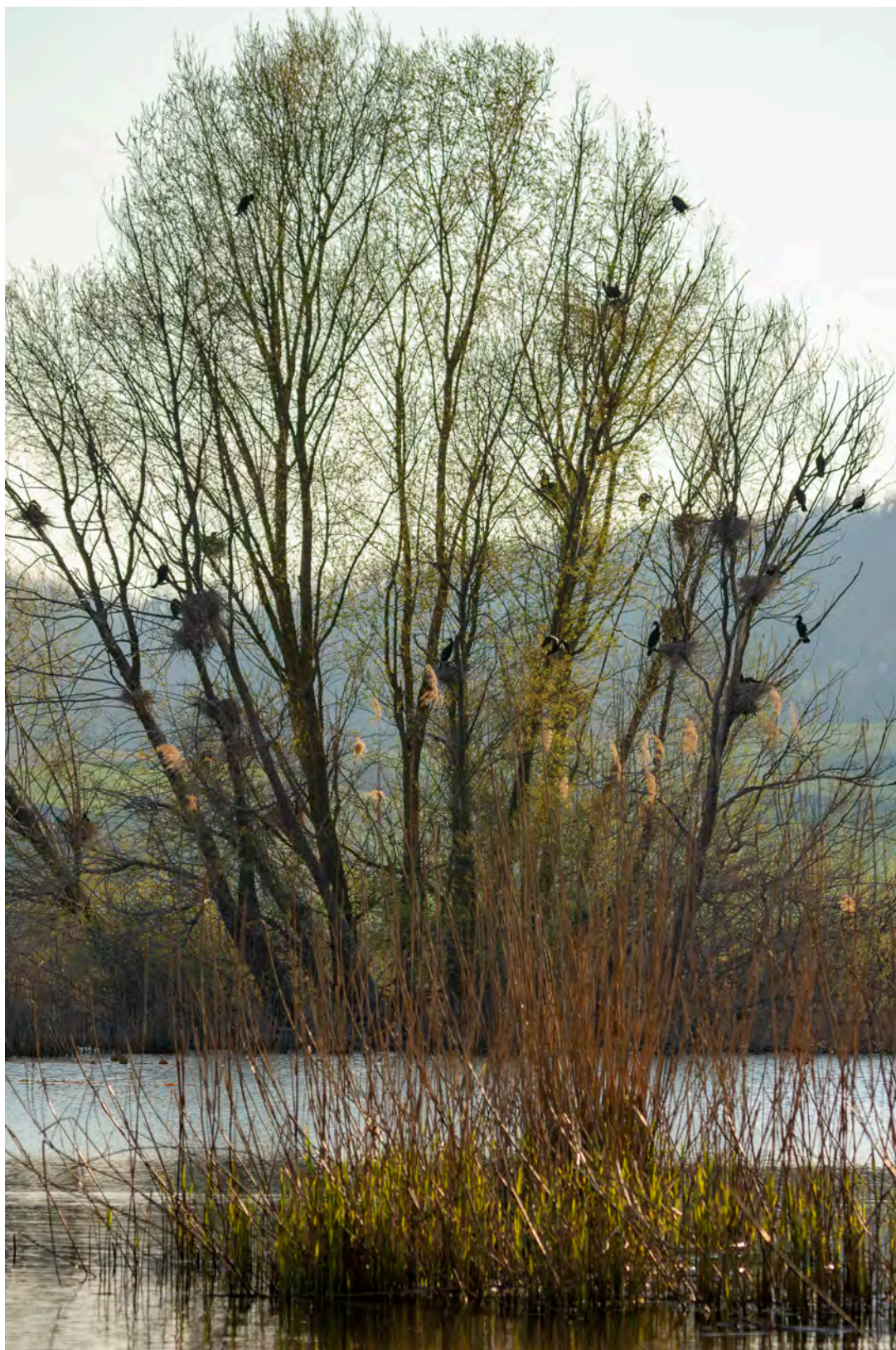
Particular attention will be given to leaf traits, such as leaf area, specific leaf area and leaf dry matter content. These traits are easy-to-collect in the field and to analyse in the laboratory, and are considered as key traits, since they underlie strategies of resource exploitation.

Leaf area (LA): the one-sided projected surface area of a single or an average leaf or leaf lamina, expressed in mm². Leaf size has important consequences for the leaf energy and water balance. Interspecific variation in leaf size has been connected with climatic variation, geology, altitude or latitude, where heat stress, cold stress, drought stress and high-radiation stress all tend to select for relatively small leaves.

Specific leaf area (SLA): the one-sided area of a fresh leaf divided by its oven-dry mass, expressed in m² mg⁻¹. SLA is in many cases a good positive correlate of its potential relative growth rate. Lower values tend to correspond with relatively high investments in leaf “defences” and long leaf lifespan. Species in resource-rich environments tend to have a larger SLA than those in environments with resource stress, although some shade-tolerant woodland understory species are known to have remarkably large SLA as well. Indeed, SLA is a function of leaf dry-matter content and leaf thickness. Both components can contribute to SLA to different degrees, depending on the habitat and the plant group in question. In cool-temperate environment, low SLA of slow-growing herbaceous species tends to be related to high leaf dry-matter content, more than to high leaf thickness. Some species that normally grow in deeply shaded, and thus presumably resource-limited, micro-habitats (e.g. *Oxalis*) have a high SLA and low leaf thickness. In areas with severe soil-nutrient limitations, slow-growing plants with sclerophyllous leaves (with thick epidermal walls and cuticle, abundant sclerification, high ratio of crude fibre to protein) are common. In these, low SLA is associated with high leaf dry matter content more than with high leaf thickness. In contrast, in the succulent plants that are common in some seasonally dry subtropical to tropical areas, low SLA is associated with low leaf dry-matter content and high leaf thickness. As a consequence of these variations, SLA and its components are often, but not always, related to each other and to productivity gradients in a simple way.

Leaf dry matter content (LDMC): the oven-dry mass (mg) of a leaf divided by its water-saturated fresh mass (g). LDMC is related to the average density of a leaf tissues and tends to scale with 1/SLA. It has been shown to correlate negatively with potential relative growth rate and positively with leaf life-span. Leaves with high LDMC tend to be relatively tough and are thus assumed to be more resistant to physical hazards (e.g. herbivory, wind, hail) than leaves with low LDMC. Species with low LDMC tend to be associated with productive, often highly disturbed environments. In cases where leaf area is difficult to measure, LDMC may give more meaningful results than SLA, although the two traits may not capture exactly the same functions (see above).

Excursions guide



Monte Saliere and Piani di Montelago

Thursday, May 9th

Geographic location – Apennine ridge between the town of Camerino and Colfiorito (Camerino Municipality)

Geomorphology – The Piani di Montelago are two tectonic depressions, with karstic processes acting belowground and surrounded by calcareous massive with altitude ranging from 1,000 to 1,400 m. a.s.l.

Vegetation – The forest vegetation is composed of mixed *Ostrya carpinifolia* and *Quercus cerris* woods (*Scutelario columnae-Ostryetum carpinifoliae* and *Aceri obtusati-Quercetum cerridis* associations), and *Fagus sylvatica* woods (*Lathyro veneti-Fagetum sylvaticae* association), which mainly cover the steepest slopes. Semi-mesophilous grasslands of the *Festuco-Ononidetea striatae* class with a dominance of *Bromopsis erecta* (*Brizo mediae-Brometum erecti* association) cover the gentle slopes and the rounded mountain tops. The “Piani di Montelago” are mainly covered by humid hay meadows belonging to the *Molinio-Arrhenatheretea* class, with a dominance of *Ranunculus velutinus* (*Hordeo-Ranunculetum velutini* association).

Management – Woods are managed as coppice-with-standards with rotation cycles of 20-25 years. Grasslands are grazed by cows and sheep. Grazing of grasslands usually starts in mid-May and lasts until October. The humid meadows are mown every year at the end of June.

Itinerary – We will start at 1,100 m a.s.l. at the Saliere pass. Firstly, we will cross a dry grassland vegetation, grazed by cows with high stoking intensity and some evidence of land degradation. Time to time we will pass through small *Ostrya carpinifolia* or *Fagus sylvatica* woods, mixed with *Quercus cerris*, and with several geophytes in the underwood. Surrounding these woods, we will observe the effect of the absence of grazing with the invasion of *Brachypodium rupestre*. This clonal species, because of its competitive behaviour, tends to spread in undergrazing condition or after grazing cessation. In this site *Brachypodium rupestre* is restricted around *Juniperus* shrubs, because they are disliked by grazing animals and protect *B. rupestre* from to be eaten. The excursion will continue walking across a *Quercus cerris*-dominated wood growing on decarbonated paleosoils formed during the last interglacial period. Finally, we will reach the top of Monte Saliere covered by semi-mesophylous grasslands of *Brizo mediae-Brometum erecti*

Duration of the excursion – 2/3 hours.

Rasiglia – woods of Terne-Pupaggi

Friday, May 10th

Geographic location – Apennine ridge between the town of Foligno, Sellano and Colfiorito

Geomorphology – The area is characterized by gentle, calcareous, low mountain reliefs with altitude ranging from 800 to 1,100 m. (a.s.l.).

Vegetation – The forest vegetation is composed of mixed *Quercus cerris* woods (*Carici sylvaticaei-Quercetum cerridis* association), with *Fagus sylvatica* or anthropogenic woods of *Castanea sativa*. Several acidophilous species are present in the underwood (e.g. *Pyrus piraster*, *Orchis provincialis*, *Platanthera clorantha*). All around these woods it will possible to observe a very ancient cultural landscape made by field, old castle and villages. We will visit the village of Rasiglia that is the “Venice of Apennine” with a peculiar system of water streams, pools and public hand wash basins. The water bodies are characterized by a rich hydrophytic flora vegetation (e.g. *Apium nodiflorum*, *Veronica beccabunga*, *Veronica anagallis-aquatica*, *Nasturtium officinale*).

Management – Woods are managed as coppice-with-standards with rotation cycles of 20-25 years. Chestnuts woods are composed by centuries-old trees.

Itinerary – We will cross the area by the pullman with some stops to observe the landscape and the woods features. In Rasiglia we will make a short walk among the old houses and the water bodies.

Duration of the excursion– 4 hours.

Col Falcone - Bocchetta della Scurosa

Saturday, May 11th

Geographic location – Apennine ridge bordering the *plateau* of Colfiorito (Serravalle Municipality)

Geomorphology – The visited area is a calcareous massif with altitude ranging from 1,000 to 1,500 m a.s.l.

Vegetation – The forest vegetation is composed of mixed *Ostrya carpinifolia* and *Quercus cerris* woods (*Aceri obtusati-Quercetum cerridis* association), and *Fagus sylvatica* woods (*Lathyro veneti-Fagetum sylvaticae* association), which mainly cover the steepest slopes. Semi-mesophilous grasslands of the *Festuco-Ononidetea striatae* class with a dominance of *Bromopsis erecta* (*Brizo mediae-Brometum erecti* association) cover the gentle slopes and the rounded mountain tops.

Management – Woods are managed as coppice-with-standards with turns of 20-25 years. Grasslands are grazed by cows and sheep. Grazing of grasslands usually starts in mid-May and lasts until October.

Itinerary – We will start at 1,000 m. a.s.l. at the Brogliano Monastery. Firstly, we will cross the *Aceri obtusati-Quercetum cerridis* woods with several geophytes in the underwood. After that, we will cross a hilly dry grassland vegetation, grazed by cows with high stoking intensity and wide areas with understoking conditions and invasion of *Brachypodium rupestre*. Later, as we reach the valley floor and then the head of the valley we will pass through *Fagus sylvatica*-dominated woods, with *Ilex aquifolium* and *Taxus baccata* trees and several geophytes (*Anemone apennina*, *A. ranunculoides*, *Hepatica nobilis*, *Corydalis cava*, *Primula vulgaris*). In the drainage lines amid the beech wood, we will observe small pre-forest formations with a dominance of *Corylus avellana* whilst on the limestone cliffs some small patches of rock woods dominated by *Ostrya carpinifolia*. Finally, we will reach the Bocchetta della Scurosa pass, covered by semi-mesophylous mountane grasslands of *Brizo mediae-Brometum erecti*.

Duration of the excursion – 4 hours.

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Sponsors description

U-Space s.r.l. (www.u-space.it) is an engineering company founded in 2008 by a group of architects, engineers and planners from different background. In addition to its headquarters in Rome, U-Space is present in the Macerata Province with operational headquarters located in the Municipality of Camerino, in the Apulian territory in the Municipality of Conversano, and Spain in the town of Seville.

U-Space s.r.l. offers consultancy services to public administrations and private subjects and has specific skills and experience for planning actions to support sustainable development, environmental assessment procedures, green infrastructures, planning and de-placement of RES plants, communication and environmental education actions and territorial cooperation at local and international level. All these actions often involve local actors and citizens, both with traditional participation methods and with the support of ICT tools.

U-Space can offer support for the drafting and presentation of projects to funding bodies, and to prepare and coordinate all project activities including administrative and financial aspects. U-Space and its staff have provided technical support in the preparation and development of many projects funded by European programs, such as eContent Plus, Erasmus+, Horizon 2020, Interreg (Europe, MED, Italy – Croatia, ENI-Med), LIFE Environment and Resource Efficiency and Nature and Biodiversity. Since 2014, U-Space has prepared and developed more than 15 European funded projects.

As regards the preparation and submission of financing proposals, U-Space has developed a broad knowledge of the different types of "call for proposals", and considerable experience in preparing and organizing the contents of the proposals, in determining the budget and in defining the partnership. During its active participation in European projects, U-Space had the opportunity to act both as a technical consultant and as a co-financing partner.

From 31 October 2018 U-Space is certified according to the Uni En Iso 9001: 2015 and Uni En Iso 14001: 2015 standards that control the quality and environmental processes in all phases of the work.

In Formazione s.r.l. came to be from an idea thought by professional agronomists and chartered accountants who work together in the agricultural, environmental and agroindustrial sector, with the goal to promote training in farming in order to raise the skills of the entrepreneur in the business management so that the performance and quality would increase.

Founded in 2015, in 2017 it obtained the validation by the Marche Region for a constant education service and simultaneously signed a convention with the School of Bioscience and Veterinary Medicine with the University of Camerino and with the municipality of Camerino, both of which have the final goal to improve and develop the competitiveness of the agricultural companies of the territory.

InFormazione makes available the training experience of its team of professionals and university professors to the companies and their consultants which work in the agricultural, agroindustrial, agritourism and environmental sector.

Constant improvement of the company's performance through the formative itinerary offered is the basic principle of the operates of InFormazione s.r.l. To date, InFormazione has its legal base in Matelica (MC) in piazza Garibaldi and has an operative base in Rapagnano (FM) in via Castelletta.

