Biodiversity Hotspots in the Mediterranean Area:

species, communities and landscape level
45° International Congress of SISV & FIP
Cagliari, 22-24 and 25-29 June 2009

Book of Abstracts

EDITED BY Gianluigi Bacchetta
Biodiversity
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EDITED BY Gianluigi Bacchetta
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PREFACE

The 45th International SISV & FIP Congress on “Biodiversity Hotspots in the Mediterranean Area: species, communities and landscape level” was held in Sardinia, Italy, at the University of Cagliari on June 22-24, 2009. Two post-congress excursions (IGIS Iter Geobotanicum Insulae Sardiniae) to Sulcis-Iglesiente biogeographic sector and to Supramonte, Gennargentu and Sarcidano areas, were carried out on June 25-29, 2009. This meeting followed the 44th SISV Congress organized by the University of Bologna in Ravenna on February 27–29, 2008.

The conference included a opening session and three main sessions focused on the following topics: “Flora and evolution in the Mediterranean area”, “Phytosociology as plant synecology” and “Towards an ecological characterization of Mediterranean landscapes”. Four side events on “Plants species and communities in the Mediterranean mining areas: biodiversity, landscape evolution and their use in phytoremediation”, “Important plant areas in Italy and in the Mediterranean context”, “Origins of endemic plants to the Corso-Sardinian microplate: an integrative phylogenetic approach” and “Conservation studies on threatened plants in the Mediterranean area” were also organized. Additionally, the Social Assembly of SISV, the Executive Council of FIP and the 1st GENMEDA Meeting were housed during the congress.

This Book of Abstracts contains 264 contributions and in particular 69 oral invited and proposed communications and 195 posters. The congress was attended by 602 participants from 30 countries.

The organization of the meeting was possible thanks to the hard work of the local Organizing Committee and the Scientific Committee. The conference organizers thank the SISV, FIP and all the other scientific associations for their significant support.

Gianluigi Bacchetta
**PROGRAMME**

Cagliari, 22nd to 24th June 2009

*Faculty of Economics, Lecture Hall, V.le S. Ignazio da Laconi 72*

### 22 JUNE

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| 08:00-10:00 | Registration of participants  
Welcome coffee                                                      |
| 10:00-11:00 | Welcome address by local Authorities  
Opening Ceremony                                                  |
| 11:00-12:00 | Opening Session E. Biondi, C. Blasi, L. Mossa & S. Rivas-Martínez       |
| 12:00-13:30 | FIRST SYMPOSIUM “FLORA AND EVOLUTION IN THE MEDITERRANEAN AREA”  
CHAIRMAN: F. Médail                                               |
|          | F. Médail The Mediterranean Basin, a hotspot for plant evolution     |
|          | J. Migliore, A. Baumel, M. Juin & F. Médail Phylogeography of the  
Mediterranean shrub Myrtus communis and phylogenetic link with the  
Saharan endemic Myrtus nivellei                                  |
|          | S. Lavergne, J. Arroyo, M. Debussche & J. Molina Origin and fate of the  
rare Mediterranean flora                                          |
|          | J.C. Moreno Saiz Trends in Iberian plant diversity and diversification |
|          | E. Vela Biogeographical links at south of the Tyrrhenian sea: classical data and new insights from molecular biology |
| 13:30-14:30 | Lunch                                                                |
| 14:30-16:00 | Poster session and side events                                       |

**SIDE EVENT 1 “PLANTS SPECIES AND COMMUNITIES IN THE MEDITERRANEAN MINING AREAS: BIODIVERSITY, LANDSCAPE EVOLUTION AND THEIR USE IN PHYTOREMEDIATION” CHAIRMAN: M. Casti**

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S. Ravera & M. Aleffi Role of cryptogams in the definition of Italian IPAs
C. Perini, P. Leonardi, L. Pecoraro & E. Salerni The Important Plant Areas program from a mycological point of view: an experience at regional level, in the European context

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J.A. Rossellò Plant diversity in the Balearic archipelago: when continental islands are welcome to assess evolutionary patterns and processes
H.P. Comes, U. Jaros, A. Tribsch & C. Bittkau Plant speciation in continental island floras as exemplified by *Nigella* (*Ranunculaceae*) in the Aegean archipelago
T. Nikolić & O. Antonić Plant species diversity of Adriatic islands: an introductory survey

17:30-18:00 Coffee break

18:00-20:00 FIRST SYMPOSIUM “FLORA AND EVOLUTION IN THE MEDITERRANEAN AREA” CHAIRMAN: F. MEDAIL

S. Fineschi, F. Bagnoli, D. Magri, M.C. Simeone & G.G. Vendramin *Quercus suber*: the fascinating case of a Mediterranean tree species which preserves the genetic imprints of plate tectonic events
A. Terrab, S. Talavera, J.L. García-Castaño & T.F. Stuessy Genetic variation and phylogeography in the west Mediterranean firs (section *Piceaster*, *Pinaceae*)
L. Cecchi, R. Gabbielli, C. Gonnelli, A. Hasko & F. Selvi Evolutionary lineages of Ni-hyperaccumulation and taxonomy in European *Alysseae* (*Brassicaceae*): insights from nrDNA sequence data
F. Frignani & G. Iiriti The genus *Romulea* in Italy: taxonomy, ecology and intraspecific variation in relation to the flora of insular systems of Western Mediterranean
J. Agulló, A. Guilló, A. Juan, M.Á. Alonso & M.B. Crespo Genetic diversity and phylogeographical asessment of *Helianthemum caput-felis* Boiss. (*Cistaceae*) based on AFLP markers
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J.L. Garrido, G. Bacchetta, G. Fenu, E. Mattana & C.M. Herrera Structure of the genetic variation of Sardinian taxa of *Aquilegia*: macro and microevolutionary patterns

P. Escobar García, G. Schneeweiss, G. Bacchetta, F. Mascia & P. Schönswetter *Lavatera triloba* subsp. *pallescens*: The demise of a Tyrrhenian taxon

A. Asensi, B. Diez-Garretas, V. De la Fuente, D. Sanchez Mata & A.L. Marquez Floristical and biogeographical analysis of the Betic-Rifan arc

### 23 JUNE

**09:00-10:30** **SECOND SYMPOSIUM “PHYTOSOCIOLOGY AS PLANT SYNECOLOGY”**

**CHAIRMAN: E. BIONDI**

E. Biondi Phytosociologists’ pride

J.F. Mota, M.E. Merlo & C. Gil de Carrasco Relationships between phytosociology and ecology in the Iberian gypsum outcrop

L. Gratani, L. Varone & M.F. Crescente Mediterranean evergreen species tolerance threshold to air temperature increasing

P. Soriano, E. Estrelles, F. Mainardi, A. Hurtado & E. Biondi Halophytic vegetation with *Halocnemum strobilaceum* (Pall.) M. Bieb. Ecological studies of two populations of this species in Spain and Italy

**10:30-11:00** Coffee break

**11:00-12:00** **SECOND SYMPOSIUM “PHYTOSOCIOLOGY AS PLANT SYNECOLOGY”**

**CHAIRMAN: E. BIONDI**

G. Puppi Phenological traits of vegetation: examples of some phytocoenoses from selected vegetation-series

R. Gatti, S. Cesaretti & A. Catorci Biodiversity conservation and grazing management: geosynphytosociology as a tool of analysis and modelling of grassland systems

S. Bagella Vegetation series as a tool for the assessment of ecosystem services (ESS) of grasslands in Mediterranean Grazing Systems

**12:00-13:30** **SECOND SYMPOSIUM “PHYTOSOCIOLOGY AS PLANT SYNECOLOGY”**

**CHAIRMAN: E. BIONDI**

F. Taffetani & M. Rismondo Vegetation and fauna: essential bio-indicators for the assessment of agro-ecosystems

C. Gangale & D. Uzunov Plant communities of Sila Mt. (S Italy): syntaxonomy, biogeography and conservation

R. Di Pietro Coenological and syntaxonomical features of *Sesleria* gr. *juncifolia* in Italy
F. Maneli, D. Gigante, A. Menghini, L. Menghini, R. Pagiotti & R. Venanzoni Phytosociological and ecological characterization of *Gentiana lutea* L. in central Apennine, on the basis of Ellenberg indicator values

A. Catorci, S. Cesaretti, G. Ottaviani & S. Ballelli Floristic variations analysis due to different disturbance intensities in a grassland of Umbria-Marches Apennine (Central Italy)

F.M. Raimondo & R. Schicchi Hydrophytic vegetation aspects in the Nebrodi mountains (Sicily)

**13:30-14:30** Lunch

**14:30-16:00** Poster session and side events

**SIDE EVENT 3** “ORIGINS OF ENDEMIC PLANTS TO THE CORSO-SARDINIAN MICROPLATE: AN INTEGRATIVE PHYLOGENETIC APPROACH” **CHAIRPERSON: E. CONTI**

E. Conti Dating the origin of plant endemics to the Corso-Sardinian Plate: a window on the biogeography of the Western Mediterranean Basin

A. Bertini The history of flora, vegetation and climate in the Mediterranean area during the Messinian salinity crisis according to pollen records

D. Jeanmonod & A. Schlüssel Flora Corsica: an analysis of the data

G. Salvo & E. Conti Molecular dating and biogeography of *Ruta* L. (*Rutaceae*): a case study from the Mediterranean basin

**SIDE EVENT 4:** “CONSERVATION STUDIES ON THREATENED PLANTS IN THE MEDITERRANEAN AREA” **CHAIRMAN: G. FENU**

G. Fenu Plant conservation strategies in the Mediterranean hotspot

T. Ulian, E. Mattana, M.I. Daws, G. Bacchetta & H.W. Pritchard Reproductive biology, seed ecophysiology and conservation of Mediterranean plants in a changing climate

D. Draper Munt, J.B. Martínez-Laborde, F. Pérez-García & M.E. González-Benito Ex situ conservation at the Plant Germplasm Bank-UPM (Technical University of Madrid) related with the Global Strategy for Plant Conservation

D. Gargano Population biology and conservation of Mediterranean endemics: studies on the rare *Dianthus guliae* Janka

**16:00-17:40** SECOND SYMPOSIUM “PHYTOSOCIOLOGY AS PLANT SYNECOLOGY” **CHAIRMAN: E. BIONDI**

R. Costa, P. Pavone & G. Spampinato Contribution to the knowledge of woody vegetation of the Hyblean territory (S Sicily)

L. Cancellieri, M. Cutini & G. Caneva Vegetation series of the Southern district of the Lattari Mountains (Southern Apennine, Campania)

L. Kadik-Achoubi Syntaxonomical study of the formations with pine of Alep (*Pinus halepensis* Mill.) in Algerian semi-arid bioclimatic stage

S. Brullo, G. Giusso del Galdo, P. Minissale, G. Spampinato & S. Scianдрrello Syntaxonomic analysis of the halo-nitrophilous vegetation (*Pegano-Salsoletea*) in Italy
M. Puglisi & M. Privitera  Bryosociological synopsis for Italy
M. Pilar Donat & J. Martinez  Evaluation of vegetation of a Mediterranean littoral area in Alicante (Spain)

17:40-18:00  Coffee break
18:00-19:30  Social Assembly of SISV
19:30-20:30  Executive Council of FIP (Botanical Gardens, Cosmese Hall)
21:00  Social Dinner

24 JUNE

9:00-10:30  THIRD SYMPOSIUM “TOWARDS AN ECOLOGICAL CHARACTERIZATION OF MEDITERRANEAN LANDSCAPES”  CHAIRMAN: C. BLASI

  C. Blasi, G. Capotorti, R. Frondoni, D. Smiraglia & L. Zavattero  The contribution of vegetation science to current environmental issues at the landscape level in the Mediterranean Region
  Y. Carmel, L. Stoller-Kavari & R. Kent  Comparing environmental and biological surrogates for biodiversity at a local scale
  K. Tuluhan Yilmaz  Vegetation analysis as a tool for ecological characterization of landscapes

10:30-11:00  Coffee break

11:00-13:00  THIRD SYMPOSIUM “TOWARDS AN ECOLOGICAL CHARACTERIZATION OF MEDITERRANEAN LANDSCAPES”  CHAIRMAN: C. BLASI

  F.D. Pineda  Landscape from a socio-ecological system perspective
  M. Costa  Biodiversity and landscape in the eastern area of the Iberian peninsula
  E. Biondi, S. Casavecchia & S. Pesaresi  Phytosociological synrelevée and plant landscape mapping from the theory to the practical application
  E. Farris & R. Filigheddu  Patterns of plant population spatial variability in relation to vegetation dynamics: vegetation series matter

13:00-13:30  THIRD SYMPOSIUM “TOWARDS AN ECOLOGICAL CHARACTERIZATION OF MEDITERRANEAN LANDSCAPES”  CHAIRMAN: C. BLASI

  D. Galicia-Herbada, J. Hervás, R. Martínez, J. Seoane & R. Hidalgo  An environmental classification of Spain
  F. Melado  Preliminary ecological basis for the conservation of habitats of community interest in Spain
  G. Bazan, G. Baiamonte & P. Marino  Land forms, land-use and landscapes in Sicily
13:30-14:30 Lunch

14:30-15:30 Poster session

15:30-17:00 THIRD SYMPOSIUM “TOWARDS AN ECOLOGICAL CHARACTERIZATION OF MEDITERRANEAN LANDSCAPES” CHAIRMAN: C. BLASI

N. Oliveira, S. Antunes, F. Gouveia & M. do Carmo Tavares Using biodiversity action plans to manage high conservation value areas in Portuguese Natura 2000 Network

G. Filibeck & A. Scoppola Two Mediterranean landscape types and their high-biodiversity interface as candidates for a “landscape red list”


G. Capotorti, R. Frondoni, B. Mollo & C. Blasi Urbanisation and biodiversity: integrated vegetation analysis for identifying and evaluating ecosystem services in a Mediterranean metropolis

17:00-17:30 Coffee break

17:30-19:00 Introduction to the excursions and visit to the Botanical Gardens

17:30-20:30 GENMEDA Meeting (Botanical Gardens, Cosmese Hall)
ABSTRACTS
The Mediterranean macrobioclimate in the earth: a global overview

S. Rivas-Martínez & S. Rivas Sáenz
Phytosociological Research Center, Alpedrete (Madrid), España.

Corresponding author: Salvador Rivas-Martínez (rivas-martinez.cif@tsai.es)

According to the last unpublished approach (2009) of the Bioclimatic computerized maps of the Earth (Rivas-Martínez and Rivas Sáenz & cols.), we present the terrestrial emerged percentage and surface area values of the accepted macrobioclimates (helped by the colleagues Angel Penas & Sara del Rio, University of León, Spain). In the World the percentages (%) and surface area values (km² x 1000) of these macrobioclimates (from the bigger to the smaller territory size) are: 1. Tropical (38,0 - 73.854), 2. Boreal (19,2 - 42.944), 3. Temperate (18,6 - 41.742), 4. Polar (15,5 - 34.748), and 5. Mediterranean (13,7 - 30.647). The percentage and surface values of the eight bioclimate types that we accept within the Mediterranean macrobioclimate are: 1. Oceanic Pluviseasonal (12,6 - 3.861), 2. Continental Pluviseasonal (15,5 - 4.759), 3. Oceanic Xeric (10,5 - 3.230), 4. Continental Xeric (15,8 - 4.829), 5. Oceanic Desertic (9,6 - 2.952), 6. Continental Desertic (27,0 - 8.365), 7. Oceanic Hyperdesertic (6,1 - 1.881), and 8. Continental Hyperdesertic (2,8 - 870).

Keywords: bioclimatology, Mediterranean climate areas.
SESSION 1: FLORA AND EVOLUTION IN THE MEDITERRANEAN AREA

Chairman: Frédéric Médail

INVITED ORAL PRESENTATIONS
The Mediterranean Basin, a hotspot for plant evolution

F. Médail
Institut Méditerranéen d’Ecologie et de Paléoécologie (IMEP, UMR CNRS 6116), Aix-Marseille University (Université Paul Cézanne), Europôle méditerranéen de l’Arbois, Aix-en-Provence, France (f.medail@univ-cezanne.fr).

The flora of the Mediterranean Basin represents a highly complex assemblage of species with different biogeographical origins. This originality can be explained by profound and contrasted changes in historical biogeography patterns and the existence of unique ecological processes. The huge plant diversity and levels of endemism located in the regional biodiversity hotspots are indeed in great part related to the contrasted historical biogeography of this region.

Recent insights of palaeoecology, phylogeny and phylogeography indicate the importance of past events (notably the Messinian salinity crisis and glacial episodes since the end of the Tertiary) in shaping the current and unique Mediterranean plant biodiversity. Since it exists a good congruence between the location of phylogeographically-defined refugia and regional hotspots of plant biodiversity, refugia constitute key areas for the local persistence of species and they form also “phylogeographical hotspots”, i.e. significant reservoirs of unique genetic diversity favourable to the evolutionary processes of Mediterranean plants. We will discuss some recent and significant results related to the timing and modes of evolutionary divergence of some Mediterranean plants, since the phylogeographical structure of populations often preserves the imprints of contraction or splitting of the ancient species range.

The phylogeographical history of several lineages in still poorly studied areas (North Africa, Eastern Mediterranean region) suggests also that these regions were an important reservoir for plant evolution in the Mediterranean Basin. Therefore, future phylogeographical researches should better consider the biogeographical links between the Mediterranean Basin and some still poorly studied adjacent areas, notably the Irano-Turanian and Saharan regions.

Keywords: Mediterranean region, phylogeography, plant endemism, plant persistence, Mediterranean islands, Mediterranean mountains, conservation biogeography.

References:
Phylogeography of the Mediterranean shrub *Myrtus communis* and phylogenetic link with the Saharan endemic *Myrtus nivellei*

J. Migliore, A. Baumel, M. Juin & F. Médail
Institut Méditerranéen d’Ecologie et de Paléoécologie (IMEP, UMR CNRS/IRD 6116), Aix-Marseille University (Université Paul Cézanne), Europôle méditerranéen de l’Arbois, Aix-en-Provence, France.

**Corresponding author:** Jérémy Migliore (jeremy.migliore@etu.univ-cezanne.fr)

Within the Myrtaceae family, which encompasses more than 4000 tropical species, only the genus *Myrtus* is distributed in the Northern hemisphere, including two species. *M. communis* L. is quite widespread throughout the Mediterranean area and it occurs also in Madeira, the Azores, the Middle-East, Iran and Afghanistan, whereas *M. nivellei* Batt. & Trab. is a highly relictual endemic plant from the central Sahara mountains (Algeria: Hoggar, Tassili n’Ajjer and Tassili n’Immidir; Chad: Tibesti).

The geographical structure of the genetic diversity is examined for more than 120 circum-Mediterranean populations of *M. communis* and 23 centro-Saharan populations of *M. nivellei*, and our analysis is based on the sequencing of chloroplastic and ribosomal DNA intergenic spacers (trnL-F, EucpsbA-Europl2, ETS and ITS) and on AFLP markers. Phylogeographic analysis reveals the occurrence of a peri-Mediterranean lineage whose derivating haplotypes could be at the origin of western and eastern Mediterranean, and also Saharan populations. Others geographical patterns of genetic structure highlight the east-west Mediterranean differentiation, the high genetic diversity of south-western Turkish populations, the genetic homogeneity of western Mediterranean archipelagos and islands, and the biogeographic link between southern Spanish and Moroccan populations.

By combining molecular and palaeoecological approaches, the importance of dispersal hypothesis from few or numerous refugia versus the vicariance hypothesis will allow us to better understand the evolutive response implied in the persistence and differentiation of a key element of the thermophilous Mediterranean flora facing several macroecological processes.

**Keywords:** phylogeography, *Myrtus communis*, *M. nivellei*, Saharan-Mediterranean link, genetic diversity, palaeoecology.
Origin and fate of the rare Mediterranean flora

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2 Universidad de Sevilla, Dpto Biología Vegetal y Ecología, Sevilla, España.
3 Centre d’Ecologie Fonctionnelle et Evolutive, CNRS – Université de Montpellier, Montpellier, France.
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Mediterranean plant diversity is composed of many narrow endemic species which mostly emerged through recent diversification of particular lineages, but also of more widely distributed species, sometimes reaching their range limits near or around the Mediterranean Basin (Thompson 2005). This results in Mediterranean floristic regions exhibiting an exceptional phylogenetic diversity, measured as the total evolutionary history retained by all plant clades occurring in a given region. However, current predictions indicate that the exceptionally high phylogenetic diversity of Mediterranean hotspots may be particularly threatened in future decades due to climate and land use changes (Thuiller et al. 2005). Using examples from the Western Mediterranean Basin, mainly the Strait of Gibraltar and Montpellier floristic regions, I will show how we can better understand the mechanisms by which this high plant species diversity has emerged and by which current global changes may cause disproportionate losses of plant phylogenetic diversity. Local diversification of species, i.e. the repeated differentiation of narrow endemic species, has been clearly promoted by the existence of geographical barriers or land-bridges which have promoted relative spatial isolation (Lavergne et al. 2009), and by the occurrence of unusual and harsh habitats (Lavergne et al. 2003), which have probably caused catastrophic selection (Raven 1964). The evolution of particular reproductive strategies in these narrow endemic species may have also favoured local persistence relative to colonization potential (Lavergne et al. 2005, Lavergne et al. 2004). All this finally caused a strong lineage sorting in the Mediterranean region, with few plant genera and/or families having experienced disproportionately high local diversification rates. Long term data obtained over the last century suggest that populations of narrow endemic species may be quite resilient to current global changes, relative to other rare taxa reaching their range limits in the Mediterranean Basin (Lavergne et al. 2005, Lavergne et al. 2006). It results from this a strong phylogenetic bias in the patterns of species regional extinctions over the last century; yet the amount of lost phylogenetic history is always higher than the estimated losses under a scenario of random species extinctions. It thus appears that the conservation of endemism may be at conflict with the conservation of evolutionary history in Mediterranean hotspots.

Keywords: narrow endemism, evolutionary radiation, phylogenetic diversity, global changes, species extinctions.

References:
Trends in Iberian plant diversity and diversification

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The Iberian peninsula harbours about 7,500 vascular taxa (Castroviejo 1997) and represents one of the main centers of biodiversity in the Mediterranean hotspot. Plant richness is mainly distributed along its mountain ranges, particularly covering the Pyrenean and the Cantabrian mountains. Such elevations constitute a latitudinal ecotone where two climatical and biogeographical domains interact, namely the Eurosiberian and the Mediterranean regions. Range-size rarity and endemism highlight the role of the mountains as well, but now Sierra Nevada and other Baetic mountains rise the highest scores of diversity. These southern sierras perform as a geological archipelago where every island shows its own endemics or relict taxa.

Some environmental determinants have proved to be significantly related to diversity. In decreasing order, the most explaining variables were altitude, substrate, environmental heterogeneity and climate. More important than maximum elevation, resulted altitude range, what underlines the role of complex topographies in promoting speciation and supporting different vegetation aggregates (Lobo et al. 2001, Arroyo et al. 2004).

When more restricted taxonomical or ecological groups are analyzed, different geographical patterns and explanatory variables emerge. For instance, Pteridophytes are more influenced by climate variables, although the resulting model has lesser explanation power. Historical factors could probably retain an important role as some pteridological hotspots coincide with Iberian refugia delimited according phylogeographical studies (i.e Gómez & Lunt 2004, Médail & Diadema 2009).

Keywords: diversity hotspots, geographical patterns, environmental variables, refugia.

References:
Biogeographical links at south of the Tyrrhenian sea: classical data and new insights from molecular biology

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The Mediterranean Basin is usually considered as biodiversity hotspot, thanks to its geographical and climatic heterogeneity, numerous glacial and actual refugia areas, and a complex biogeographical history. Central Mediterranean area and especially the south of Tyrrhenian Sea is deeply concerned by these processes, because of the palaeogeographical connections between Italian, African, Sicilian, Corso-Sardinian, Iblean, Kabylian plates and microplates.

Since long time, strong biogeographical links have surprised biologists, both botanists and zoologists. Intrusion of molecular biology gives us a lot of hope for the knowledge and comprehension of these still poorly studied phenomenons in the Mediterranean Basin. Examples from bibliography and author’s works are presented about vascular plants and gastropod molluscs. In particular, Tyrrhenian vicariance hypothesis is placed in the heart of the discussion.

Keywords: biogeography, Mediterranean basin, endemism, vicariance.
Plant diversity in the Balearic archipelago: when continental islands are welcome to assess evolutionary patterns and processes

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The Balearic Islands show one of the most diverse floras of the Mediterranean Basin, both in terms of richness (with about 1,500 native species in 4992 km²) and singularity (with about 121 restricted endemic taxa). There have been very few studies on levels of intraspecific DNA differentiation in narrowly distributed plants from the Balearic Islands. The scarcity of these records are due to the persisting perceptions that (1) rare species show on average low levels of overall genetic variation, (2) insular species tend to show low values of genetic diversity as compared with close continental relatives, and (3) the cpDNA genome is an unsuitable target for assessing genetic markers for intraspecific analysis due to its relative slower mutation rate compared to nuclear DNA. However, these general expectations seem to be lineage-specific and the detected levels of cpDNA variation depend to a large extent on the recent evolutionary history of the species. Contrary to our expectations, the emerging picture is that the Balearic Islands are a reservoir of genetic diversity or allelic richness, both nuclear and organellar, not only for widespread Mediterranean taxa (e.g., *Quercus* sp. pl., *Buxus balearica*), but also for several narrowly distributed endemics (e.g., *Crepis triasii, Naufraga balearica, Erodium reichardii, Thymelaea velutina, Hippocrepis balearica, Hippocrepis grosii, Ononis crispa, Thymus herba-barona*).

Thus, more complex evolutionary histories, rather than a simple hypothesis based on genetic bottlenecks due to founder effects, should be invoked to explain the origin and evolution of plant species from continental islands. The pattern of population differentiation in most Balearic species is not random but suggests an association between the genealogy and the geographical distribution of cpDNA haplotypes. This population structuring has been modulated by a balance between historical processes linked to the dynamic Quaternary palaeogeography of the Balearic Islands (fragmentation) and to past and contemporary recurrent gene flow involving long-distance dispersal (range expansion, colonisation). However, the latter has not counteracted the patterns of population differentiation drawn by the recurrent Quaternary vicariance. Narrowly-restricted endemic plants from the Balearic Islands are genetically highly structured showing very few shared haplotypes between islands and a high number of haplotypes restricted to small geographical areas within the islands. This scenario appears to be shaped by historical processes and restricted gene flows that have left detectable genetic footprints. Changes in habitat availability and dynamic processes of population fragmentation and connectivity drawn by repeated cycles of conspicuous sea level changes during the Quaternary are potential underlying reasons locally shaping the cpDNA pool of most endemic plant species.

**Keywords:** phylogeography, endemic taxa, cpDNA variation, speciation, Quaternary.

**Acknowledgments**
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Plant speciation in continental island floras as exemplified by *Nigella* (Ranunculaceae) in the Aegean archipelago

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Continental shelf island systems, created by rising sea levels, provide a premier setting for studying the effects of geographic isolation on non-adaptive radiation and allopatric speciation brought about by genetic drift. The Aegean archipelago, located in the eastern part of the Mediterranean Basin, forms a highly fragmented complex of mostly continental shelf islands that have become disconnected from each other and the mainland over about the last five million years. These ecologically fairly homogenous islands thus provide a suitable biogeographic context for assessing the relative influences of past range fragmentation, colonization, gene flow and drift on taxon diversification.

Our molecular phylogenetic (ITS) and phylogeographic (cpDNA, AFLP) studies in the Aegean *Nigella arvensis* complex exemplify the importance of allopatry and genetic drift coupled with restricted gene flow in driving recent (late Pleistocene) plant speciation in this Mediterranean archipelago. By contrast, founder event speciation has likely played an only minor role. This might reflect a migratory situation typical for continental archipelagos characterized by niche pre-emption due to a long established resident flora.

When subjected to AFLP-based $Q_{ST}/F_{ST}$ analyses, island populations of *N. degenii* provide little support for diversifying selection being important in structuring variation in quantitative vegetative and floral characters.

In sum, these molecular and quantitative genetic studies in Aegean *Nigella* have so far revealed population genetic processes that conform remarkably well to predictions raised by drift theory. However, there is a need for additional studies on the nature of phenotypic differences between species of the complex, and of other Aegean plant lineages in general. For those populations and species that strongly differ in habitat requirements and/or breeding system, the diversifying effect of selection should become more apparent.

**Keywords:** Aegean, allopatric speciation, genetic drift, *Nigella*, non-adaptive radiation.
Plant species diversity of Adriatic islands: an introductory survey

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The European Mediterranean region is one of the world’s major centres of plant biodiversity. Nevertheless, research on plant species diversity in this region has neglected the area along the eastern part of the Adriatic basin in comparison to the other Mediterranean areas. The main aim of this study is to focus on this neglected area, by supplying data which is at present lacking in order to discuss the species-area relationship (SAR), floristic richness and endemism of the Adriatic islands and coast. Floristic data for 106 Croatian islands collected by different authors were integrated, systematized and presented in a form usable by other researchers worldwide. The power (Arrhenius) function was used for modelling (by non-linear regression) the SAR. Residuals around the regression curve (as indicators of floristic diversity without the influence of island area) were calculated for each island. The proportion of endemics in the total island flora varies from 0% up to 28.6%, and 17.5% for narrow endemics. Floristic richness of the broader region was estimated (on the basis of SAR extrapolation) on 1807 species for all Croatian islands, and on 2797 species for the entire Mediterranean area in Croatia. The main causes of diversity distribution (topography, geological events, climate, etc.) are discussed, as well as the new initiatives related to the biogeography of Croatian islands.

Keywords: Adriatic basin, Arrhenius function, endemism, floristic diversity, species-area relationship, species richness.

References:
Duplančić et al. 2004. Coastline lengths and areas of islands in the Croatian part of the Adriatic Sea determined from the topographic maps at the scale of 1:25 000. Geoadria 9:5-32.
SESSION 1: FLORA AND EVOLUTION IN THE MEDITERRANEAN AREA

Chairman: Frédéric Médail

PROPOSED ORAL PRESENTATIONS
Quercus suber: the fascinating case of a Mediterranean tree species which preserves the genetic imprints of plate tectonic events

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The Mediterranean area is characterised by a complex geological history, a considerable physiographic and climatic heterogeneity, and a long-term impact of human activities that caused repeated isolations of plant populations and admixtures of populations of different origins. This region shows a remarkable diversity of plant populations, documented by numerous studies based on the combined analysis of phylogeographical and palaeobotanical results. Most of these surveys have focused on population dynamics that took place during the Quaternary and particularly after the last glacial maximum (about 18 000 years bp). However, it has been demonstrated that some plant species have retained the genetic imprints of much more ancient dynamics (Dick et al. 2003, Petit et al. 2005, Grivet et al. 2006). We studied the phylogeography of cork oak (Quercus suber L.). We analysed chloroplast DNA polymorphism in more than 100 populations throughout the range (Magri et al. 2008), and identified five haplotypes whose distribution is clearly geographically structured. Two haplotypes are found in Morocco, the Iberian Peninsula, the Balearic Islands and south-western France, while another two haplotypes only occur in the Italian Peninsula. The last haplotype characterises a narrow belt ranging from Tunisia and Algeria via Sardinia and Corsica to south-eastern France. Our results demonstrated that cork oak range-wide population structure is consistent with the breakup and separation of different microplates that took place in the Oligocene and Miocene, between 25 and 15 million years ago. According to our findings, cork oak populations have persisted in a number of separate microplates, currently found in Tunisia, Sardinia, Corsica, and Provence, without detectable chloroplast DNA modifications for a time span of millions of years. An other western Mediterranean tree species has preserved traces of these Tertiary events: a similar haplotype distribution (with lower resolution) has been described in a study of mitochondrial DNA in Pinus pinaster (Burban & Petit 2003).

Keywords: phylogeography, Mediterranean trees, biogeography, evolution, palaeoebotany.

References:
Grivet D. et al. 2006 Contrasting patterns of historical colonization in white oaks (Quercus spp.) in California and Europe Mol. Ecol. 15: 4085–4093
Genetic variation and phylogeography in the west Mediterranean firs (section Piceaster, Pinaceae)

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We investigated patterns of genetic variation within and among populations of the genus Abies (section Piceaster, Pinaceae) in the western Mediterranean Basin. We genotyped a total of 204 individuals from nine populations using amplified fragment length polymorphisms (AFLP). The six AFLP primer combinations generated 593 unambiguously scorable DNA fragments. Different analyses such as principal co-ordinate analysis (PCoA), AMOVA, neighbor-joining (NJ), and Bayesian clustering revealed that the Strait of Gibraltar acted as an efficient barrier against gene flow between the Moroccan and Spanish firs for a very long time. The Algerian fir (A. numidica) was genetically more closely related to the A. alba than to the Moroccan ones. Also, our analysis indicates that the population formerly assigned to the species A. tazaotana is, in fact, genetically very close to most A. marocana stands, which was very congruent with the results published previously using cpSSR markers. These results are also interpreted in the context of postglacial history of the region plus human impacts.

Keywords: Abies pinsapo, A. marocana, A. numidica, biogeography, AFLP, Quaternary, west Mediterranean.

References:
Evolutionary lineages of Ni-hyperaccumulation and taxonomy in Euro-Mediterranean *Alysseae* (*Brassicaceae*): insights from nrDNA sequence data

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Ni-hyperaccumulation is a rare form of physiological specialization shared worldwide by a relatively small number of endemic or subendemic angiosperms usually growing in serpentine ecosystems. These plants are currently considered as models for applications in phytoremediation and phytomining. Among the 65 hyperaccumulators native to the Euro-Mediterranean area, the greatest number is found in the Balkan peninsula, a region that includes the largest serpentine ecosystems in Europe and support one of the richest serpentine floras in the world. Family Brassicaceae contains the greatest diversity of hyperaccumulators, that belong to four or five out of the 35 monophyletic tribes: *Aethionemeae*, *Alysseae*, *Cardamineae*, *Noccaeeae* and, perhaps, *Thlaspideae*. Up to 40 species belong to *Alyssum* sect. *Odontarrhena* (*Alysseae*), but the taxonomy of this group is still critical and affected by a redundant nomenclature resulting from an exceedingly narrow species concept in especially the polymorphic complex of *A. murale*.

Molecular phylogenetic analyses in *Alysseae* s.l. allowed to elucidate the evolutionary distribution of Ni-hyperaccumulation and the relationships between specialised lineages at the genus, species and infraspecific levels, and to contribute to an improved systematics of this group. Molecular data retrieve two Ni-clades, *Bornmuellera-Leptoplax* and *Alyssum* sect. *Odontarrhena*.

The Greek monotypic genus *Leptoplax*, which is included by some authors in *Peltaria* (*Thlaspideae*), is sister to *Bornmuellera* (*Alysseae*), as represented by two endemic species from serpentine areas in Greece. Ni-hyperaccumulation in this lineage may represent an ecological synapomorphy inherited from a common ancestor close to *Phyllolepidum*, a neglected genus that should be resurrected to accommodate the non-hyperaccumulator endemics *Ptilotrichum rupestre* and *P. cyclocarpum*.

*Alyssum* sect. *Odontarrhena* is monophyletic and includes three clades, two of which with serpentine accessions from the Italian and the Balkan peninsulas. Edaphic specialisation for metalliferous soils may have multiple origins in this group, possibly thanks to a form of genetic "preadaptation" that is not associated with morphology or geographic distribution of the taxa. The low DNA variation between some supposed species in *A. murale* s.l. and the remarkable phenotypic plasticity within populations, calls for a lumping approach and the reduction of the number of species to be recognised.

**Keywords:** Ni-hyperaccumulation, *Alysseae* systematics, molecular phylogeny, serpentine flora.
How phylogeography can help understanding geographic genetic pattern of the orchid *Himantoglossum hircinum* (L.) Spreng.

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This study presents results of our research that aimed to link demographic traits and postglacial re-colonization processes with genetic traits in *Himantoglossum hircinum* (*Orchidaceae*). We used amplified fragment length polymorphism (AFLP) markers and employed plastid markers to study geographical structuring of genetic diversity, genetic differentiation and phylogenetics of this sub-Mediterranean orchid in its entire European distribution area. Isolation-by-distance patterns were analysed across all populations and at the group level to test for the presence of specific barriers to gene flows. Plastid microsatellite markers were used to infer migratory pathways of the species. Also, we measured demographic traits to assess population fitness at each site as an additional explanatory variable of observed genetic diversity.

Reduced genetic diversity and haplotype frequency at many marginal sites of the study species reflect historical range expansions. According to the central-marginal concept (CMC), one would expect reduced genetic diversity from the centre to the periphery of the range of a species due to reduced habitat suitability, higher demographic fluctuations and lower population sizes at the periphery. However, the decrease in genetic diversity towards the range margins of the species is not consistent. For those sites where genetic diversity was higher than expected from the Central-Marginal-concept, the geographic pattern is probably masked by other factors, which affect either demography or population genetic structure directly. Changed habitat suitability especially with regard to weather favoured population growth at some sites at the northern and northeastern periphery probably preventing loss of genetic diversity due to demographic fluctuations. Contrary, high genetic diversity of sites in the southern periphery of the range and in the Atlantic populations may be a consequence of historical processes including survival in glacial refugia, postglacial migrations and ‘secondary contact’ and hybridization with *H. adriaticum* in southern Italy.

We suggest that postglacial re-colonization patterns and more recent range shifts induced by climate change play a major role in the structuring of geographical genetics of *H. hircinum* emphasizing the importance of distinguishing historical effects from those caused by geographical variation in population demography to understand genetic structure of European plants (Pfeifer et al. 2009).

**Keywords**: AFLP, demographic trends, geographical genetic structure, abundance-centre concept.

The genus *Romulea* in Italy: taxonomy, ecology and intraspecific variation in relation to the flora of insular systems of western Mediterranean

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The genus *Romulea* Maratti (*Iridaceae*) was stated by Maratti on the basis of a species found in the surroundings of Rome and included at first in the genus *Crocus* L. and then in the genus *Ixia* L.

A very patchy area of distribution and evident differentiation centres are shown by this genus. The first of them is situated in the Cape Region (South Africa) where more than 40 species of *Romulea* occur; the second (about 20 species), comprises the South Mediterranean province and the Atlantic European province in the Holarctic kingdom, according to the phytogeographical synthesis of Takhtajan (1986).


As far as the Mediterranean species of the genus *Romulea* are concerned, Sardinia is an extremely interesting region since it is a very important area in the middle of the Western Mediterranean in terms of genetic exchange between different populations, hybridization and speciation. Sardinia is the only Italian region with all the spontaneous species except *R. linaresii* Parl. subsp. *linaresii*, endemic to Sicily. The high number of entities in the islands of this part of the Mediterranean is also confirmed by recent studies on Corsica (Jeanmonod & Gamisans 2007) where height taxa can be found, six of which are shared with Sardinia, five with Sicily, Tuscany and Maltese archipelagos, and three with the Balearic islands.

**Keywords:** *Romulea*, phytogeography, western Mediterranean species, islands.

**References:**


Genetic diversity and phylogeographical assessment of *Helianthemum caput-felis* Boiss. (*Cistaceae*) based on AFLP markers

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*Helianthemum caput-felis* Boiss. shows a fragmented distribution throughout the western Mediterranean area. Their current populations are located in four well isolated areas: East of Iberian Peninsula, Balearic islands, North Africa and Sardinia. Their natural habitat corresponds to littoral areas, mainly rocky slopes; so, they are mostly threatened by anthropic activities. In general, the occurrence of this plant is quite rare, since most of their current populations are characterised by extremely reduced areas of occupation. Therefore, the habitat fragmentation together with the anthropic activities could be generating, among others, a loss of genetic diversity, bottleneck processes and a lack of current gene flow.

A total of seven populations from different areas (East of Iberian Peninsula, Balearic islands and North of Morocco) were collected. Leaf samples were preserved in silica gel, and they were used for DNA extraction (a modified 2x CTAB protocol). The AFLP technique was performed using the AFLP Plant Mapping (Applied Biosystems). An initial primer trial was done using a total of 31 EcoRI and Msel primer combinations. However, only three of them gave excellent resolution to infer genetic differences among and within the studied populations. The obtained matrices were analysed by different statistics programmes (PopGene, Arlequin) and a dendrogram was obtained using PAUP software (Swofford 2002).

As preliminary results, the dendrogram indicates a population structure and some inter-population differences, specially North Morocco against Iberian Peninsula and Balearic islands. However, some common patterns of genetic diversity appear between Iberian Peninsula and Balearic islands populations, due to the mixing of some specimens. This result points out the strong genetic relationships among these two Mediterranean areas, as previously reported for other plant species.

**Keywords:** *Helianthemum*, AFLP, phylogeography, fragmented habitats, Mediterranean flora.

**References:**
Character transitions and patterns of diversification of the genus *Aquilegia* in the Mediterranean context

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The genus *Aquilegia* is an example of adaptive radiation mediated by pollination specialization in North America (Whittall & Hodges 2007). In spite of low pollinator diversity, Europe is home for ca. 22 species of *Aquilegia*, many of which are endemics of the south Mediterranean mountain systems. *Aquilegia*, like many other montane-alpine European genera (*Primula*, *Soldanella*, *Gentiana*, *Ranunculus*, *Saxifraga*) has strong affinities to the floras of central and eastern Asia (Kadereit et al. 2008). Many of these genera have a relatively recent origin between 10-2 Mya, a period characterized by high orogenic activity and by the drastic climatic oscillations of the Quaternary.

We constructed a phylogeny (ITS & cpDNA) of *Aquilegia*, including 32 taxa (13 European species). SIMMAP was used to estimate habitat ancestral states and the number of habitat transitions within the European species. Furthermore, we explored diversification patterns of European species, using lineage-through-time plots (LTTs) to investigate whether diversification rates have been constant through time. The $\gamma$-statistic (Pybus & Harvey, 2000, Pybus et al. 2002) and various diversification models (Paradis 1998) were employed to test for departure from constant diversification rate.

Our phylogenetic analysis shows clear relationships of the European species with Caucasian, or central and western Asian species. Within European species we found a clade comprising many species inhabiting the circum-Mediterranean mountain systems. European species showed at least ten habitat transitions, with a tendency to occupy more rocky habitats in species distributed in southern European mountain systems. The value of $\gamma$-statistic within European species was $-0.74$ ($-1.57$, after correcting for missing species) suggesting a decreasing speciation rate in the continent. Though such decrease was not statistically significant, the best diversification model fitting the observed diversification rates was model B, which assumes a gradual change of diversification rate.

**Keywords:** *Aquilegia*, adaptive radiation, habitat diversification, Mediterranean mountains.

**References:**
Structure of the genetic variation of Sardinian taxa of *Aquilegia*: macro and microevolutionary patterns

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The Mediterranean Basin is one of the most interesting places to study adaptive radiation in wild plants. The plant groups that confer such a relevant position on the Mediterranean area are those involved in recent and wide radiation processes. This is the case of the genus *Aquilegia* which is radiating from one million of years ago and has reached a quite wide distribution throughout North America, Asia and Europe (Bastida et al. unpublished). The genus *Aquilegia* has been broadly studied in North America, from where it has been considered as a paradigmatic example of adaptive radiation in flowering plants by means of pollinator specialization and floral traits differentiation (Fulton & Hodges 1999, Hodges et al. 2002). However, this not seems to be the case for the European Columbines, which have radiated to a similar diversity extent, but only relying on a single pollinator group and with a relatively low level of floral differentiation. Recent evidences suggest that the differentiation processes of European columbines are mainly due to selective pressures exerted by the abiotic environment on vegetative traits (Medrano et al. 2006, Bastida et al. unpublished), rather than due to pressures of the pollinator environment on floral traits like described for North American Columbines.

We hypothesize that this is also the case of the Sardinian Columbines, *A. barbaricina*, *A. nuragica* and *A. nugorensis*. Therefore, as a first step in the study of differentiation processes in these species, we aim to delimit accurately their genetic identities and to determine the geographic structuring of their genetic variation. As genetic markers, we used AFLP, since they allow us to explore huge genomic regions in non-model species (i.e. without any prior genetic knowledge). The results obtained here may provide a solid basis, robust enough to deepen in the study of the differentiation process acting in these species.

Keywords: Adaptive radiation, AFLP, *Aquilegia*, differentiation, Sardinia.

References:
Lavatera triloba subsp. pallescens: the demise of a Tyrrhenian taxon

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Hybrid zones have fascinated plant biologists for many decades. They provide a valuable insight into speciation processes, allowing the study of the role of natural selection in maintaining species boundaries and the evolution of reproductive isolation. Hybrids often harbour new and genetically heterogeneous genotypes that may enable exploitation of new habitats, eventually giving rise to new taxa.

Lavatera triloba subsp. pallescens is a Tyrrhenian endemic occurring in the western Mediterranean islands of Menorca and Sardinia, while our data strongly suggest that L. triloba subsp. triloba constitutes an Iberian endemic. Lavatera triloba subsp. pallescens is a very rare plant which grows in populations of few individuals, and only five extant populations are known on the island of Menorca. The single Sardinian population of the subsp. pallescens, located on the San Pietro island, has not been observed since 1894. It may be extinct, as island floras are particularly prone to extinction events, not only because of habitat disturbance by human activity, but also by stochastic phenomena due to small population sizes. In the case of subsp. pallescens, the main threat to population viability is human activity. On the other hand, subsp. triloba has been traditionally thought to be present in southern Sardinia. Using DNA plastid markers and AFLP data, we provide evidence that the Sardinian populations of L. triloba actually belong to subsp. pallescens and not to the Iberian subsp. triloba. Moreover, our data prove the existence of an extensive hybrid zone between the common L. olbia and the Sardinian populations of L. triloba, which may account for the unusual morphology of individuals belonging to populations of the latter. We suggest that extensive hybridization with the frequent L. olbia may be a threat to the existence of the much rarer subsp. pallescens in Sardinia.

Keywords: hybrid zones, Mediterranean islands, Sardinia, Menorca, Tyrrhenian endemic.
Floristical and biogeographical analysis of the Betic-Rifan arc

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The Betic-Rif territories have been considered zones of high plant biodiversity with a notable number of taxa as well as plant communities. In the last few years, a large number of data have been furnished in order to better understand the biogeography of the flora of this complex area. A biogeographical synthesis of Andalusia that included a large part of the Betic mountains was carried out using endemic taxa in addition to characteristic plant communities (Rivas-Martínez et al. 1997). Nearly 800 endemic taxa of the Betic and Rif ranges have been analysed of which 70 % are exclusive of the Betic mountains, 23 % correspond to the Rif and 7 % shares both territories.

We prepared a regionalization of the Betic-Rif region based on the distribution of the endemic flora. We divided the study area into 28 phytogeographical sectors and classified them using Baroni-Urbani and Buser similarity index and the UPGMA (Unweighted Pair-Group Method using Arithmetic Averages) (Sneath & Sokal 1973) as a cluster method. In each node of the cluster we assessed the statistical significance of each group. Moreover, the African part and Iberian zone of the study area were analysed separately.

A preliminary advance about the biogeographical relations between both zones besides a delimitation of homogeneous territories in the Rif is proposed.

Keywords: Betic-Rif ranges, biogeography, endemic taxa.

References:
SESSION 1: FLORA AND EVOLUTION IN THE MEDITERRANEAN AREA

Chairman: Frédéric Médail

PROPOSED POSTER PRESENTATIONS
Chromosome number and genome size assessment of Lebanese taxa of Astragalus genus

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The Mediterranean Basin is one of the world’s major centers for plant biodiversity (Myers et al. 2000), where 10% of the world’s higher plants can be found in an area representing only 1.6% of the Earth’s surface (Médail & Quézel 1997). Within the Mediterranean region, Lebanon is a recognized center of plant diversity and it is considered as a regional biodiversity hotspot. Its floristic richness includes 2,600 vascular plant species of which ca. 400 are endemic to Lebanon, Syria and Palestine (15%) and ca. 92 are endemic to Lebanon (3.5%) (Mouterde 1966, 1970, 1983).

The genus Astragalus L. constitutes a key component of the Lebanese plant biodiversity since it is represented by 59 species of which ca. 47 are endemic (Tohmé & Tohmé 2007). Astragalus is not only the largest in number of taxa rather it is also considered as one of the most diverse and taxonomically difficult genera in legumes. This genus exhibits great morphological variability: size of the plants, nature of indumentums, stipules, leaf rachis, type of inflorescence, relative length of petals, pods. Slight changes in edaphic and climatic factors bring out drastic modifications in the general appearance and structure of the taxa. Therefore, the delimitation of Astragalus at various taxonomic ranks poses considerable taxonomic problems worldwide. It has been widely established that morphological characters alone are not sufficient to explain the systematic relationships and evolutionary processes among Astragalus species.

In order to obtain a better understanding of the phylogenetic relationships among species and of the karyotype evolutionary mechanisms that have operated in Astragalus genus, we undertook the assessment of chromosome number, karyotype evolution, genome size and ploidy level of the Lebanese species of Astragalus with special emphasis on endemic taxa. To our knowledge, no genome size data is available for Astragalus genus. Values obtained in our study varied between 1.68 pg/2C for Astragalus angulosus DC. and 4.76 pg/2C for Astragalus emarginatus Labill. Within eight species studied, the chromosome number seems to be stable with 2n = 2x = 16 chromosomes.

Keywords: Astragalus L., chromosome number, genome size, endemism, Lebanon.

References:
Phylogeography patterns of genus *Aquilegia* within the Mediterranean basin

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*Aquilegia* genus (the columbines) comprises 60-75 spp. distributed through the Northern hemisphere, inhabiting from forest to alpine habitats and desert springs. In Europe, *Aquilegia* shows a considerable diversity of species, many of them are endemics to South European peninsulas (Iberia, Italy plus Corsica and Sardinia, and Balkans). We used a bayesian phylogeny based on ITS & cpDNA, which includes 32 species (13 European), to explore possible phylogeographic patterns within European species. In order to estimate the origin of European columbines, we construct a family level phylogeny of *Ranunculaceae*. Beast v1.4.8 (Drummond & Rambaut 2007) was used to estimate ages and two calibrating points were used: the split between Menispermaceae-Ranunculaceae (91 mya) and the split between *Xanthorhiza-Ranunculus* (51-66 Mya).

Ours estimation dates the origin of European species around 2.54 (1.26-3.96 Mya) mya. Interestingly, the origin of many endemic columbines from south European mountain systems was dated in 1.89 (0.78-3.15 mya) mya. This estimate places the diversification of European columbines in the context of Quaternary climate oscillations and their associated changes in geographic distributions of plant taxa, suggesting that related processes of geographic isolation, migration and adaptation to the abiotic environment are critical to understand the current diversity of the genus in this continent.

**Keywords:** *Aquilegia*, South European peninsulas, Quaternary, altitudinal shift, geographic isolation.
Is there pollen limitation in the Mediterranean Basin? The case of the heterocarpic plant *Hypochaeris achyrophorus* L. (*Asteraceae, Lactuceae*)

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In entomophilous plants, animals are necessary as a pollen vectors; indeed, the reproductive success of these plants may be reduced as a consequence of a lack of pollinations visits, a low quantity of pollen per visit or if self or incompatible pollen is delivered (Gibbs & Talavera 2001, Ortiz et al. 2007, Ortiz et al. 2008). 

*Hypochaeris achyrophorus* L. is an annual plant that lives in calcareous or siliceous soils, from the sea level to 1600 m, in the Mediterranean area (Greuter et al. 2008). Thirteen populations and 177 plants were analyzed in order to determine if this species is ruled by a self-incompatibility system, as other species in the same genus. For this purpose diallelic crosses in two populations were done, as well as 849 heads were bagged to make sure the system is homogeneous in all the 13 populations studied. Additionally, the reproductive success of *H. achyrophorus* in the wild was analyzed and the fruit-set of 207 plants and 19 populations was counted.

We could conclude that *H. achyrophorus* is a self-incompatible plant. The fruit-set in the field is generally very high, therefore there is no pollen limitation in all the populations analyzed.

**Keywords:** *Hypochaeris achyrophorus*, Mediterranean region, reproductive success, self-incompatibility.

**References:**
Image analysis a new tool for pips morpho-colorimetric measurements of the Sardinian landraces of *Vitis vinifera* L. subsp. *vinifera*

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Sardinia is characterized by a huge number of cultivars traditionally considered as landraces (Lovicu 2007). This variability could be the result of an heterogeneous origin characterizing the Sardinian grapevine platform. Some of these cultivars are considered to be the product of different events, such as direct domestimations from local wild grapes and others could have been imported from elsewhere. The Sardinian grapevine germplasm could also have been enriched through breeding events among local varieties and wild plants. This is the result of the ancient and rich history of viticulture of Sardinia, an island that has been colonised by different populations, some with their specific grapevine varieties and viticultural techniques (De Mattia et al. 2007).

Among the autochthons landraces of Sardinian *Vitis vinifera* L. subsp. *vinifera*, some accessions from different varieties, were collected during three years (2005-2006-2008) in the experimental fields of Agricultural Research Agency of Sardinia (AGRIS) – Ussana (CA) and stored at AGRIS – Uta (CA).

The pips images were acquired at the Germplasm Bank of Sardinia (BG-SAR) using a flatbed scanner, and successively analysed at the Stazione Consorziale Sperimentale di Granicoltura per la Sicilia (SSG) with a specifically developed macro VITIS.mcr based on Image Analysis software KS 400.

The morpho-colorimetric data and elliptic Fourier descriptors obtained, were elaborated by Linear Discriminant Analysis to build a statistical classifier able to identify the landraces through pip traits (Bacchetta et al. 2008). Moreover, expected results consist to draw phyletic relationship between Sardinian landraces and some archaeological pips, founded inside a Phoenician-Punic amphora (IV-III B.C.) on the Coltellazzo (Pula) island seabed, close to Cagliari.

Keywords: grape, domestication, pip, morpho-colorimetric characterization, Sardinia, image analysis.

References:
Comparison among the alien floras of Sardinia, Sicily and the Balearic Islands

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This work aims to compare the alien flora of Sardinia with those of other two territories belonging to the Western Mediterranean biogeographic subregion: Sicily and the Balearic Islands. We drew up a checklist of the alien flora of Sardinia on bibliographic data, herbarium data and field work. This list includes 462 taxa, while Sicily has 335 and the Balearic Islands 324. More than 54% of the non-native flora of Sardinia is shared with Sicily and more than 52% with the Balearic Islands.

The checklist taxa are divided in three categories: naturalised, casual and invasive ones, according to Richardson et al. (2000) readapted from Pyšek et al. (2004). Another distinction was made between neophytes, introduced before 1492/1500, and archaeophytes (62% and 38% respectively in Sardinia). 44% of the neophytes are naturalised, 39% casual and 17% invasive. These data show that most of the invasive species in Sardinia are neophytes; in fact *Ricinus communis* L., *Arundo donax* L. and *Acanthus mollis* L. are the only archaeophytes. Invasive species represent more than 11% of the alien flora of the island. The same division was used for Sicily and the Balearic Islands, pointing out 3% and 15% of invasive taxa, respectively. The alien flora of Sardinia includes 98 families; Fabaceae is the richest one (47 taxa), followed by Asteraceae (30) and Poaceae (32). Aizoaceae (12) and Agavaceae (9) have only exotic taxa. For Sicily the most represented families are: Asteraceae (32), Poaceae (29) and Fabaceae (22) and for the Balearic Islands: Fabaceae (28), Asteraceae (27) and Poaceae (25). The comparison of the biological spectrum of the three territories reveals that only in Sardinia phanerophytes appear to be the most represented (41% SA, 32% SI, 33% BL), while therophytes prevail in Sicily and the Balearic islands (30%, 36%, 34%), followed by hemicryptophytes (12%, 14%, 15%), geophytes (9%, 11%, 10%), chamaephytes (6%, 6%, 8%) and hydrophytes (2%, 1%, 1%). A data analysis according to the geographical origin shows a dominance of the American element (30%, 39%, 31%) rather than the Mediterranean one (16%, 13%, 21%). In the Mediterranean context, the comparison of the alien flora of different territories can be an important tool to formulate common strategies of control or eradication of the invasive species. Further analysis and comparisons with other territories of the Mediterranean basin are currently in progress.

Keywords: Alien flora, invasive species, islands, Mediterranean area.

References:
Polyploidy and genome size in *Dianthus broteri*, an Iberian endemic

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The study of spatial distribution of cytotypes and genome size in plants can provide valuable information about the evolution of polyploid complexes (Baack 2004, Kron et al. 2007). Here we investigate the spatial distribution of cytotypes and the genome size in *Dianthus broteri* Boiss. & Reuter, an Iberian carnation. Total genome size (2C-value) was determined from flow cytometry, and ploidy levels were ascertained by chromosome counts in 244 individuals from 25 populations. ANOVA was performed to test differences in 2C and 1Cx value among ploidy levels within phytogeographical provinces. The relationship between geographical and genome size was also tested. Extensive variation in chromosomes numbers (2n = 2x = 30, 2n = 3x = 45, 2n = 4x = 60, 2n = 6x = 90, and 2n = 12x = 180) was detected, and a dodecaploid cytotype is reported for the first time in this genus. Out of 25 populations, six were diploid, 11 were tetraploid, three were hexaploid, and five were dodecaploid.

**Keywords:** Caryophyllaceae, chromosome numbers, flow cytometry, genome size variation, polyploidy, refugia.

**References:**
Phylogeography of the polyploid complex *Dianthus broteri* (*Caryophyllaceae*)

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The *Dianthus broteri* s.l. complex is a polyploid endemic group (2x, 3x, 4x, 6x and 12x) of perennial herbs, with laciniate xenogamous flowers and phalaenophilous pollination. *D. broteri* occurs mainly in the calcareous or siliceous soils along the South and East of the Iberian Peninsula. We used nuclear ribosomal internal transcribed spacer (ITS), chloroplast DNA (cpDNA), and Amplified Fragment Length Polymorphism (AFLP) data to infer the phylogeography and evolutionary history of this polyploid complex.

The analysis of cpDNA and ITS sequences in the 25 Iberian populations resulted in two main clusters, one including southern populations (1-16) and another including eastern populations (17 - 25). Nevertheless, Bayesian and Principal Coordinates Analysis of AFLP fragments in 245 individuals results in three well-supported groups.

The existence of one refuge in the East of the Iberian Peninsula during the Quaternary glaciations may explain this South-East genetic barrier. A similar disjunction is also found in other Iberian species such as *Phlomis* sp. (Albaladejo et al. 2005), *Quercus ilex* (Lumaret et al. 2002) and *Ferula loscosii* (Pérez-Collazos et al. 2009).

**Keywords:** AFLP, chloroplast DNA, *Dianthus broteri*, Iberian refugia, nuclear ribosomal ITS, polyploidy.

**References:**


The crop wild relatives as a key research to prevent cultivated plant genetic erosion: a case study of wild *Brassica* species in central Italy

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Effective conservation and utilization of Crop Wild Relatives taxa is dependent on the availability of, and access to, high quality ecogeographic information (i.e. distribution, biology, ecology and conservation status, with respect to the environments in which they grow). The present research is part of an international project (AEGRO European project) aimed to the knowledge, valorization and conservation of the Plant Genetic Resource (PGR) in Europe.

In particular, the aim of this contribute is to analyze the wild *Brassica* species related to *B. oleracea* L. cytODEME in central Italy, in order to identify the Most Appropriate Areas (MAA) for PGR conservation (see poster Siciliano et al.), that could be included among the Important Plant Areas (IPAs) project.(Blasi et al. 2007). The origin of crops belonging to *B. oleracea* seems to be located in the Mediterranean Basin and linked to relatives which are likely to be *Brassica cretica, B. incana, B. insularis, B. macrocarpa, B. montana, B. rupestris* and *B. villosa* (Branca 2007). Within the Mediterranean area, the Sicily has been designed as the centre of diversity for *Brassica* species. Therefore, the majority of research project to date has been focused on plant populations in that area. By contrast, poorly is known about the wild *Brassica* species populations in central Italy, where we developed our research. Previously, a taxonomic revision of all valid species within the *Brassica* genus reported in Italy has been conducted by consulting databases. The following species: *B. fruticulosa, B. gravinae, B. incana, B. napus, B. nigra, B. oleracea L., B. procumbens, B. rapa,* have been identified as *Brassica* species CWR occurring in central Italy (Pignatti 1982). For the mentioned species, plant populations with high biogeographic and ecological value have been selected for the investigation. On the base of the available records for the evaluated populations, sampling area to survey such as Trasimeno lake, Mt. Argentario, and Mt. Conero have been identified. The fieldwork has been carried out by using “In situ Data Management Methodologies” (Guarino 1995). Two approaches have been considered in the work: Site and Population Information. The first describes the ecogeography of a site in which the CWR taxon has been found, including the spatial location, microclimate, geomorphology, geology, soil, vegetation and human interactions at the site. The second describes the location, size, structure, biotic interactions, ethnography, local threats relating to an individual population of a CWR taxon. The Braun-Blanquet scale is one of the standards employed to define the target population size and the associated vegetation (Braun-Blanquet 1927).

**Keywords:** *Brassica oleracea* L. cytODEME, crop wild relatives, genetic erosion, Most Appropriate Areas, Important Plant Areas.

**References:**
The project “Floristic mapping of the Lazio region (central Italy)”

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Knowledge of plant biodiversity and assessment of the flora value are essential prerequisites for efficient land management, planning and conservation. Although several important contributions (floristic records and papers, herbaria collections) by famous botanists in the nineteenth and twentieth centuries, the botanical heritage of the Lazio region is not completely known. This area has not been extensively covered, and the distribution of individual taxa is still partially understood (Anzalone et al. 2005).

The floristic mapping method of the Central European Floristic Cartography (C.F.C.E.), popular in different European countries and in Italy employed in few regions, is a fundamental tool that can overcome the problem of unevenness in floristic investigations. In this context, a project of floristic mapping of the Lazio region is being carried out, based on the European standard survey protocols. The objective is to gain a good knowledge of the flora of this area and to integrate this information with the phytoclimatic and vegetation data according to the symphtosociological approach.

Results are stored in a digital georeferenced database that enables to query, visualize and map the distribution of taxa and other related environmental data (geology, climate, land use, vegetation). They will be compiled in a series of papers, one for each base area. The study, still in progress, started in 2008 in the base unit n.° 14344 covering the north western area of the Lepini Mountains and produced a preliminary list of about 900 taxa, some not previously recorded in a recent floristic paper (Rosati et al. 2006). Vegetation is made of: Fagus sylvatica forests, Ostrya carpinifolia woods, Castanea sativa woods, Quercus sp.pl. woodlands, Quercus ilex forests; shrub communities of Prunus spinosa and Rubus sp. pl.; therophytic grasslands, perennial xerophytic and mesophytic grasslands with Bromus erectus, grassland communities with Cynosurus cristatus.

Keywords: biodiversity, floristic mapping, plant communities, Lazio.

References:
Flora protection measures in the Tavolara Archipelago (north-eastern Sardinia)

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Current protection measures of the flora include the IUCN lists prepared back in 1966 by the International Union for Conservation of Nature, the CITES, Convention on International Trade in Endangered Species, the Bern Convention, and the Habitat Directive 92/43 as subsequently supplemented. On the basis of the contents of these measures, national and regional-scale lists have been drawn up in Italy (Conti et al. 1992, 1997, Pignatti et al. 2001, Scoppola & Spampinato 2005). These plant protection measures also address entities present on micro-island systems, where there is a high occurrence of plants covering only small areas, often at risk of extinction. In carrying out research on the micro-island systems of Sardinia, we have focused attention on measures for the protection of their flora.

More specifically, this work considers the Tavolara archipelago (north-eastern Sardinia) which comprises 15 islands off the coast between Capo Ceraso and Capo Coda Cavallo. The archipelago's islands include ecosystems of naturalistic importance and habitats of European Community importance whose conservation has been favoured by the presence of military easements or private ownership. These factors have fostered the survival of species of phytogeographic interest, making the archipelago a fundamental element in the vast ecosystem of the small Sardinian islands (Bocchieri 1995).

The following are the plant species of the Tavolara Archipelago covered by national and European Community protection measures, together with their conservation status according to the IUCN categories: Ranunculus cordiger Viv. subsp. diffusus (Moris) Arrigoni, critically endangered (CR); Brassica insularis Moris and Helicodiceros muscivorus (L. f.) Engl. endangered (EN); Centaurea horrida Badarò, Cynomorium coccineum L. subsp. coccineum, Limoniastrum monopetalum (L.) Boiss., Silene succulenta Forssk. subsp. corsica (DC.) Nyman and Soleirolia soleirolii (Req.) Dandy, vulnerable (VU), and Alyssum tavolarae Briq., Asperula deficiens Viv., Buphthalmum inuloides Moris and Limonium protohermaeum Arrigoni et Diana, lower risk (LR). For other species, such as Centaurea x forsythiana Lév., Erodium corsicum Léman, Limonium sinuatum (L.) Mill. subsp. sinuatum, Spergularia macrorhiza (Loisel.) Heynh. At present, no protection measures are provided, but it would be necessary at local level to ensure their conservation in these territories subjected to considerable tourist pressure.

Keywords: conservation, flora, small islands, Sardinia.

References:
The Ogliastra region: a flora hotspot in Central-East Sardinia

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Sardinia comprises many interesting biotopes with a particular flora and vegetation. As a matter of fact, the island is covered by 92 SIC (Sites of Community Importance) and 34 Special Protection Areas (ZPS) of “Rete Natura 2000”.

In Sardinia, Ogliastra holds a relevant role being situated in the Central East area which includes several ecosystems of naturalistic importance. The diversity of the taxa and its various endemic plants originate from the complex geological formation of the region. One of the most important landscapes are some Giurassic dolomitic-limestone plateaux called “Tacchi”. These factors have fostered the survival of species of phytogeographic interest, making Ogliastra a fundamental element in the local landscape.

This group of mountains is located in the “Priority area 29”. In 2007, several municipalities tried to find a possible agreement to register this area as a Natural Park. The European Community has identified the following SIC in Ogliastra: “Monte Ferru di Tertenia” (ITB020015), “Lido di Orri” (ITB 022214), “Stagni di Murtas” (ITB 040017), “Riu Sicaderba” (ITB022215) and “Monti del Gennargentu” (ITB 021103).

In these SIC, besides numerous habitats of Community interest, there are several plant taxa subject to protection measures and included in the Habitat Directive 92/43, as the *Linaria flava* (Poir.) Desf. subsp. *sardoa* (Sommier) A. Terracc. and *Rouya polygama* (Desf.) Coincy. Other floristic elements present in Ogliastra turn out to be inserted in the red lists of the Italian flora (Conti et al. 1992, 1997, Pignatti et al. 2001, Scoppola et Spampinato 2005): *Anagallis tenella* (L.) L., *Aquilegia nugorensis* Arrigoni et Nardi, *Borago pygmaea* (DC.) Chater et Greuter, *Cynomorium coccineum* L. and *Plantanthera algeriensis* Batt. et Trab., which are threatened and/or vulnerable as reported by the current IUCN classification. The endangered flora of the Ogliastra region, with approximately 100 endemic taxa and numerous rare elements of phytogeographical interest, explain that this area constitutes an important “hotspot” at the scale of Sardinia and the Mediterranean. It is therefore urgent to develop some suitable programmes to protect this unique biological heritage.

**Keywords**: conservation, hotspot, flora, Ogliastra, Sardinia.

**References**:

A new autumn-flowering species of *Allium* (*Alliaceae*) from Croatia

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*Allium telmatum* Bogdanović, Brullo, Giusso & Salmeri, a new species of *Allium* sect. *Codonoprasum* from North Dalmatia (Croatia) is described. Its chromosome number (2n=32), karyotype, leaf anatomy, ecology and taxonomical relationships are examined. Several features, such as phenology (flowering in autumn), occurrence in coastal salt marshes, tetraploid chromosome number, and morphology, indicate that it is most closely related to the Tyrrenian species *Allium savii*. On the basis of our herbarium survey, we present here a distribution map of the autumn-flowering species of *Allium* sect. *Codonoprasum* in the Mediterranean area.

**Keywords:** *Allium telmatum*, *Allium* sect. *Codonoprasum*, Dalmatia, karyology, leaf anatomy, taxonomy.

**References:**


Phytogeographical remarks on the flora of cushion-like orophilous communities from Sterea Ellas and Peloponnisos (Greece)

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The flora characterizing the shrubby vegetation of the high mountains of mainland Greece has a remarkable phytogeographical value (Musarella et al. 2005). The plant communities occurring in these habitats are linked to extremely harsh environmental conditions mainly due to the climatic conditions (referable to the supra-mediterranean or oreo-mediterranean thermotypes), substrates (chiefly represented by carbonatic rocks with superficial and eroded soils) and growing sites (usually steep, windy, and eroded). Most plant belonging to these communities are chamaephytes and nano-phanerophytes with a pulvinate, often thorny, habit or caespitose hemicryptophytes. Physiognomically, this vegetation is characterized by the dominance of thorny cushion-like Astragalus sp. pl. or caespitose grasses belonging to the genera Festuca, Sesleria and Stipa.

From the chorological viewpoint, an important role is played by endemic taxa which represent the element floristically more relevant within such communities. Depending on the more or less narrow distribution, many different types of endemics can be recognized. In particular, we found widely spread Greek species (Cerastium candidissimum, Asperula boissieri, Festuca cyllenica subsp. cyllenica, Galium thymifolium, Pterocephalus perennis, Viola graeca, Rindergraeca, Eryngium multifidum, Asperula thessala, etc.), Euboia endemics (Sideritis euboea, Astragalus rumelicus subsp. euboeicus, Nepeta dirphya, Paronychia euboaea, etc.), endemics circumscribed to Sterea Ellas (Erysimum parnassi, Geocaryum parnassicum, Astragalus parnassicus, Marrubium velutum, Nepeta spruneri, Thymus parnassicus, etc.), taxa exclusively occurring in Achaia (Aster cylleneus, Astragalus cylleneus, Globularia stygia, Marrubium cylleneum, Sideritis peloponnesiaca, etc.) or Laconia (Anthemis laconica, Asperula mungieri, Astragalus taygeteus, Nepeta camphorata, Viola sfikasiana, Jurinea taygetea, etc.).

The eastern Mediterranean orophilous element is also well represented, with some species growing as well in Anatolia, Crete and other Balkan territories (Acantholimon echinus, Astragalus angustifolius, A. rumelicus subsp. rumelicus, Anthemis cretica subsp. cretica, Carduus tmoles, Draba lasiocarpa, Minuartia stellata, Morina persica, Thymus chaubardii, etc.).

Keywords: Greece, dwarf shrubby vegetation, mountain flora, endemism, phytogeography.

References:
Phylogeny of the autumn-flowering *Allium* species of *A.* sect. *Codonoprasum* from the Mediterranean region

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The genus *Allium* is well represented in the whole Mediterranean area. The most critical and taxonomically relevant species belong to *A.* sect. *Codonoprasum* Reichenb. Within this section, some species show an autumnal flowering period ranging between late August and November, whereas most of alliums are typically spring-flowering. This interesting group is characterized by a long vegetative phase with short or no dormancy and usually all species show a relict or fragmented geographical distribution, often representing punctiform endemics. Their populations are confined in refuge habitats all having a quite humid soil during summertime, such as shady rocky places, mesophilous forest underwood, salt marshes and swamps.

These species have two different chromosome ploidy levels; some of them are diploid with a somatic chromosome number 2n = 16 and other ones are tetraploid with 2n = 32.

The diploid group is exclusive of the eastern Mediterranean area (Greece, Aegean islands and Israel) and it comprises the following species: *A. tardans* Greuter & Zahariadi from Crete, Karpathos and Kasos islands, *A. aegilicum* Tzanoudakis from the island of Antikithira, *A. euboicum* Reching. from Evvia, *A. piatakisii* Tzanoudakis & Kypriotakis endemic to Pondikonisi islet near Crete, *A. autumnale* Davis from Cyprus, *A. archeotrichon* Brullo, Pavone & Salmeri endemic to Rhodos, *A. rausii* Brullo et al. from few localities of NE Greece, *A. brussalisii* Tzanoudakis & Kypriotakis circumscribed to Mt. Parnitha near Athens, and *A. tardiflorum* Kollmann & Shmida from Mt. Carmel in Israel.

The polyploid group is mostly distributed in the western Mediterranean area, including *A. savi* Parl. localized in some localities of C Italy, Corse and S France, *A. anzalonei* Brullo, Pavone & Salmeri. from Tuscany and Latium, *A. oporinanthum* Brullo, Pavone & Salmeri from France and S Spain, *A. telmatum* Bogdanovic, Brullo, Giusso del Galdo & Salmeri from Croatia, while *A. apolloniensis* Biel, Tan & Tzanoudakis is the only tetraploid species from the Aegean area, endemic to Sifnos. On the base of morphologic, karyologic and genetic analyses, this autumnal group results well distinct from the other taxa of *A.* sect. *Codonoprasum*. Due to the ontogenetic cycle, fragmentary distribution and their localization in conservative habitats, these species can be considered as relict elements of the old Tertiary flora linked to aseasonal climate conditions and this explains why many of them are really threatened.

**Keywords:** *Allium* sect. *Codonoprasum*, autumn-flowering, cytotaxonomy, molecular analyses (ITS), phylogeny.
Biotic element and areas of endemism approach applied to endemic plant species of Maritime and Ligurian Alps hotspot

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The main aim of this study was to compare different methods for the determination of areas of endemism (AoEs) and of biotic elements (BE) by analysing all the endemic plant species in the Maritime and Ligurian Alps.

The Maritime and Ligurian Alps were recognized as a regional biodiversity hotspot by Médail & Quézel (1997). The present distribution patterns of endemic taxa reflect the influence of ecological factors and the low impact of glaciations which allowed some Tertiary flora plants to survive in this area (Casazza et al. 2008).

A presence/absence matrix of 36 endemic plant species was analysed using cluster analysis, PAE and BE analysis. INDVAL was used in order to compare the results obtained using the three former methods. The use of PAE and clusters analysis combined with INDVAL allowed the selection of 7 AoEs in the cluster analysis and 7 in the PAE, significantly characterized by at least two species even if not endemic to the AoE. The AoEs defined by the two methods did not completely match each other: they overlapped completely in one case, and partially in three other situations. NMDS plots resulted in a circular arrangement of species. However, seven BE were recognizable in the final plot even if most of these overlap.

The AoEs defined by this study sometimes match with the refugia already reported in the literature. For instance, the Roya valley AoE was recognized as a glacial refugium and as a survival place for some relicts of the Tertiary flora. The high level of homoplasy recorded in PAE analysis might be explained by the extent of dispersal events resulting in endemic taxa with wide or disjointed ranges. This line of evidence is also congruent with the partially fuzzy results of the NMDS analysis. The high overlap of BE in the Roya valley is congruent with the high number of endemic taxa/OGUs detected in this area. In a region such as the Maritime and Ligurian Alps, where the present distribution patterns of endemic taxa mainly reflect the influence of ecological factors, PAE and cluster analysis defined comparable AoEs characterized by the same species constituting the BE. However, PAE and cluster analysis approaches revealed different relationships between the area/taxa congruence and the congruence among taxa ranges. In accordance with our previous study (Casazza et al. 2008) we found that dispersal events hid vicariance’s patterns.

Keywords: Areas of endemism, biotic elements, historical and ecological biogeography, Maritime Alps.

References:
Phylogeny of *Erophaca baetica* subsp. *baetica* (L.) Boiss. (*Fabaceae*)

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_Erophaca baetica_ was included in the genus _Astragalus_ as _A. lusitanicus_ for a long time. Actually, we can separate the monospecific _Erophaca_ in two subspecies: _E. baetica_ subsp _baetica_ in the western Mediterranean area (CS Iberian Peninsula and north of Algeria and Morocco) and _E. baetica_ subsp _orientalis_ in the eastern Mediterranean area (Greece, Turkey, Cyprus and Lebanon).

We sequenced the ribosomal ITS region (ITS1-5.8S-ITS2) in two individuals from ten populations of _E. baetica_ subsp _baetica_ and one of _E. baetica_ subsp _orientalis_.

In order to situate _Erophaca_ in the phylogeny, we also added from the GenBank the following ITS sequences representing the different subtribes of tribe Astragaleae: _Astragalus boeticus, Astragalus membranaceus, Oxytropis multiceps, Oxytropis splendens, Swainsona purpurea, Swainsona stenodonta, Galega orientalis, Glycyrrhiza glabra_, as well as another sequence of _Erophaca baetica_ subsp _orientalis_, and three related taxa were chosen as outgroups: _Chesneya deshunagara, Sophora flavescens_, and _Styphnolobium japonicum_.

Both subspecies appear well separated and _Erophaca_ appears as a monophyletic group and as the sister lineage to subtribe Astragalinæ (Astragalus and Oxytropis).

**Keywords:** _Astragalus, Erophaca, ITS, Leguminoseae, Mediterranean area, Oxytropis, phylogeny, Tribe Astragalea_.

Phylogeography of *Erophaca baetica* subsp. *baetica* (L.) Boiss. (*Fabaceae*)

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*Erophaca baetica* has a Mediterranean distribution, and actually we can separate *Erophaca* in two subspecies: *E. baetica* subsp. *baetica* in the western Mediterranean area (CS Iberian Peninsula and north of Algeria and Morocco) and *E. baetica* subsp. *orientalis* in the eastern Mediterranean area (Greece, Turkey, Cyprus and Lebanon).

In order to study the phylogeography of *Erophaca baetica*, we analyze the genetic structure by AFLP of 189 individuals from 19 populations of *E. baetica* subsp *baetica* and one population of the subsp. *orientalis* (taken as outgroup). We tried 72 primer combinations and we chose 9 of them. We obtained 561 unambiguously scorable DNA fragments, most of them were polymorphic (93.9%). Bayesian analyses of population structure (STRUCTURE) showed three main groups: Moroccan populations, Sierras Beticas populations and Iberian Massif populations. Moroccan population presented the highest values of genetic diversity, number of fragments, percentage of polymorphism, number of private fragments and Rarity Index (DW).

This suggests that Moroccan populations are the oldest and *E. baetica* subsp. *baetica* seems to have its origin in Northern Africa.

Contribution to the knowledge of the vascular urban flora of Cagliari (southern Sardinia)

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Recent floristic studies put in evidence the limited knowledge of the flora and vegetation of urban ecosystems (Celesti Grapow et al. 1996). The causes of this lack of data are numerous, but probably the main objective difficulties arise from the particular ecological conditions of these habitats, since every single city harbour has a peculiar natural flora and vegetation, deeply linked to the geographical position, historical/cultural events, climatic conditions, city’s size and possibilities of immigration. Moreover, vegetal component of urban ecosystems is subject to continuous modifications, thus creating an heterogeneous and variable environment.

In this study we analyze several works carried out in the urban area of Cagliari from 1950 to 1996. The only specific study about flora and vegetation of Cagliari is that of Martinoli specialized on the flora and vegetation of Capo Sant’Elia (1950), although the most complete is Biondi and Mossa’s phytosociological study (1992), focused also on the city’s hills. There are also other sporadic and partial researches on urban flora of the city, such as Biondi et al. (1993-94) and Bocchieri and Mulas (1983), respectively for nitrophyllous flora and for the roman amphitheatre. The most recent work dealing about Cagliari’s flora is a comparative study of urban flora in Italy (Celesti Grapow et al. 1996), but it’s more than 12 years old. For this reason, and considering also that urban landscapes have been affected by deep and rapid changes, the update of floristic knowledge of the urban area is required.

The bibliographic researches and the analysis of exsiccata reveal a high number of species (951) for the urban flora of Cagliari. Proportionally, the number of exotic species is high (about 14%). More than 65% of these taxa are neophytes, while about 35% are archaeophytes. The category of invasive accounts more than 26% of the total alien flora. The analysis underline also that therophytes are the most represented biological form (more than 43%), with the American origin prevalent among all species (more than 37%), followed by Mediterranean (about 15%).

The next step of this study will be the comparison of our flora with that of other Italian cities, in order to understand how and how much alien flora is threatening native one in sinanthropic and disturbed areas.

Keywords: Cagliari, sinanthropic and disturbed ecosystems, alien species, Sardinia.

References:
**Ecosistema filtro: plant biodiversity of a constructed wetland located in to a natural park**

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The first results of a survey on the flora of a constructed wetland, the Ecosistema Filtro (ESF), of the Regional Natural Park of Molentargius-Saline (Southern Sardinia), are reported. The structure is a Free Water Surface System (FWS) located within the Bellarosa Maggiore and covers about 37 hectares. The ESF receives wastewater from sewage treatment of the Is Arenas depurator, following a finishing treatment through a phyto-purification, feeds the ponds of the Bellarosa Minore and Perdalonga. Completed in 2005, the system has been the subject of planting of reedbeds, and Phragmites australis is appointed to play an active role in the finishing water process. From then to now there was a constant monitoring of the flora of this area who just in four years has become a reservoir of unique genetic diversity, constituting 37% of the plant biodiversity of the Park. The flora of the ESF consists of 190 taxonomic units relating to 133 species, 56 subspecies and 1 variety distributed in 47 families and 126 genera. With reference to the growth forms, the analysis of the biological spectrum puts in evidence the high therophytic component close to 53% as confirmation of the territory remarkable aridity. The examination of the chorological elements shows a dominance of the Mediterranean species – also comprehensive of the endemic species – that is 63%.

The context where the Ecosistema Filtro is placed, its particularly important dimensions and the role it plays in a Park area, make it a unique case for Europe. The floristic characterization of this interesting wetland, is the result its location between two wetlands, a freshwater one, the Bellarosa Minore, and the other with salt water, the Bellarosa Maggiore. The ESF is also an ideal habitat for the stopping, the wintering and the breeding of particular important bird species, making it necessary to find the suitable balance between the objectives of protection and preservation of species and the management and maintenance of a water finishing installation integrated in a natural protected area.

**Keywords:** flora, ecosistema filtro, Regional Natural Park Molentargius-Saline.
Wild grapevine: *Vitis vinifera* subsp. *silvestris*, hybrids or cultivar escaped from vineyards? Morphological and molecular evidence in Sardinia

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*Vitis vinifera* subsp. *silvestris* (or *sylvestris*) is the spontaneous subspecies of *V. vinifera* L. and it is believed to be the ancestor of present cultivars. In this work, morphological traits and polymorphism at 13 SSR loci were investigated to answer this key question: are wild plants real *V. vinifera* subsp. *silvestris*, or hybrids between wild and cultivated forms or individuals ‘escaped’ from vineyards? In particular, the objective of the present study is to establish truly wild individuals and to investigate putative hybridization events. In this perspective, improving the diagnostic power of both molecular and morphological markers would allow a better monitoring of hybridization. The experimental work was developed in Sardinia, the second largest island in the Mediterranean sea, characterized by a huge but well described number of cultivars and wild populations. This region was selected because the spatial isolation of the island harboured and protected the genetic richness of grapevine accessions limiting the opportunities for contamination from out-coming material. The results of this study confirm that domesticated and wild germplasm are genetically divergent. Both pure lineages show very high average posterior probabilities of assignment to their own clusters, with low level of introgression.

**Keywords**: admixture analysis, bayesian clustering, hybridization, microsatellite, Sardinia.
Development of plant DNA barcoding approach to identify *Lamiaceae* species

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Methods for species identification by means of short orthologous DNA sequences, known as “DNA barcodes”, have been proposed and initiated to facilitate biodiversity studies and to develop a suitable conservation strategy. A useful DNA barcode requires sufficient sequence variation to distinguish between species and ease of application across a broad range of taxa. Plants are considered problematic for DNA barcoding because the standard DNA barcode regions such as CO1 (cytochrome oxidase I) used in animals have exceedingly low levels of variability. Recent works support the idea of a multigene DNA barcoding approach based on nuclear or plastidial DNA markers. Basing on this consideration our work was focused on set up a usefulness DNA barcode markers to univocally identify spontaneous plants of the Lamiaceae. This is a typical Mediterranean family consisting in about 200 Italian taxa; some of these are endangered and some others are critical taxonomic groups. The samples were collected from different Italian locations as well as from historical herbaria of University of Cagliari and Civic Museum of Natural History of Milano.

The goal of our work is define an alternative taxonomy system basing on molecular markers to univocally identify plant stored in germplasm collections (herbarium, seed bank, botanical garden) or collected from different localities. Several coding genes and non-coding spacers of chloroplast genome have been suggested as DNA barcodes for plants (Fazekas et al. 2008). Universal primers are available for many of these markers. First we will test the trnH-psbA intergenic spacer proposed by Kress (2007) and Lahaye (2008). Among the eight candidate genes defined from the DNA barcoding working group, trnH-psbA is the most variable at the interspecific level followed by matK (Lahaye et al. 2008). Considering that matK gene has showed low intraspecific but high interspecific variation, our work included both trnH-psbA and matK markers.

Keywords: DNA barcoding, germplasm collection, *Lamiaceae*, MatK, psbA-trnH.

References:


Genetic diversity in five populations of *Galanthus* from Sicily using isozymes

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In Sicily, according to Giardina et al. (2007), three taxa belonging to the genus *Galanthus* occur: *G. nivalis* L., *G. reginae-olgae* Orph. subsp. *reginae-olgae* and *G. reginae-olgae* subsp. *vernalis* Kamari. They are discriminated by the flowering period, occurrence of leaves at flowering and perianth segments morphology. Nevertheless, in the whole Mediterranean taxonomic delimitation requires still to be clarified for this genus (Davis 1999). This study aims to use isoenzymes in order to improve the taxonomic knowledge of the Sicilian populations of *Galanthus*. Five populations at different altitudes and substrata were studied: Piano Zucchi (Madonie, PA), Fiume Flascio (Nebrodi, CT), Punte di Cuti (Monti di Palermo, PA), Monte San Calogero (Termini Imerese, PA) and Valle Cerasa (Mezzojuso, PA). No variation has been recorded in leaf or perianth morphology in all the studied populations. The main discrepancies in the wild regarded the flowering period: Piano Zucchi, Punte di Cuti and Mezzojuso populations bloom in early Spring, while Fiume Flascio and Monte San Calogero ones in Autumn.

Plants from these populations cultivated in the Botanical Garden of Palermo, under the same climatic conditions and substrata, since several years are blooming almost simultaneously in January-February and have almost the same luxuriance.

Isoenzymatic analysis involved the ADH, IDH, MDH, PGD, PGI, PGM enzymatic systems. Enzymes were extracted from young leaves and electrophoresis was performed on gel-starch according to Kephart (1990) and Wendel & Stuber (1984).

Eleven loci were marked: 3 for PGI, 2 for MDH, 6PGD, PGM and one for each of the other systems. Four loci (Adh-1, 6-Pgd-2, Pgi-1, Pgm-2) are monomorphic in all the studied populations. On the whole 24 alleles were marked; the highest polymorphism and intra-population variability were recorded in the Fiume Flascio and Punte di Cuti populations (P = 45.5%, He = 0.244 and 0.242 respectively). The comparison of genetic distance reveals that the Mezzojuso and Piano Zucchi populations are very close; the Fiume Flascio one differs slightly from them; the Punte di Cuti one is the most different. These results point out that the most suitable systems to detect variability are PGM, PGI, MDH and IDH. Cultivation under controlled conditions shows that most of polymorphism in Sicilian populations can be referred to environmental factors.

**Keywords:** *Galanthus*, flowering period, polymorphism, genetic variability.

**References:**
Vulnerability of Mediterranean coastal phryganas

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Mediterranean coastal areas are vulnerable ecosystems subjected to strong and increasing human disturbances. Conservation and management of coastal ecosystems and species need an accurate understanding of causes of vulnerability and potential for species to persist or adapt.

This study considers the ecology, leaf necroses, reproductive success, and survival potential of three rare and protected species growing on the rocky coasts near Marseille (southeastern France): Astragalus tragacantha (Fabaceae), Plantago subulata (Plantaginaceae) and Thymelaea tartonraira subsp. tartonraira (Thymelaeaceae). These species compose a unique vegetation close to the third most inhabited French city. Results show that habitat degradation causes changes in community composition towards more ruderal plant communities. Despite a high reproductive effort, reproductive success and seedling recruitment are very low, and adult survival is endangered by polluted sea sprays causing necroses. The long term persistence of phrygana species along the Provençal coast is really uncertain.

Keywords: conservation biology, human disturbances, necrosis, persistence, rarity.
Invasive species effects on a threatened endemism during drought: *Retama monosperma* vs. *Thymus carnosus*.

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*Retama monosperma* (L.) Boiss. (white broom) is a leguminous shrub that currently dominates the inland dunes of El Rompido Spit, a natural prolongation of the beach and sand dune system in the province of Huelva, SW Spain. It is considered an exotic invader in California and, despite being native to the study site, its behaviour is invasive as well. On the other hand, *Thymus carnosus* Boiss. is a type of dune thyme endemic to the SW of the Iberian Peninsula, and it is under threat of extinction in Spain.

Sizes and growth differences between both species cause an unbalanced interaction, harming *T. carnosus*. We designed a greenhouse competence experiment with six months old individuals obtained from seeds planted at the same time, thus avoiding age and size effects. Plants of the two species were planted in an addition design where a simple plant individual served as control, and there were intra- and interspecific competition treatments. After six months growing together, a two months drought experiment was also carried out to compare with field site conditions in water stress periods.

We measured growth at early stages, and fluorescence, photosynthetic rate, and stem water potential during the drought period. Biomass measurements were taken at the end of the process. *T. carnosus* growing and biomass were not importantly affected by *R. monosperma*, not even biomass by drought experiment, thus indicating *Thymus* resistance. Nevertheless, during drought period water potential was significantly affected only for *Thymus* competed with *Retama*, following the same pattern that the latter. It agrees with previous studies carried out at the field site and it could suppose a serious risk for the endangered thyme populations.

**Keywords:** *Thymus carnosus*, *Retama monosperma*, water potential, drought, competence.
Germination of *Cistus albidus* L. seeds in Sardinia: effect of pre-treatments

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*Cistus albidus* L. is an obligate seeder and an important component in many shrub-lands in fire prone-summer-dry Mediterranean ecosystems (Clemente et al. 2007, Thanos et al., 1992). In fact seeds of many species of Cistaceae are stimulated to germinate by the heat generated from the burning of plant material. The tests were carried out in the laboratories of Sardinian Germplasm Bank (BG-SAR). In the first phase, in order to test the best germination conditions, the temperatures of 15°C and 20°C were selected with both lightness and darkness. The light has not influence in the germination behaviour. The optimum temperatures value to reach maximum germination was found to be 15°C. In the second phase the characteristics of breaking dormancy were studied. Different pre-treatments were applied: manual scarification (chipping), dry heat (80°C 45’, 100°C 5’, 100°C 15’, 100°C 30’, 110°C 5’, 110°C 15’), hot water (95°C 5’) and boiling water (100°C 10’). Data were recorded for the final germination percentage and the germination rate, expressed as number of days necessary to reach 50% of the final germination percentage (T50). In conjunction with the germination tests, vitality tests with the tetrazolium method were carried out for each pre-treatment, in order to define the influence of the heat on seed survival. Germination without pre-treatment (control) was very low (5.6%), but the highest germination percentage was obtained through manual scarification (96.0%). Concerning the tested pre-treatments, dry heat (100°C 15’) allowed to reach a germination percentage of 87.8%, whereas seeds preheated in boiling water for ten seconds showed a significant increase in germination with a percentage of 95.0%. Tetrazolium tests showed a low decrease of seed vitality after the pre-treatment with dry heat at 100°C 30’ (89.9%) and a still less value at 110°C (respectively 75.9% after 5’ and 72.6% after 15’). Comparing the results of the two types of test for each pre-treatment, it is possible to notice that pre-treatments with dry heat at the temperatures of 80 and 100°C are less effective in cracking of the hard seed case. On the other hand, the highest tested temperatures allowed a higher imbibition, but it affected the embryonal vitality. The best pre-treatment turned out to be the boiling water, which permits a good imbibition of the seeds preserving at the same time their vitality. The best pre-treatment turned out to be the boiling water, which permits a good imbibition of the seeds preserving at the same time their vitality. These results show that the hardness and the impermeability of the seed coats to water are the most important cause of the dormancy present in seeds of *C. albidus* as in other *Cistus* species. Physiological dormancy occurs at the embryo level (Doussi M.A., Thanos C.A., 1994).

Keywords: seed dormancy, seed germination, *Cistus albidus* L., pre-treatment.

References:


ISSR genetic diversity and geographical differentiation in *Linaria capraria* Mill. (*Scrophulariaceae*)

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*Linaria capraria* Moris & De Not. is a perennial herb endemic of the Tuscan archipelago. It is described from Capraia, Elba, Pianosa, Montecristo and Giglio, where it occurs with restricted and well isolated populations (maximum six populations for Elba island, minimum one for Montecristo). Despite *L. capraria* is well known by its morphological traits, no comparative genetic study has been performed to estimate the level and the distribution of genetic diversity of this *taxa*. Inter-simple sequence repeat (ISSR) markers, based on single-primer PCR reactions, have been used to assay genetic variability at three hierarchical levels: within the populations, between the populations and among groups of populations. ISSR analysis was successfully performed on 121 accessions. The selected primers combination produced a total of 41 analyzable loci, yielding a total of 1704 bands for the 14 pseudo-populations. Variation in estimate of intra-population genetic variability, calculated as average gene diversity over loci, was “medium-high” and ranging from 0.166 (population number 2 from Elba: Madonna del Monte) to 0.048 (Capraia 5: Cala di Fondo and Pianosa 2: Porto Romano). The Neighbour-Joining dendrogram of 14 pseudo-populations examined, based on Slatkin’s linearized pairwise $F_{ST}$ matrix, indicate a well defined genetic structure with three centers of differentiation localized in Capraia, Elba and Montecristo. The Analysis of the Molecular Variance (AMOVA) showed that 58% of the total variation occurred among populations and the analysis of hypothetical groups of populations confirms the result obtained by NJ analysis.

This work represents a first step towards a full genetic characterization of a group of endemic plant from the Mediterranean, and thus contributes towards the planning of genetic-informed conservation strategies.

**Keywords:** ISSR, *Linaria capraria*, genetic diversity, biogeography, endemism, Tuscan archipelago.
The phylogeography of Chamaerops humilis L. has been modelled by more than 30 Ma of geological and climate changes

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Chamaerops humilis L. is one of the two native palms occurring in Europe and the only one in western Europe (do Amaral Franco 1980). Nowadays, the distribution of C. humilis is confined to the western Mediterranean, both on the European and on the African sides. In Europe, it occurs in the coasts of S Portugal, SW (sometimes several hundreds kilometers inland), and S and E Spain, SE France, and W and S Italy. It also occurs in the western Mediterranean islands: the Balearics, Sardinia, Sicily and Malta (where it is probably extinct); The few populations in Corsica are probably not autochthonous. Twenty-two populations (ten individuals per population), representative of all the distributional area, were sampled and analyzed with the AFLP method in order to draw the phylogeographic main lines of the current distribution of this species and to reconstruct the process leading to this distribution, from an early expansion to the current landscape. Additionally, ten individuals of Trachycarpus fortunei were included for its use as an outgroup. Three primers were used and a total of 226 fragments detected, ranging from 60 bp to 447 bp. These fragments led, through different analyses as the Neighbor-Net, the Principal Coordinates Analysis and the Bayesian Inference, to the existence of four groups of populations: (1) E Iberian Peninsula plus Al Hoceima (Morocco), the Balearics and Sardinia populations, (2) populations from SE France, the Italian Peninsula and Sicily (with some differences between the N and the S of the island), (3) SW Iberian Peninsula and NW Morocco populations, and (4) var. argentea, located in S Morocco. The first three groups are currently included in the var. typica. Other populations (Tarifa in Spain, and the Mamora and Tazzeka in Morocco) showed an intermediate position, probably as a result of contacts between some of the pointed out main groups. The geological history of the western Mediterranean from the Eocene explains satisfactorily the present-day distribution of this species through plate contacts and breaks, (Hampe & Petit 2007), also shaped by the influence of climatic changes notably the Quaternary glaciations.

Keywords: AFLP, Chamaerops humilis L., phylogeography, Quaternary, Tertiary.

References:
Diversity generation in *Centaurea*: a new *Seridia* hybrid and polyploid complex

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*Centauera* (*Compositae*) is a modern genus originated between Pliocene and Pleistocene. It belongs to the subtribe *Centaureinae* (tribe *Cardueae*), which has its diversification centre in the Mediterranean Basin. Section *Seridia* is exclusive from western Mediterranean and is composed of perennial species, whose evolution includes more polyploidization and hybridization events than annual species (Hellwig 2004, García-Jacas et al. 2006). Two species of this section, the tetraploid *C. seridis* and the diploid *C. aspera*, grow side by side in sandy coastal dunes of few reported sites of eastern Spain, and several intermediate forms were identified with a confusing taxonomy (Mateo & Crespo 2009). This contact zone can be used as a model for studying the evolutionary processes which have lead to the great diversification of the genus. The aim of the present work is to analyse the morphology of the observed phenotypes and to infer their ploidy level using flow cytometry.

The polyploid complex was clearly found in six zones of the eastern coast, covering 350 kms. In all of them, three morphotypes were observed, which correspond to different ploidy levels. The *C. seridis*-like plants, that display bigger capitula and hairy leaves, are tetraploid. The *C. aspera*-like individuals, that show a higher morphological diversity, smaller capitula and narrower leaves, are diploid. The intermediate morphological plants are triploid and highly sterile. These different forms segregated spatially as a result of niche differentiation and maybe a minority cytotype exclusion effect (Petit et al. 1999).

According to these findings, *C. aspera* is located in shrublands of the more stabilised dunes, while *C. seridis* grows on nitrophilous mobile dunes and the intermediate forms colonize intermediate habitats. These preliminary results show that polyploidization and hybridization have been taking part in the evolution of *Centaurea*, probably leading to a rapid diversification of the genus. Further studies may throw light into the genetic diversity of each form, the genetic and ecological competition among them, and how these evolutionary mechanisms can create new well-adapted species in a long term, contributing to the diversity of the Mediterranean Basin hotspot.

**Keywords:** *Centaurea*, contact zone, evolution, hybridization, Mediterranean, polyploidization.

**References:**


Germination requirements of four endemic species of *Verbascum* (*Scrophulariaceae*) in relation to habitat and seed mass

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The genus *Verbascum* is one of the largest genera of *Scrophulariaceae* and 33 species and subspecies were detected in Italy, with seven of them being endemics. In this study germination ecology of four endemic *Verbascum* species of the Mediterranean area is compared.

Seeds were collected in two different regions and in two different habitats: Molise sandy coast (*V. niveum* subsp. *garganicum* (Ten.) Murb.) and mountain grasslands (*V. argenteum* Ten.), Sardinia coasts (*V. conocarpum* Moris subsp. *conocarpum* and *V. plantagineum* Moris) and mountains (*V. conocarpum* Moris subsp. *conocarpum*). Among these species, only *V. conocarpum* subsp. *conocarpum* can be found in different vegetation belts, consequently to investigate germination differences between coastal and mountain populations, seed lots belonging to three different populations were tested.

Effects of temperature, light and prechilling on germination were investigated for all seed lots and the achieved results were correlated to seed mass and population altitudes. Cumulative germination percentage and germination rate (expressed as T50 values) were determined and statistically analysed for each population. Results allowed to characterize the germination requirements of each species and to single out differences on seed germination in relation to elevation variability.

**Keywords:** *Verbascum*, endemic, germination, Molise, Sardinia, seed dormancy.
The role of polyploid evolution in flowering plants: a case study from the Alpine species *Primula marginata*

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Hybridization and polyploidization are frequent phenomena in angiosperms and they have been estimated to be responsible for 2-4% of speciation events. In particular, two different kinds of polyploidization may occur: autopolyploidization and allopolyploidization. Many plant species are thought to be allopolyploids that originated through a hybridization event followed by genome duplication. The occurrence of different chromosomal races at different ploidy levels within a species has also been reported.

*Primula marginata* Curtis (*Primulaceae*), an endemic species of the western Alps, represents an ideal group to study the role of polyploidization in plant evolution, because two different cytotypes (2n=6x and 2n=12x) are known to exist, but the mode of origin of these races (autopolyploidy vs. allopolyploidy) has never been investigated. Therefore, a study was undertaken in order to assess whether the two different cytotypes form two distinct phylogenetic entities (i.e. clades). Preliminary results suggest that *P. marginata* with 2n=12x is an allopolyploid, probably derived from hybridization between hexaploid individuals of *P. marginata* and *P. latifolia*. However, these preliminary results remain inconclusive, and multiple lines of evidence must be brought together to assess whether *P. marginata* 12x is an auto- or allopolyploid. We therefore aim at elucidating the nature of the different cytotypes of *P. marginata* by analysing phylogenetic, cytological, morphological and ecological data.

Keywords: *Primula marginata*, hybridization, polyploidization.
Seed identification by image analysis technique: a testing-bench in the *Astragalus* Sect. *Melanocercis* Bunge in the Corso-Sardinian microplate

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An intriguing testing-bench was realised to further highlight the consistence of results of image analysis application to the germplasm of native species of Sardinia, and more in general of the Mediterranean basin, in order to characterize the accessions coming into the Sardinian Germplasm Bank (BG-SAR), by means of morpho-colorimetric characters. 

*Astragalus* L. genus (*Fabaceae*) is constituted by more of 3000 species and it represents the type of the Tribu *Astragaleae* Bercht. & J. Presl and of the Subtribu *Astragalinae* DC. 

The relationship between *Astragalus terraccianoii* Vals. and *A. tegulensis*, a new species described by Bacchetta & Brullo (2009), was studied and correlated into the Sect. *Melanocercis* Bunge. A specifically developed tool of image analysis was used to measure morphometric and colorimetric features of seeds of the two cited taxa, and the data were analysed and statistically elaborated to verify and confirm the validity of this new species and to increase the number of species of the whole data base and improve the performance of the correct classification of the classifiers previously developed for taxonomic purpose (Bacchetta et al. 2008).

Using the morpho-colorimetric data of the available accessions (three populations of *A. terraccianoii* and one of *A. tegulensis*), the statistical processing, realized by Stepwise Linear Discriminant Analysis, allowed to carry out a statistical classifier able to distinguish the two studied species with a performance, expressed as percentage of correct classification of 94.4%.

The study confirms, one more time, the validity of the methodology also in distinguishing close species with very similar seeds.

**Keywords:** *Astragalus*, endemic flora, *Fabaceae*, image analysis, Sardinia, seeds, taxonomy.

**References:**


Conservation status of the threatened Iberian Peninsula narrow endemic
Antirrhinum valentinum Font Quer (Scrophulariaceae)

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Antirrhinum valentinum Font Quer is a narrow endemic of the eastern Spain (central Iberolevantine province, Setabense sector). This species is protected by Autonomous Community of Valencia law since 1985, but several actions have reduced the population size in the recent years.

This paper provides a detailed study of the species distribution, population size, threats, and current conservation status. An exhaustive bibliographical survey, a review of herbarium specimens from several institutions and field work was carried out to determine the Area of Occupancy and the Extent of Occurrence. We also studied the climatic dates to study the possible influence of the climatic change in the reduction of the populations.

Fifteen populations (11 naturals and 4 artificial) distributed in two distinct areas (north and south of the valley of the Valldigna) are currently known. The estimation of the species population size was near 1330 individuals, but the direct census reduced considerably this number. The microclimatic differences between areas could justify the number and density of individuals in each area.

More than the 50% of the populations are severely threatened. The main species threats are the loss of habitat, the fires, the potential hybridization with A. controversum Pau, and the aggressive actions of an archaeological prospection. Therefore its threatened category and the efficacy of the conservation actions are being revised.

Keywords: Antirrhinum, conservation, habitat disturbance, hybridization, narrow endemic, archaeological prospection.

References:
Effect of the natural fragmentation and genetic variability on salt-marshes species: the study of Sarcocornia in the western Mediterranean area

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Sarcocornia A.J. Scott (Amaranthaceae, sensu APG) includes erect or prostrate shrubby plants, which grow on littoral and inland salt-marshes. These habitats are naturally fragmented and are also severely threatened by several anthropic activities, mainly urbanization and salt extractions.

In the western Mediterranean area, two species are well recognized: Sarcocornia fruticosa and S. perennis, based on morphological features (e.g. testa of the seed, habit). The peculiar nature of their such fragmented habitats could be affecting dramatically the genetic variation within and among populations. In order to assess the current genetic structure of the Sarcocornia taxa among their natural areas, molecular fingerprinting markers were done. The selected techniques were AFLP (Amplified Fragment Length Polymorphism) and plastid markers (e.g. trnL-F). The plant material was collected from six sites along the western Mediterranean area: Iberian Peninsula, Sicily, southern of France, Balearic islands, Tunisia and northern of Morocco; one population from the Canary islands was also included.

To evaluate the intra-population genetic relationships, and to evaluate the relative genetic distance among and within areas, two populations were studied in some genetically zones (e.g. Iberian Peninsula). Preliminary data support the existence of well characterized population structure, and some of them appear notably isolated and therefore, they could be considered as independent ESUs.

Keywords: Sarcocornia, fragmentation, genetic variation, AFLP, plastid markers.
Morpho-functional differentiation to edaphic variation in two widespread vs. narrowly distributed Iberian *Aquilegia*: implication for radiation genus

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The genus *Aquilegia* (the columbines) in North America is a textbook example of adaptive radiation driven by pollinator specialization (Whittall & Hodges 2007). However, European and Asiatic columbines are differentiated mainly in vegetative traits (Medrano et al. 2007). Namely, Iberian columbines show habitat segregation in altitude, soil humidity and soil nature and depth. The Iberian columbines constitute thus a unique model system to explore mechanisms involved in phenotypic divergence linked to habitat segregation.

We performed a common garden experiment to explore morpho-functional differentiation. A total of 14 variables were measured, including vegetative, functional and allocation traits in relation to soil nature (calcareous vs. siliceous) and soil depth. We used two pairs of Iberian columbines, each pair composed by a widely and a narrowly distributed subspecies (*A. vulgaris* subsp. *vulgaris* vs. subsp. *nevadensis*, and *A. pyrenaica* subsp. *pyrenaica* vs. subsp. *cazorlensis*). The experiment was conducted in 10 banks, each with 8 trays (6 pot/tray) representing 3 replicates of each treatment for each subspecies in each block (30 replicates per treatment for each subspecies). Seeds used came from mature fruits collected from 15 mother plants of a single population per subspecies.

The studied columbines differentiate in most traits at species level. The subspecies of *A. vulgaris* differed in number of leaves, inflorescence height, LWR, specific leaf area (SLA) and root diameter while *A. pyrenaica* subspecies differed in SLA and leaf petiole diameter. These results agree with studies suggesting that plant size rather than stress-resistance traits are related to endemic species differentiation in the western Mediterranean (Lavergne et al. 2004). Regarding the level of tolerance to edaphic variation, the widely-distributed taxon was the most tolerant to edaphic variation at the species level. These differences between taxa in tolerance to edaphic variation, which could be related to differential adaptive plasticity, probably contribute to the ability of *A. vulgaris* to inhabit wider geographic and habitat ranges than *A. pyrenaica*. Results are consistent with the idea that phenotypic plasticity to the abiotic environment, followed by ecotypic differentiation, might be linked to the radiation of the genus, or at least to the diversification of some European species.

**Keywords:** Iberian columbines, phenotypic differentiation, edaphic variation, western Europe endemism.

**References**
Plant cover, species richness and diversity under three tree species in an afforested area in arid Southern Tunisia

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The introduction of woody plants for the restoration of degraded arid and semiarid ecosystems has become increasingly important worldwide as a measure to protect soils, to combat desertification, to supply natural resources and therefore, increase plant cover, species richness and diversity. However, in Mediterranean arid and semiarid areas, very few studies have performed manipulative field experiments to dissect the net effects of woody species on their understorey vegetation dynamic. This knowledge is necessary to understand community dynamics and to develop sound management programs.

A field experiment was carried out in an afforested *Stipa tenacissima* steppe in arid southern Tunisia with the objective of evaluating the effect of three tree species (*Acacia salicina*, *Pinus halepensis* and *Eucalyptus occidentalis*) on the plant cover, species richness and the Shannon-Wiener diversity of the understory vegetation. For each tree species two sub-habitats were distinguished, the canopied sub-habitat (under the tree crown) and the uncopied sub-habitat (on the open grassland). For each tree (at four aspects: N, S, E and W) we located four sample quadrats of 1 m x 1 m beneath and outside of the canopy. Within each quadrat we determined the floristic composition, and visually estimated the total plant cover and the individual species cover as a percentage of their vertical projection. Species richness was measured as the average number of species per quadrat and diversity was calculated using the Shannon-Wiener index. Plant traits and names are based on Chaieb & Boukhris (1998).

Our results show that among the three tree species, *A. salicina* has the strongest effect with the highest vegetation parameters. *P. halepensis* seems to follow *A. salicina* as understory vegetation improver. *E. occidentalis* presents the lowest understory vegetation parameters. For each tree species, statistical analyses produce a significant difference between the canopied and the uncopied sub-habitats. *A. salicina* exhibits the strongest positive effect on the understory vegetation parameters, and thus it seems to be more useful as a restoration tool in arid areas and more suitable to foster succession than the tow other investigated tree species.

**Keywords:** understory plant cover, species richness, species diversity, tree canopy, restoration, arid, Tunisia.

**References:**
Intraspecific diversity of some accessions of *Cenchrus ciliaris* L., a perennial grass of arid zones

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Like many apomictic species, *Cenchrus ciliaris* (*Poaceae*) is highly polymorphic in nature. For a better understanding of the phenotypic polymorphism of this species along a wide geographical range throughout Tunisia, we tend to clarify the relationships among diverse individuals. Especially we search for a correlation between intraspecific variability of *C. ciliaris* and aridity. This study deals with the phenotypic polymorphism of the offsprings of 20 *Cenchrus ciliaris* plants collected in various climatic areas of Tunisia. Six seedlings per plants were cultivated according to a common garden experiment design and 33 phenological or morphological variables have been measured during one cycle of growth. A principal component analysis was performed on the phenotypic and bioclimatic variables characterizing the site of collection of each studied genotype. The phenotypic PCA provides further support for the important fixed genetic polymorphism of this species. The principal component analysis based on the bioclimatic variables, confirmed the important climatic variation occurring through the geographical distribution of *C. ciliaris* in Tunisia. However, the comparison of the bioclimatic PCA with the phenotypic PCA shows no clear correlations between climatic and phenotypic groups. Bioclimatic variables are therefore not discriminant to structure the phenotypic polymorphism of *C. ciliaris*.

The phenotypic diversity of *C. ciliaris* observed in this study represents a high morphological variation, preserved by asexual reproduction. The absence of clear geographical or climatic pattern which could structure the multivariate phenotypic variation pleads towards existence of an important interindividual variability hiding effects evolutive process such as genetic drift of populations or selection by climatic factors.

**Keywords:** *Cenchrus ciliaris*, apomixis, multivariate analysis, phenotype.
Floral biology in *Campanula primulifolia* Brot. (*Campanuloideae, Campanulaceae*)

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*Campanula primulifolia* Brot., an endemic and threatened species (Cabezudo et al. 2005) from the W Iberian Peninsula (W Portugal and SW Spain), is related to *C. peregrina* L. (Anatolia, Cyrenaica and Lebanon-Syria) and *C. alata* Desf. (Algeria and Morocco) (Damboldt 1976). Reproductive biology of these species is little known. The aims of this work are (1) to characterize the flower, fruit and seed attributes, and (2) to determine whether *C. primulifolia* is self-compatible or not. For this purpose we grew, in a glasshouse, seven individuals from one population in Sierra de Aracena (SW Spain). Flowers were bagged prior to anthesis, hand-pollinated in the female phase and, again, bagged until seed maturity. Flowers, when being in the male phase, showed untidy stamens on corolla surface. When being in the female phase, flowers had glabrous styles with three straight stigmas, which showed pollen-collector hairs at the abaxial face but were receptive at the adaxial one. Fruits were ovoid, with pores in the middle. Seeds were elliptical (0.7-1.0 mm x 0.4-0.6 mm), flat, winged and striate. Diallelic crosses proved that plants from this population were self-compatible.

**Keywords:** *Campanula primulifolia*, floral biology, Portugal, self-compatibility, Spain.

**References:**


How much protect protected area in Lazio (central Italy)?

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In Lazio region 61 areas were selected as protected areas at different times and criteria, whereas other important areas are not actually protected. Therefore, a few questions arise, as “how much effective is protection for the species in protected areas” or “all territory has the same effect to preserve biodiversity” (Moilanen & Kujala 2006).

To solve this questions an approach is to compare the present protected areas pattern applying an original method of optimization (OMBOSS – Optimization Method Based On Singleton Species). This method assumes the territory divided into equal quadrants (Araujo & Williams 2000) and is based on the skewness of species distribution through quadrants (many species in few quadrants). The method is easy and quick to use and holds many features, as speed in calculating all the optimal solutions and measuring irreplaceability, capability of obtaining alternative solutions with the same conservation degree, clear meaning of results, easy selection of optimal solution with the highest “mean richness”, etc. For the study purposes, 54 protected areas out of 61 were selected (excluding some scarcely representative areas like urban areas, marine areas, etc.), ranging from few to many kmsq (max 308 kmsq). Selected areas show a high richness of endemic species (163 out of 193 in Lazio), with highest values in the wide mountain national or regional parks. With respect to threat status, there are 615 threatened species (in brackets, total values of Lazio): 357 LR (391), 158 VU (178), 37 CR (45), 37 EN (37), 26 EW (35), with a trend to lower values as threat degree increases; this shows that overall EN species of Lazio are present in protected areas as a total, so this could be an evidence of a good protection aptitude. OMBOSS minimizes the number of quadrants necessary to protect all species actually existing in protected areas, and produces all possible minimal combinations of quadrants; we define as “irreplaceable” at 100% level a quadrant present in every minimal combination. Another parameter is also calculated to measure the “greatness” of irreplaceability, and simply counts the number of singletons present in a each quadrant with irreplaceability of 100% (i.e. an irreplaceable quadrant with 10 singletons has a “greater” irreplaceability than a quadrant holding only 1 singleton). The % of priority quadrants (those with irreplaceability = 100%) in each protected area has little correlation with surface of protected areas (Kati 2004). Protected areas hold 307 “singletons”; 181 of them are exclusive (thus with high “priority” for general conservation aim), while other 126 are present in some other quadrant. Considering all the 209 quadrants of protected areas, 50% holds all the species diversity shown by all protected areas. This analysis highlights a possible use in conservation scenario, where protected areas would be redefined according this quantitative method; another problem to consider is how to protect species that are not present in protected areas?

Keywords: prioritization, optimization, irreplaceability, singleton, protected areas, OMBOSS software, Lazio, C-Italy.

References:
Relationship between forest management and cross-taxon congruency in Mediterranean ecosystems using plants, lichens, fungi, vertebrates and insects

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Distributional similarity (congruence) between phylogenetically independent taxonomic groups has important biogeographical as well as conservation implications. When multiple groups show congruence, one or two of them can be used as surrogates of diversity in others. Forest management is recognized widely to affect biodiversity although only few studies pointed out how different taxa respond to silvicultural practices. Furthermore, little is known on cross-taxonomic congruence regarding those ecosystems in the Mediterranean basin. The use of a surrogate taxon in conservation planning has become questionable because recent evidence suggests that the correlation of species richness between pairs of taxa is highly variable both taxonomically and geographically. Species richness is only one measure of species diversity and cross-taxonomic congruence of community similarity between sites among taxa has rarely been examined and may be the most relevant measure of species diversity in the context of coarse-filter conservation strategies. To assess and compare the response pattern of different taxa to management versus near-natural state forest ecosystems, we analyzed managed and old-growth stands in 36 squared plots areas of 2500 sq m in Cilento National Park (southern Italy), considering variations in forest structure, species richness and composition. Vascular plant data were plotted against data on lichens, invertebrates, vertebrates, bryophytes and fungi, to assess the congruence of diversity and community composition related to forest management. To summarize the conservation status, experts assigned to each plot a quality value ranging from 1 to 5. Hence, we assessed the correlation existing between different taxa using the qualitative conservation value expert-based. A good congruence were found for all pairs of taxa, excluding vascular flora and investigated vertebrates (i.e. dorm house and birds), probably because chosen plot dimension is too small for vertebrates. The concordant relationships between them conform to the hypothesis that species assemblages of certain taxonomic groups could still be used as surrogates for efficient monitoring of species diversity in other groups whose distribution may further predict the importance of conserving overall biodiversity in landscapes. Assessment of the responses of different taxa to forest management is crucial to coherently propose actions to conserve biodiversity in near-natural state forest ecosystems and promote sustainable forestry. In fact, old growth forests properties are a useful references to develop approaches for sustainable forestry and for restoration programmes.

Keywords: old-growth forest, biodiversity conservation.
An approach to the phylogenetic relationships in *Daucus* agg. *gingidium* in the western Mediterranean basin, based on nuclear plastid and AFLP markers

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*Daucus carota* L. sensu lato is considered one of the most problematic groups in the *Apiaceae (Umbelliferae)* (Heywood 1968). It includes a large number of taxa, which are quite frequent in the western Mediterranean area. Among that diversity, the so-called *D. aggregate gingidium* comprises several taxa scattered on rocky coastal areas in the whole Mediterranean Basin. This group is characterized by a remarkable morphologic variation (both inter- and intrapopulation), as well as a discontinuous distribution pattern (Pignatti, 1982, Pujadas 2003). All those combined factors led to an extremely confusing nomenclatural scenario - taxa in the aggregate are not well characterized morphologically, and hence their putative distribution areas probably are not properly delimited. Habitats in which taxa of *D. agg. gingidium* grow are fragmented and dramatically threatened by anthropic activities, namely by tourism. Therefore, taxonomic clarification is of paramount importance prior to establishment of effective conservation programmes. In order to clarify this complex situation, plant material was collected from several locations along the western Mediterranean Basin: Iberian Peninsula, Balearic Islands, northern Morocco, southern France, Sicily, northern Italy and Malta. They were analyzed based on plastid and nuclear markers (Downie 2008) and Amplified Fragment Length Polymorphism (AFLP) techniques.

**Keywords:** *Daucus*, phylogeny, fragmentation, West Mediterranean, plastid markers, nuclear markers, AFLP.

**References:**
Contributions to the conservation of the flora and riparian forests of the area of the River Cabriel (Cuenca, Spain)

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This work provides a methodology to prioritize areas for conservation that unifies the floristic value and the quality of riparian forests. The study was carried out in a mountainous area of 104,000 ha around the river Cabriel in the province of Cuenca (E Castilla-La Mancha, Spain). This upland river is one of the most interesting botanical areas in the region of Castilla-La Mancha. It rises at 1,600 m high in the Iberian System mountain range and is tributary to the river Júcar, which empties into the Mediterranean sea. The studies carried out since 2000 have permitted to obtain a catalog of more than 1,400 taxa, 144 (10%) of which are listed as rare or threatened under the Endangered Species List of Castilla-La Mancha (CREA), which represents more than 20% of the total species of this catalog, while the studied area occupies only the 1.2% of the total area of the region. The presence in the area of the only population of Sparganium natans, a species listed as endangered in the CREA and vulnerable in the IUCN Red List, explains as well the interest to contribute to the conservation of this area.

A quantitative analysis of the rare or threatened taxa shows a large group formed by Dicotyledons (68%), followed by 24% of Monocotyledons, 6% of Pteridophytes and only 1% of Gymnosperms. All the species belong to 60 families of which Rosaceae, Cyperaceae and Orchidaceae are the most represented.

The chorological spectrum of the rare and endangered species highlights a greater proportion of Eurosiberian taxa like Carex remota, Convallaria majalis, Daphne mezereum, Lathyrus vernus, or Quercus petreae (50 taxa representing the 35%), followed by the Mediterranean taxa like Campanula mollis, Cotoneaster granatensis or Prunus prostrata (25 taxa, 17%). Holarctic elements like Drosera rotundifolia, Menyanthes trifoliata, or Utricularia australis are represented by 19 species (13%), most of them extremely rare in the area.

The study of the riparian forests quality using the QBR index in the Cabriel, and performed along 97.5 km of the river (i.e. 44% of the total length of the river), shows that its quality is generally good: 55% of the total length has good quality, 17% excellent, 24% moderate and only 4% has poor quality.

From the distribution data of rare or endangered species of flora and the quality of riparian forests, we propose eight areas of interest for the conservation of riversides and rare and endangered vascular flora, four of which are not protected nowadays.

Keywords: conservation, endangered flora, chorology, riparian forests quality, Cuenca, river Cabriel, Spain.

References:
Identification of endemity areas in the South of the Iberian Peninsula

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The Mediterranean Basin is one of the 34 hotspots for the world-wide biodiversity (Médail & Quézel 1997), and within this area Andalusia is one of the eleven regional hotspots due to its important plant richness and endemism (Médail & Quézel 1999). A 60% of the Spanish flora inhabit in the Andalusian territory, which represents approximately a 15% of the Iberian surface. We must point out the high peculiarity of this flora: approximately 500 of these taxa are exclusive Andalusian endemics (Peñas et al. 2005).

Our aim is to analyze the distribution of the endemic plants of Andalusia in order to determine the areas of endemism of this territory. We used an identification method based on the optimality criterion, which is put into practice by NDM/VNDM programs (Szumik et al. 2002, Szumik et al. 2004). This software evaluates the distribution patterns within the concept of areas of endemism. These results are compared with other ones originated by two alternative methods (PAE and Cluster Analysis).

The centers of endemity are particularly accentuated in some biogeografic sectors as Rondeño (Sierra de las Nieves and Sierra de Grazalema), Nevadense (siliceous portion of Sierra Nevada), Subbético (Sierra de Cazorla) and Malacitano-Almijarense (Sierra Tejeda y Almijara).

These analyses indicate that the Andalusian Baetic ranges constitute one of the major endemity center in the Mediterranean Basin. With Corsica and North Africa mountains, the South of the Iberian Peninsula represents one of the three greatest points of plant diversity and endemisms in the western Mediterranean Basin.

Keywords: biodiversity, conservation, endemism, hotspot, Mediterranean Basin.

References:
Taxa relationships in the *Onopordum dissectum* complex (*Cardueae*, *Asteraceae*) revealed by AFLP markers

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*Onopordum dissectum* s.l. is a complex confined to sandy soils from the Atlantic coastline of NW Morocco and SW Spain (Doñana National Park). This species was originally described by Murbeck (1921) near Casablanca. Later, the populations from the Mamora forest (Morocco) were described by Lindberg (1932) as *O. murbeckii*. Recently, two new species have been described by Talavera et al. (2008) in this complex: *O. magrebiense*, from the south of the river Loukos, near Larache (Morocco), and *O. hinojense*, from the Guadalquivir valley (Spain).

In order to characterize the different taxa within this complex and to infer their phylogeography, we analysed Amplified Fragment Length Polymorphisms (AFLPs) from 13 populations out of the four distribution areas. Five primer combinations were selected for the selective polymerase chain reaction (PCR) and applied to 206 individuals. The analysis of the data obtained indicated that *O. dissectum* and *O. magrebiense* are well differentiated whereas *O. murbeckii* and *O. hinojense* are very close.

**Keywords:** AFLP, Doñana, Morocco, *Onopordum*, phylogeography, W Mediterranean.

**References:**
Endemic centers, threatened plant species and refugia: is the distribution of protected areas well defined in the French Maritime Alps hotspot?

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The Maritime and Ligurian Alps constitute one of the eleven Mediterranean regional hotspots of plant biodiversity and one of the about fifty Mediterranean refugia identified by phylogeographical analysis (Médail & Diadema 2009). Diverse historical and palaeogeographical episodes, long term human influence and current geographical and climatic contrasts have played a key role in the biogeographical singularity of this region which constitutes a major biogeographical crossroad where several lineages have persisted or have been differentiated since the Tertiary. With ca. 3800 indigenous plant taxa including ca. 110 endemics s.l. and 76 threatened species, the French Maritime Alps constitute an important part of this regional hotspot with several putative microrefugia both for Mediterranean and Alpine species.

In the global change context, we examine here the spatial congruence between the locations of endemic and threatened species centres, the distribution of refugia, the location of protected areas and urbanisation pressures at the fine scale of the French Maritime Alps. The objective is to estimate the importance of the conservation effort necessary to better protect the future of this plant biodiversity.

Based on the distribution of endemic plants s.l. of the Maritime Alps, we identify that 3/4 of the operational geographic units (OGU) contain more than 10 endemic species and half of the OGU more than 20 endemics. The major centres are found in the high mountains of the northern part of the hotspot and in the southern mountains behind Menton and Grasse. Comparisons between the distribution of putative refugia and areas of endemism show a strong biogeographic congruence. These results are compared with the distribution of protected areas within this region.

Diverse and tremendous human impacts, including urbanization, contrasted land-use changes and habitat fragmentation threat this unique flora, especially along the coasts and the Prealps where few protected areas are found (Médail & Diadema 2006). The spatial congruence between the location of endemic centres and urbanization pressures is examined and these results allow us a critical analysis of the current network of protected areas.

Keywords: endemic centres, conservation, Maritime Alps, operational geographic units, protected areas, refugia.

References:
Seed germination characteristics of *Periploca angustifolia* Labill. and *Rhus tripartita* (Ucria) Grande: effects of temperature, salinity and water stress

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Native plants can be used in restoration or rehabilitation of degraded ecosystems. Seed germination of two indigenous woody species (*Periploca angustifolia* and *Rhus tripartita*) from arid and semi-arid regions of Tunisia was assessed under controlled conditions by determining the optimum temperature of germination and simulating drought stress using polyethylene glycol (PEG 6000) and salt stress using different concentrations of NaCl. The germination response of the seeds in darkness was determined over a wide range of temperatures (between 10 °C and 30 °C), salinity (between 0 mM and 400 mM) and water stress (0 MPa and -3 MPa). Our results suggest that germination percentage was influenced by salt and osmotic stress at 25 °C and 15° C respectively for *P. angustifolia* and *R. tripartita*, which represent their optimum temperature of germination. However, studied species respond differently to stress induced by NaCl and PEG 6000. *P. angustifolia* is characterized by a better adaptation to drought conditions compared to *R. tripartita*. These findings will be useful for future trials involving the use of indigenous shrubs in the restoration of rangelands.

**Keywords:** shrub, salt stress, water stress, germination, temperature, Tunisian arid zone.
Multiple effects of *Acacia tortilis* (Forssk.) Hayne subsp. *raddiana* Savi on vegetation structure in arid lands of North Africa

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This study was conducted in a pseudo-savanna of *Acacia tortilis* under arid bioclimate in North Africa (Tunisia). In this ecosystem, *A. tortilis* creates patches that can strongly influence the spatial distribution of plant and soil resources. In land restoration of arid and semi arid environments it is important to study the potential role of such ecological patchiness that may provide sites for coexistence of species with different life and growth forms.

Our main objective was to test whether *A. tortilis*, a leguminous tree, can improve the vegetation structure and soil properties in arid lands of southern Tunisia.

Vegetation, microclimatic and edaphic characteristics under canopies of *A. tortilis*, as well as in the open spaces, were compared for ungrazed and grazed sites.

Plant richness and diversity were positively related to canopied subhabitat. Protection from grazing, especially under canopies, was associated with an increase in diversity and richness of herbaceous plants, an improve of soil microclimate and an increase of soil nutrient concentrations. Overall, our results show that *A. tortilis* has facilitative effects on vegetation structure through different mechanisms.

**Keywords:** *Acacia tortilis*, facilitation, arid zone.
Mediterranean mountains as a refuge and dispersal area of plants. The study case of Montseny Massif (Catalonia, Spain)

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Throughout the history, mountains have been biological refuges both for the diversity of environments in relation to the vegetation stage, as well as biotopes influenced by topography and water points. Climate changes have caused the main modifications on the spatial distribution of organisms. Over the past millennia, human activity has also played a significant role in the distribution patterns of plants. Both factors, climatic and human, are considered fundamental to understanding the present distribution of plants. The mountain areas have been less influenced by human activity, or at least have hosted sites which that by their topography have constituted important biological refuges.

In the northern Mediterranean, the progressive abandonment of traditional activities during recent decades has led to a decrease in the land occupation of the mountainous areas, with concentration in urban areas more topographically flat. The result is the regeneration of the natural landscape with a greater maturity in mountain areas, where there have been plans for the protection and conservation of natural systems.

In this context, the authors are studying the role of mountains as refuge areas and as centers of dispersal of plant species at the Montseny massif (Catalonia, Spain). Based on the assumption that the current conditions, with a higher degree of human occupation in the lowlands and with less impact on the mountains, have determined a higher profile as areas of refuge and as centers of plant dispersal.

The objective is to analyze the current state of vegetation, especially the vegetation which colonizes biotopes where rare plants communities are found. These are set out in rocks, water and micro-sites with micro or topoclimates influenced by the topography and relief. The chorology of the flora has been carried out with an unit reference corresponding to the square of 1x1 km UTM grid. In each square a full list of taxa was completed, establishing its presence for each square in three degrees: local, frequent and abundant. The study of vegetation is based on phytosociological inventories, which enabled an analysis of the current dynamics. The results are expressed synthetically by maps and profiles. Emphasizing on the value of communities as a refuge from the crests, valley bottoms, water points and the base of the cliffs, especially in shady situation. Finally, we analyze the distribution and the presence of some interesting plants from a biogeographical point of view, such as Abies alba, Fagus sylvatica, Prunus lusitanica and Taxus baccata, and some taxa with sub-alpine affinities or that are markedly xerophilous.

Keywords: biodiversity, biological refuge, chorology, Montseny, vegetation dynamics.
Phytogeographical considerations on the endemic vascular flora of Iglesiente, Sulcis and Sarrabus-Gerrei (South Sardinia, Italy)

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In this study, are presented and discussed the phytogeographical relations between the endemic vascular flora of Sarrabus-Gerrei (SE Sardinia), Iglesiente and Sulcis (SW Sardinia). The endemic flora of these territories consists of 193 taxa, 114 of which were recorded in Sarrabus-Gerrei, 150 in Iglesiente and 140 in Sulcis. The Sardinian endemics (42.6%), together with the Sardo-Corsican ones (26.4%), count for the 69.0% of the total. The endemic taxa common to all the investigated areas are 80, while 70 are restricted to only one of these territories: 29 occurring exclusively in Iglesiente, 24 in Sulcis and 17 in Sarrabus-Gerrei.

The affinity between the different territories is shown from an analysis of 47 taxa present in only two of these: 30 present just in Iglesiente and Sulcis, 11 in Iglesiente and Sarrabus-Gerrei, while only 6 in Sulcis and Sarrabus. Differences and similarities are also testified by the presence of endemic taxa which are exclusive of the various areas: 13 in Iglesiente, 11 in Sulcis and only 2 in Sarrabus-Gerrei. The analysis of chorologic data highlighted the environmental peculiarities of Southern Sardinia, given by the local evolution of a rich floristic contingent. The comparison of the endemic vascular florals emphasizes the affinity between Sulcis and Iglesiente, which are separated from the rest of Sardinia by the tectonic deep of Campidano, while Sarrabus-Gerrei is geographically closest to the other mountains of central Sardinia and it has a smaller ecologic variety and in particular lithologic diversity.

A confirmation of this hypothesis comes from the analysis of chorologic spectra of the endemic flora of the three sectors, since it shows a predominance of taxa exclusive of Sardinia, in Iglesiente and Sulcis (35.3% and 33.6%) whereas it occurs in Sarrabus a major number of Cyrno-Sardinian taxa (33.3%) and an important contingent of Tyrrenhian endemics (19.3%).

Our results confirm the rank of biogeographical sector to the Sulcis-Iglesiente area and lets to hypothesize to define another sector for the Sarrabus-Gerrei region.

Keywords: endemic flora, Sardinia, lithologic diversity, biogeography of Sardinia.
Seed shape and size in psammophile species of the Tuscan coast

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All seed samples were collected in the summer 2008 in Marina di Vecchiano (PI). Measurement of length, width, and depth of 30 seeds per species were made by means of a caliper (0.01 mm precision). After measuring each sample, 1-5 seeds were photographed with a high-resolution digital camera mounted on a stereoscope. Seed shape has been calculated according to Thompson et al. (1993). The dry weight has been recorded after oven-drying 50 or 100 seeds at 103° C for 17 hours.

In the selected species, mean seed length varies from 0.67 mm (*Echinophora spinosa*) to 7.29 mm (*Juniperus oxycedrus* subsp. *macrocarpa*); shape varies from nearly spherical (0.01 for *Euphorbia paralias* and *Cistus monspeliensis*) to moderately elongated (0.24 for *Solidago litoralis*). Dry weight varies from 1.2 x 10-4 (Silene colorata) to 6.2 x 10-2 g (*Juniperus oxycedrus* subsp. *macrocarpa*). Weight and shape are relevant in predicting seed persistence in the soil seedbank in different environmental conditions and geographic locations (Thompson et al. 1993, Thompson et al. 2001), although exceptions have been reported (Leishman & Westoby 1998). Following the general model, small and rounded seeds tend to form persistent seedbanks in the soil. If this model applies to the species targeted by this work, then *Euphorbia paralias*, *Cistus monspeliensis*, *Dorycnium hirsutum*, *Arbutus unedo*, *Cistus salviifolius* (shape index < 0.05) should predominate in the seed bank. Further studies, taking advantage of the photographic images, will be undertaken in order to verify the composition of the soil seedbank in the investigated area.

Keywords: Seed mass, seed shape, biometry, seed images, seed bank.

References:
Cytogenetical study of the facultative serpentinophyte species *Narcissus poeticus* L. from Dinaric Alps

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*Narcissus poeticus* L. (*Amaryllidaceae*) is south-eastern European species, and the populations of this species in Balkans mainly occur on limestone, and rarely on peridotit-serpentine complexes which are the subject of this cytogenetical study. The bulbs were collected in eight natural populations from Bosnia and Herzegovina and Croatia on serpentine and limestone soils. The karyotype and chromosomal organization of heterochromatin and ribosomal genes were analyzed by Schiff staining, CMA (chromomycin A3), DAPI (4',6 diamino-2-phenylindol), Hoechst 33258 bandings, and by double FISH (Fluorescence in situ hybridization) using 18S-5.8-26S and 5S rDNA probes. Activity of 18S-5.8S-26S genes was tested by silver nitrate staining.

In all investigated populations the basic chromosome number \(x=7\) was confirmed. The presence of 1 B chromosome was observed in five of investigated populations. Additionally, inter-individual variation of karyotype was observed in one population on serpentine soils: \(2n=2x=14+B, 2n=3x=21\) and some individuals with chromosomal translocations. In common karyotype, two chromosome pairs possess the intercalary DAPI bands, where one of them co-localized with Hoechst and CMA bands, and 5S rDNA locus. On the 7th chromosome pair, only with secondary constriction, was detected 18-26S rDNA locus, which co-localized with CMA staining. Among populations the differences concerning seventh pair were observed. Only individuals which present CMA and 18S positive signals on the satellites moreover possess B chromosome. This B chromosome has also both CMA and 18S rDNA signals in two populations on serpentine soils and one population on karst valley. Other populations on limestone are either without B or possess B chromosome, but without signals. The supplementary 18S locus on B chromosome is active since three, instead of expected two, nucleoli were confirmed by silver nitrate staining. Based on these obtained results we raise the question: is it presence of B chromosomes one of possible plant genome responses of *Narcissus poeticus* in relation to abiotic stressful conditions?

**Keywords:** karyotype, fluorochrome banding, 18S-26S rDNA activity, B chromosome, serpentinophyte, Balkan region.
Peat florulas in the Madonie Regional Park (Sicily)

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The floristic exploration of the eastern slopes of the Madonie Mountains in Sicily, carried out between 1975 and 1980, resulted in the discovery of several hydromorphic environments characterized by a thick peaty horizon. Locally named "margiu" or "triemula", depending on the lower or higher depth, they host plant communities characterized by some species of Juncus and Carex together with acidophilous bryophytes including some species of Sphagnum. Their ecology as well as their flora and vegetation have been studied (Petronici et al. 1978). In some localities fossil pollens have also been examined (Bertolani Marchetti et al. 1984).

Floristic analyses pointed out some phytogeographical patterns (Raimondo & Dia 1978, Raimondo et al. 1980, Raimondo et al. 1981). These data primarily provide the key lecture of some taxa in relation to glacial expansion in the Mediterranean Basin. New floristic data have been reported (Marcenò & Raimondo 1977, Raimondo 1979), and further unpublished data came out during following collections and surveys on the conservation status of this habitat, mostly destroyed by the drainage produced after the gathering up of mineral waters (Raimondo & Spadaro 2003). On the basis of previously collected data and herbarium specimens housed in Palermo (PAL), combined with more recent observations, a survey of the peat flora of the Madonie (Anthophytes, Pteridophytes and Bryophytes) is reported. The biogeographical analysis points out the importance of the boreal taxa, and their character of glacial relicts.

Keywords: glacial relict, wetlands, Sicily, peat flora.

References:
The Lobarion in Cilento (southern Italy)

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The Lobarion pulmonariae Ochsner 1928 is the characteristic epiphytic lichen vegetation of mesic deciduous forests in the post glacial (Barkman 1958, Rose 1988), previously distributed in all temperate and boreal regions of the northern hemisphere and in those cooler areas of tropics (Scheidegger 1988).

Among the species belonging to the communities of Lobarion, cyanolichens have an important role. Both for the narrow ecological range of these species, both for the scarce capacity of propagation of Lobaria pulmonaria (L.) Hoffm., the distribution range of Lobarion is gradually declining and fragmenting, at the risk of disappearance. The threats are man-made, especially air pollution by phytotoxic gases and inadequate forest management (Rose 1988). The communities of Lobarion differ mainly on the basis of the presence of oceanic and mountains species: the former prevailing in the Mediterranean Basin in the mountain belt, the other to characterize communities whose distribution is limited to beech forests of central European (Barkman 1958). A third type has been suggested for southern Europe, where transgressive species of other more thermophilic and/or acidophilic alliances become part of the communities of Lobarion (Rose 1988).

The aim of this work is to contribute to the knowledge of the Mediterranean Lobarion communities, their floristic composition, their status and the actual presence of regional and local species. The study was carried out in Cilento (southern Italy) during the summer 2008 as part of the project “Monitoraggio alla rete dei boschi vetusti del Parco nazionale del Cilento e Vallo di Diano” supported by the National Park (agreement with Dept. of Plant Biology of “La Sapienza” University, Rome).

In this area, bioclimatic conditions ranges from Mediterranean to temperate. Precipitation increases along with altitude from 730 to 1,700 mm year-1 with a peak in winter and a period of aridity in summer. The mean annual temperature ranges between 17.8°C and 11.6°C. Between 400 and 1,000 m, forests are dominated by Quercus cerris L. and are mainly managed by selective or seed tree-cutting, at higher altitudes, between 1,000 and 1,800 m, forests are dominated by Fagus sylvatica L. and are mainly unmanaged or non intensively managed.

A preliminary extensive survey allowed to map the abundance of Lobaria pulmonaria throughout the area in randomly selected plots of 50x50 m. In each plot, three mature trees were randomly selected for lichen survey. Based on rapid assessment methods, lichens were surveyed from the base of the trunk up to 2 m.

Keywords: Mediterranean area, lichen vegetation, threatened communities, regional and local species.

References:
Preliminary phylogenetic relationships in western Mediterranean *Tamarix* based on morphology and molecular data

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The taxonomy of the genus *Tamarix* is considered as complex by different authors, since there are a few morphological useful characters to differentiate among taxa. According to global revisions (e.g. Baum 1978), most of the species are weakly separated by flower and inflorescence characters such as the morphology of the insertion fo the stamens, number of petals, length of the bracts, indument of the raquis and the width of the inflorescence. However, the taxonomical identification in the vegetative stage is quite difficult and almost impossible to determinate some particular taxa (e.g. *T. canariensis* vs *T. gallica* or *T. africana* vs *T. boveana*). Moreover, some *Tamarix* taxa have been used as ornamental plants outside of its natural area of distribution, since some of them show a high ecological plasticity related to semiarid and arid areas characterized by saline soils. Moreover, some of them could act as invasive plants, as has been reported in some areas from North America.

A total of 7 native species from the Western Mediterranean area have been studied: *T. canariensis*, *T. gallica*, *T. aphylla*, *T. boveana*, *T. africana*, *T. dalmatica* and *T. parviflora*, and according to Baum (1978) they belong to sections *Tamarix* and *Oligadenia*. First, a morphological study based on some flower and vegetative features would allow characterizing each taxa and its identification during the whole year. Moreover, the use of scanning electron microscope (SEM) has showed a detailed analysis of the secretory glands and indumenta of the raquis of the inflorescence. Secondly, the phylogenetic position of this genus and the relationships among these Mediterranean taxa were also analyzed based on plastid (e.g. *trnL*-F) and nuclear (e.g. ITS) markers.

**Keywords:** *Tamarix*, phylogeny, morphology, Mediterranean area.

**References:**
The reproductive biology of *Daphne gnidium* L. (*Thymelaeaceae*)

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*Daphne gnidium* is a circum-Mediterranean evergreen shrub. Flower and pollen features related to pollination mechanism were analyzed, and the seasonal presence of insects visiting the plant was monitored. The flower and fruit production of a number of individuals within a population was recorded along three flowering seasons.

The morphology and functionality of flowers are compatible with entomophily; in fact, pollen viability is maintained for a few hours only after anthesis and the stigmatic receptivity is very short. All plants bear the hermaphroditic flowers that always reveal an efficient male function, whereas the pistils often fail to produce a well formed fruit. The reproductive fitness of the species is low because of the missing of the ripening process (35% collapsed embryos), particularly in some plants.

For this reason functional male and hermaphroditic plants were recorded. Despite a high reproductive effort during the flowering season, all plants show an almost completely unsuccessful reproductive process. The recorded gender behaviour and the anatomical differences between the two *D. gnidium* morphs might suggest this species as a new example of functional androdioecy.

In fact, these complex and transient evolutionary traits might be interpreted as a first step of an evolutionary pathway toward dioecy. These complex or transient evolutionary traits displayed by *D. gnidium* are comparable to those of other *Thymeleaceae*, viz. *Thymelaea hirsuta* and *Daphne laureola*.

**Keywords:** *Daphne gnidium*, fruit/flower production, pollen vectors, sexual organ functionality, androdioecy.
Vines of Mediterranean forests: species richness, life-traits and ecology

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Vines participate modestly to the biodiversity of Mediterranean forests at the difference of tropical forests, mainly because of climatic stresses (drought). Their diversity and abundance within forest communities vary however with the ecological conditions. The aim of the present study was: i) to quantify their diversity in the main forest types of the Mediterranean; ii) to describe their geographical distributions, and iii) to define the ecological specificities of this biological type in the Mediterranean context.

The study is based on the analysis of 220 forest communities. For this purpose, they were classified into seven types based on the classification of Bohn et al. 2003. The mean total diversity of vines corresponds to 13,4% ± 6,3 of the total plant biodiversity of the Mediterranean forests. These indices are similar in islands, indicating an easy dispersal for most species. In contrast, the number of vines is lower but the proportions of vines are significantly higher in island forests. The 63 species recorded belong mainly to the Fabaceae (27%) and to the Convolvulaceae (11%) but the total number of genera is 22. 12 species are present in more than 50% of the forest communities: Hedera helix (59%), Smilax aspera (44%) et Clematis vitalba (34,4%) for the high strata, Tamus communis (54,1%) and Asparagus acutifolius (41,1%) for underlayers. Many species are endemic species in islands or on the extreme parts of the Mediterranean basin. 61 % vines are deciduous including 80 % herbaceous vines. Woody vines of the canopy are globally rare, but more abundant in G and U where water and nutrient resources are the highest.

Three main groups of vines can be distinguished: i) the vines growing in deep and moist soils, rich in nutrients (G, U, W) where woody vines are many and abundant; ii) the vines growing in dry environment of plains (J) dominated by sclerophyllous species; iii) the vines living in mountain forests (K and F), a group which is poor in vines. Compared to vine communities of temperate Europe, the diversity in vines of the Mediterranean forests is significantly higher given the absence of frost and the long period of vegetation. Vines adapt by physiological strategies or colonise more suitable habitats in the Mediterranean Basin. The taxonomic richness of vines is also linked to the microevolutive processes.

The vine diversity of other Mediterranean forests of the world is similar, except in Chile where the diversity is higher and close to the patterns occurring in temperate rainforests. Forests of the current Mediterranean landscape have deeply changed compared to primeval old-growth forests, and the vine communities adapt to these human changes. Native forests offered more suitable habitats for vines than to a more buffered microclimate, a more stable forest dynamics and the conservation of deep and moist soils. These conditions probably helped canopy vines to reach larger sizes and longer life time.

Keywords: vine, Mediterranean, forest, strategy, biodiversity, island.
Origins and relationships of serpentine endemics in Mediterranean Lithospermeae (Boraginaceae): insights from Onosma and other Balkan taxa

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Serpentine adaptation is the complex of eco-physiological and morpho-anatomical traits allowing given plant species or populations to tolerate the physical and chemical anomalies of ultramaphic soils, especially the low Ca/Mg ratio and the toxic levels of heavy metals. Such a capacity originated in a restricted number of species growing obligately or facultatively on ultramaphic outcrops. These occur all over the world in the form of ecological islands and are colonized by selected floras with high endemism rates. With ca. 320 endemics, the Balkan ultramaphics represent a major hotspot of plant diversity and endemism in the Mediterranean (Stefanović et al. 2003). Two angiosperms groups have their centre of diversity in this region, i.e. tribes Alysseae (Brassicaceae) and Lithospermeae (Boraginaceae). Both include endemic lineages at the genus, species and subspecies level, providing the opportunity to study the origin of serpentine endemics at the macro- and micro-evolutionary scales using a phylogenetic approach.

A two-markers molecular analysis of Euro-Mediterranean Lithospermeae showed that serpentine specialisation, at least as a facultative condition, originated in three unrelated lineages, among which the Halacysya-Paramoltkia and Onosma-Echium clades. The unexpected sister relationship between Balkan monotypic Halacysya and Paramoltkia shows that obligate serpentinophytism did not originate independently but represents an ecological synapomorphy inherited from a common ancestor. In the Onosma-Echium clade, the species-rich genus Onosma include several serpentine endemics, five of which are restricted to the ophiolitic islands of Greece. These taxa represents a model system to investigate whether they represent a monophyletic group with a single origin or a polyphyletic assemblage with multiple origins from non-serpentine, sympatric species. Preliminary results from ITS sequences are revealing complex patterns and a likely polytopic origins through a small number of events, suggesting that potential for serpentine tolerance evolved early in the phylogeny of Onosma as a pre-adaptive trait.

Keywords: Lithospermeae systematics, serpentine endemics, Onosma, Balkan flora, molecular phylogeny.

References:
First steps towards a database of genome size for the Balkan flora

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Nuclear DNA content or genome size is an important character for the evaluation of biodiversity. The presence of different biogeographical plant groups, such as the remnants of Tertiary relictual, glacial and postglacial flora, makes the Balkans region a natural laboratory for evolutionary studies for many plant groups. Given the paucity of information about genome size for the Balkan flora we have determined the DNA content of 343 taxa, of which 242 are novel, mainly from Bosnia and Herzegovina, Croatia, FYR Macedonia, Monte-Negro and Serbia. Generally, the DNA 2C values have been estimated in several populations, and if these results were similar only one population is presented.

In several taxa, the presence of B chromosomes, polyploidy and hybridization events led to significant genome size variation at intraspecific level. In these cases the values of several populations are presented. The 2C DNA content and base composition (GC%) were assessed by flow cytometry and chromosome number was determined using standard methods. Genome size of studied species ranged from 1C=0.14 pg for Selaginella helvetica to 47.94 pg for Fritillaria gracilis. Using Leitch’s criteria 49% of these taxa belongs to the group of very small C-values, 24% to small, 19 % to medium values, 6.7% to large, and 1.2% to very large genome size. Typically, the last two groups consist of gymnosperm and monocot species. These are the first 2C-values for one family, 53 genera (9 monocots and 44 eudicots) and 242 taxa (210 specific, 27 intraspecific categories and 5 hybrids).

Keywords: genome size, base composition, flow cytometry, intraspecific and interspecific variation, polyploidy, B chromosome.
Phylogeography of *Rumex bucephalophorus* L. in the western Mediterranean

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*Rumex bucephalophorus* is a very polymorphic species, for which Press (1988) distinguished four subspecies that vary in fruit peduncle and valve morphology. *Rumex bucephalophorus* subsp. *bucephalophorus* presents fruits that have valves with wide triangular shaped teeth and is distributed across the Mediterranean coastline. The subsp. *hispanicus* and the subsp. *canariensis* have valves with more or less linear hooked teeth. The subsp. *hispanicus* lives across the Atlantic coastline in NW Spain and SW France, while the subsp. *canariensis* lives in Macaronesia (Canary and Madeira islands). The subsp. *gallicus* is the most widely distributed in the western Mediterranean and the most variable. It has fruits with heteromorphic peduncles (short and long), and the valves are normally entire in short pedunculated fruits and dentate in long pedunculated fruits. Occasionally, short pedunculated fruits are produced in the stem basis and they are finally buried in the soil. For that reason this is considered an amphicarpic taxon.

For this purpose, ITS and AFLP molecular markers were used to characterize these subspecies. The ITS region was analysed in 10 plants of the four supposed subspecies of *Rumex bucephalophorus*. As outgroup we choose *R. acetosella* and *R. hastatus*. Results show that all the populations of *Rumex bucephalophorus* form a monophyletic group, in which *R. bucephalophorus* subsp. *bucephalophorus* occupies a basal position and *R. bucephalophorus* subsp. *canariensis* appears as the most derived taxon; no differences were found between the subspecies *hispanicus* and *gallicus*. In the AFLP study, 20 populations from the western part of the distributional area of *R. bucephalophorus* belonging to the four subspecies were analysed. The results show that the subspecies *bucephalophorus* and *canariensis* are perfectly delimited and that the subspecies *hispanicus* and *gallicus* belong to the same group. In the subspecies *gallicus*, two groups can be distinguished, one from the Atlantic coastline of the SW Iberian Peninsula and NW Morocco, and other from the continental and Mediterranean populations from Spain and Morocco.

**Keywords:** genetic diversity, phylogeography, *Rumex bucephalophorus*, western Mediterranean, Macaronesia.

**References:**
Distribution of male and female plants of the hemiparasitic dioecious shrub *Osyris lanceolata*

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*Osyris lanceolata* Hochst. et Steud., known as African sandalwood (*Santalaceae*), is an evergreen hemiparasitic dioecious shrub of Mediterranean habitats. Its phenology has been cited in previous studies as the phenological pattern showed by species from tropical flora (Herrera 1988a), because it is a pre-mediterranean species, survivor of an old evergreen tropical flora still living in Mediterranean refugia. In this study, we analysed the spatial distribution of male and female plants of *O. lanceolata* in “El Asperillo” (Huelva, SW Spain) and their potential host species by direct observation of its root system (Herrera 1988b). Our two main objectives were: to determine if *O. lanceolata* individuals had a special affinity for some species as hosts and if there were differences between sexes. We studied plant size measuring: height, major and minor diameter in all individuals (sandalwood and their hosts). We also estimated size distribution in the population of “El Asperillo” mapping the position of all individuals (Wiegand et al. 2004). As well we followed the development of *O. lanceolata* seedlings to determine how they establish connections with their hosts. In “El Asperillo”, the most common sandalwood’s neighbour is the pine tree (*Pinus pinea* L.), present as neighbour in 95% of the cases due to the high density of pine trees. We could confirm that it was the most common host. Other species in the area, sandalwood’s neighbours, and potential hosts were *Corema album* (L.) D. Don, *Halimium calycinum* (L.) K. Koch and others. We found no evidence about differences between sexes regarding the election of their host. We accounted from small seedlings until plants around a 310 cm height (all the size range of the species), that indicates a good regeneration process of the species in the studied population. We conclude that at the study area the hemiparasitic shrub *Osyris lanceolata* is closely linked to the pine trees, whose roots reach deeper into the soil, a fact that could supplies a better success of *O. lanceolata* in a strongly seasonal climate.

**Keywords:** *O. lanceolata*, *P. pinea*, spatial distribution.

**References:**
The botanical features of the “Repertorio Naturalistico Toscano” (Re.Na.To. – Tuscan Naturalistic Repertoire) project: revision and update

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Following the assignment by the Regione Toscana and in collaboration with the University of Siena and Pisa, a long-term project was carried out leading to the creation in 2004 of lists including species (flora and fauna), habitats, and phytocoenoses of conservation interest (Sposimo & Castelli 2005). For each selected element, the sites detected from bibliography (1960-2000), herbaria and unpublished were georeferred, and a synthetic file reporting information on general and local distribution, ecology, status in Tuscany following the IUCN categories (1994), threat factors, and conservation measures was compiled.

All the collected and elaborated information was made accessible on the internet (http://web.rete.toscana.it/renato/principale.htm).

Between 2004 and 2008, the RENATO archive was subjected both to a technical optimization (modification of the data entry and retrieval software), and to an in-depth revision and update of its contents regarding:

- validation and correction of the data in the archives;
- critical revision of the “special care lists”, i.e. the lists of elements (floral and faunal species, habitats, phytocoenoses – in the terrestrial context) of regional conservation interest that form the repertoire;
- update the data with the available knowledge up to 2005.

On the whole, the selection criteria applied to individuate the floral species to include in the special care list were more precisely and pragmatically defined, and, in the numerous cases in which the EU directives were unclear and misleading, the habitats were better delimited.

This work allowed including in the special care lists 369 rare and endemic plant species (3236 reports in total), 94 habitats (1088 reports in total) and 85 special interest phytocoenoses. Furthermore, thanks to GIS technique, it was possible to establish differentiated levels of knowledge and presence indexes according to the various territorial zones and, consequently to better plan some investigation strategies.

Keywords: conservation, vascular flora, habitat, Tuscany.

References:
Analysis of Ord. Violarieen, Capparideen, Cistineen and Sileneen from C. Studniczka’s herbarium

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We have analysed Ord. Violarieen, Capparideen, Cistineen and Sileneen, consisting of 134 herbarium sheets. Most plants were collected in Europe (128 herbarium sheets). Most herbarium sheets were collected in the area of today’s Austria (26), followed by: Croatia, Montenegro, France, Italy, Czech Republic, Romania and other countries. According to the affiliation to particular herbarium collections, the most representative plants are those from the collection Flora Dalmatiens (including collections Flora von Dalmatien and Flora Süddalmatiens). 24 herbarium sheets have remained unmarked, since we don’t know which collection they belong to. In reference to Ord. Ranunculaceen, Cruciferen, Berberideen, Nymphaeaceen, Papaveraceen and Fumariaceen, there are some new collections: Aus der Flora Istriens und des Quarnero, Flora comitat Neógrad, Flora Valachiae and H.A. Oertel Herbarium. Most herbarium sheets were collected by Studniczka himself (75). In reference to Ord. Ranunculaceen, Cruciferen, Berberideen, Nymphaeaceen, Papaveraceen and Fumariaceen, some botanists or collectors are mentioned for the first time and these are: Ahlberg, Anthouard, Cartier, Cornaz, Foucaud, Malinvaud, Moulin, Oertel, Piccone, Pisani, Tripet, Vagner and Wiesbauer.

The oldest herbarium sheet dates from the year 1869 and the newest one is from 1904. The majority of herbarium sheets, 94 to be precise, were collected during the period from 1871 till 1880. The exact year of collection is missing from 3 herbarium labels. According to Studniczka, within 79 herbarium sheets there are 16 genera with 49 species, in terms of which 14 taxa were registered. According to Flora Europaea, there are 17 genera with 41 species of plants, in terms of which 5 subspecies were registered.

Keywords: C. Studniczka’s herbarium, Natural History Museum and Zoo, Split, Croatia.
Phylogeography of *Euphorbia spinosa* L.

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The historical influence of the last glacial phase is reflected in the population structure and genetic diversity of plant species (Hewitt 2000). Events of hybridization through secondary contact might also affect the genetic variability of populations. To examine the role of the Ligurian Alps and Apennines in glacial survival of plant species, we have selected *Euphorbia spinosa*, a perennial plant that is naturally distributed across the Italian peninsula (Pignatti 1982). But if the Italian peninsula is considered to be one of the principal glacial refugia in Europe (Taberlet et al. 1998), few plant population genetic and phylogeography studies have been undertaken. The combined analysis of chloroplast and nuclear loci (ITS, cpSSR and ISSR) allowed the detection of extensive DNA variation and proved to be highly informative in reconstructing its phylogeography.

Our data show that there is a clear geographical structure of chloroplast haploclades that divides this species into the two distinct groups: (i) the Maritime Alps, Sardinia, Corsica, northern and central Apennines, and, (ii) the Southern Apennines and the Balkans. The phylogeny obtained with nuclear ribosomal ITS1 and ITS2 DNA sequences corresponds fairly well with that based on microsatellites and minisatellites chloroplast DNA data and provides evidence of a genetic divergence caused by the last climatic oscillations.

The existence of allopatrically fragmented lineages is most likely the result of long-term isolation in multiple refugia, probably due to climatic changes and topographic complexity of the Italian peninsula. The most plausible hypothesis assumes the formation of two migration paths during more recent periods: the first one starting with a migration southward and the second one moving northward. Indeed, the absence of monophyly in the intermediate group observed in the ITS tree indicates several cycles of range contraction, isolation and expansion leading to repeated hybridization events. The range-overlap of two genotype groups stretching from the central Apennines to Sardinia, Corsica and Northern Apennines, is also confirmed by data obtained from hybridization analysis on ISSR.

**Keywords:** Apennines, glacial refugia, hybridization, Maritime Alps, multiple refugia, pollination routes, recolonization.

**References:**
SESSION 2: PHYTOSOCIOLOGY AS PLANT SYNECOLOGY

Chairman: Edoardo Biondi

INVITED ORAL PRESENTATIONS
Phytosociologist’s pride

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There is no doubt that phytosociology in the first century of its history plaid the role of the real Plant Sinecology: starting from the association’s level to that of plant landscape unit. In all these, phytosociology expresses a great ability to integrate through the bioindication, different ecological levels, that are consequent among them. The session want to face the issue of ecological evidence of taxa and syntaxa, series and geo-series expressed according to concepts of quantitative ecology with examples regarding the biodiversity hotspots in the Mediterranean. The phytocoenoses that are represented in phytosociology terms have to be more enriched in their real significance and identified through the weighting of the ecological factors that determine the diffusion limits and therefore the representativeness as bioindicator.

At the beginning of the new millennium, in completely different cultural and socio-economic conditions from those in which the phytosociology was born, it is necessary to move from the description of phytocoenoses to their ecological weighted characterization as to our science it is asked to work in terms of applications in different areas of sustainable management of land and its resources.

We have seen that for the first time with the application of the various phases of the Habitats Directive when to phytosociology has been asked not only to recognize ecosystems that allow to identify habitats and then SCI areas, but also to participate in the development of Management plans, together with various experts who traditionally handle natural and semi-natural environments.

In this context it is necessary to give applicable answers, by characterizing the identified processes, especially in quantitative terms. After having acquired many knowledge, absolutely essential to let our discipline advance as these form the foundations of it, for example the syntaxonomical and succession types, the real application of our science goes through its quantitative representation. So for example, the vegetation dynamics, already extremely important in the recognition process for managing the sites, become a considerably higher value in the project phase including the time factor, becoming therefore an absolutely predictive model.

The session will express, with different examples, the necessity to interpret in quantity terms the phenomena that we have in the past expressed mainly in terms of quality.

Key words: phytosociology, plant sinecology, quantitative ecology, syntaxonomy.
Relationships between phytosociology and ecology in the Iberian gypsum outcrops

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In the 18th century Cavanilles noted the close relationship between some plant species and the gypsum outcrops. This phenomenon, later known as gypsophily, caught the eye of a large number of botanists and ecologists. In Spain, research tended for decades to adopt a phytosociological approach as far as the gypsum outcrops were concerned and made a remarkable contribution to the knowledge of the distribution and location of these environments. Despite being considered as a simply descriptive approach, the well recorded observation of gypsophily and the individual experience of many researchers actually produced, by means of an inductive procedure, helpful ideas to correctly interpret these ecosystems. Gypsophilous scrubs (Gypsophiletalia order) have been sometimes seen as an extreme degradation of the vegetal cover and sometimes as the best and peculiar response to extreme edaphic and climatic conditions. The EU Habitats Directive adopts the latter interpretation and gives priority to these Gypsophiletalia scrubs. A review of the Spanish geography, particularly of the eastern half of the Peninsula where the gypsum outcrops or aljezares are most abundant reveals that repeated reafforestation attempts have dramatically altered the biological crusts and scrubs. The deleterious effects of wrong decisions based on wrong interpretations last for long. It is not an easy task to correctly interpret the rich variety of the communities recorded on these gypsum environments. The works of Braun-Blanquet and Bolós (near the Ebro river) distinguish three gypsophilous scrub communities. However, other researchers reduce this number to one for the same territory. Between these two maximum and minimum diversity estimates, other researchers consider that there are two communities: a high scrub community and a low thyme scrubland. In order to bring light to this issue, we have studied the Gypsophiletalia scrubs by means of other research approaches: an edaphic and an ecophysiological approach. From an edaphic point of view, different soils can be distinguished as key parameters are concerned, especially soil texture. We have tried to measure the ecophysiological response of different species (Gypsophila struthium, Helianthemum squamatum, Teucrium turredanum, Helianthemum syriacum and Ononis tridentata) to these soils. For this purpose we have made use of chlorophyll fluorescence records. These have revealed that, under the same environmental conditions, the species under study react differently in the period of highest stress. This period corresponds to the mid-summer months at midday.

Keywords: gypsophytes, soil, chlorophyll, fluorescence.

Acknowledgments
The Junta de Andalucía sponsored this research as part of the project “Conservación de la diversidad genética y florística de los afloramientos de yeso en Andalucía: el reto del desarrollo sostenible en un archipiélago edáfico explotado por la minería”.
Mediterranean evergreen species tolerance threshold to air temperature increasing

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Global change effects on Mediterranean region are likely to produce warmer and drier conditions, water deficit and more frequent and stronger drought periods. Increased drought stress may be a discriminant of species abundance and distribution, determining changes in vegetation in the long time. The high plant diversity of the Mediterranean vegetation reflects different adaptive strategies to cope with summer drought stress; when prolonged or more severe drought periods occur, the capacity of the different species to avoid damaging effects determines their survival. Search for those traits indicative of plant species adaptability to environmental constraints is crucial to the understanding of their functional ecology, also in consideration of global change. The main objectives of our researches were to define the adaptive strategies of the most important evergreen species co-occurring in the Mediterranean maquis, and to determine their tolerance threshold to increasing stress factors, in particular to air temperature increasing. The results on the whole underline that the combination of phenological, morphological, anatomical and physiological plant and leaf traits provides the placing of the considered species in different groups, which are characterized by different adaptive strategies. On an average, species characterized by leaves with a higher amount of biomass per unit of area (i.e. high LMA and LTD) might be at a competitive advantage relative to the other ones in regard to drought stress increasing. Moreover, high LMA and LTD values are associated to a longer leaf longevity, which seems to be a key traits discriminating among the typical sclerophillous species and the semi-deciduous ones. Nevertheless, a lower LTD allows a higher CO₂ diffusion path from stomata to chloroplasts which determines a higher photosynthetic capacity. The results can be used to hypothesize trends in traits variations in response to environmental conditions, and to identify global change bioindicators.

Keywords: air temperature, Mediterranean species, photosynthesis, drought stress.
Halophytic vegetation with *Halocnemum strobilaceum* (Pall.) M. Bieb: ecological studies of two populations of this species in Spain and Italy

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Soil salinity is one of the major abiotic stress factors in plant development. Halophytic vegetation growing in natural environments face two main problems, on the one hand the high concentration of salt in the soil that prevents germination phase and the first stages of seedling development, and on the other the difficulty of water absorption, that mainly affect adult plants. In these environments germination phase is a very sensitive stage, even for plants that in adult stage are tolerant to high salt concentrations. Salt tolerance in halophytic communities depends on a range of adaptations embracing many aspects: osmolyte production, germination responses, osmotic adaptation, succulence, selective transport and uptake of ions, enzyme responses, salt excretion and genetic control. A characteristic of this vegetation is the dominance of *Chenopodiaceae* perennial shrub species. Of these species *Halocnemum strobilaceum* is the most scarce in the European salt marshes. Furthermore, it was chosen as a representative species of hypersaline environments and because it is also a protected species reported as “vulnerable” in Italy and as “in critical danger” in Spain, according to the IUCN categories. Likewise, natural communities characterized by this species are included in the Natura 2000 network. The aims of this study were:

- To compare some ecological aspects of *H. strobilaceum* communities in two populations, one of them in Italy, in the North Adriatic area (Riserva Naturale Sacca di Belloccchio) and the other in the mediterranean coast of Spain (El Hondo, Crevillent). Both populations have some degree of protection at a state or local level. - These two populations have differences at a phenotypic level and the objective of the study was to evaluate if there were also differences in the germination behaviour. Likewise the aim was to evaluate the behaviour of seed collected in different years.

**Materials and methods:**

- A climatic characterization was carried out and a series of physical and chemical soil parameters were analyzed in both populations.
- Seeds were collected in November 2005, 2006 and 2008. The optimum germination temperature was established by testing a range from 5 to 40°C, at intervals of 5°C. The germination tolerances to 11 increasing concentrations of NaCl were determined, from 0 to 500 mM.

*H. strobilaceum* is a very salt tolerant species, and its response differ between both populations. However, seeds from southeastern Spain could germinate at a higher salinity than those from Italian population. From the data obtained a comparison between climatic and edaphic conditions of the *H. strobilaceum* communities and an ecological interpretation of the differences in results obtained in seed germination of both populations were carried out. These differences are valued as strengthening the hypothesis of the existence of two different taxa at specific or subspecific level.

**Keywords:** *Halocnemum strobilaceum*, halophytic communities, germination, salt tolerance.
Phenological traits of vegetation: examples of some phytocoenoses from selected vegetation-series

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The symphenological analysis of phytocoenoses allows us to assess the individual and collective rhythms of the growth, flowering and fruiting of plant communities. In the temperate zone, it can be assumed that the phenological timing is optimally adapted to the seasonal period favourable for growth and reproduction and that the natural selection acts by means of synchronising (temperature, rain, frost and drought risks) and asynchronizing factors (competition for resources, pollinators and seed dispersal). Species can be categorized into phenological types selected a priori or by agglomerative methods (clustering) (Puppi et al. 1994). The symphenological pattern of a plant community is usually represented graphically by symphenograms, while the synchrony or the asynchrony (diversity) can be evaluated by numerical methods. Moreover, the analysis of phenological traits of a phytocoenosis can be compared and related with other features and criteria of classification (Taxonomy, Syntaxonomy, Chorology, pollination types, ecological and morpho-physiological traits) in order to assess the relationship between seasonal timing and the other attributes of plants.

Each phytocoenosis has a typical symphenological pattern, that is subject to variations (anomalies) depending on the weather and also on the stress and disturbance level. In Europe, climatic change has already caused a significant shift in phenophases timing: an advance of spring phases and an extension of the growing season. Moreover, species have been found to respond differently to climate change (Menzel et al. 2006): phenano-anomalies can lead to variations in the fitness of some species and consequently the competitive relationships within a plant community will alter, possibly until the loss of biodiversity.

In order to predict the consequences of climatic impact on plants it is important to assess the phenological fingerprints (Root et al. 2003) of the most sensitive phytocoenoses (an example on summit vegetation is given) and to construct pheno-climatic models suitable for forecasting future scenarios.

Besides the climate, the disturbance too can produce "pheno-anomalies" (examples: the effect of mowing a grassland and of defoliation by grubs in a wood). Thus, the analysis of phenological traits of vegetation is a useful tool in characterizing ecological features of phytocoenoses and in predicting the plant responses to the natural and anthropic impact. In fact, a global view of plant communities both in descriptive and functional terms, increases their bio-indication value and their benefit in the applications for the sustainable management of ecosystems.

Keywords: plant phenology, symphenology, diversity, anomalies, fingerprints.

References:
Biodiversity conservation and grazing management: geosynphytosociology as a tool of analysis and modelling of grassland systems

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Following a series of research topics the aims and objectives of this relation are to present the tested process of forage resources modelling at a large scale in a pastoral system in order to define essential management and decision making aimed at biodiversity conservation.

According to the hypothesis of intermediate disturbance (Grime 1973, 1979, 2001; Connell 1978), floristic diversity conservation of grasslands, in a given pedologic and climatic contest, is strongly linked with intermediate stress/disturbance levels. In grasslands stress/disturbance factors are: phytomass removal, trampling, etc.; on the base of these assertions, to consider the plant community submitted to intermediate disturbance, it is necessary that the number of grazing animals corresponds to the number of animals able to remove all the primary production during vegetative season, without provoke damage to the grass sward and to animal welfare. Beginning from these premises the analytical process is based on correlation between phytosociological and agro-zootecnical analysis.

This approach allows to extend any type of heterogeneous data provided this is in any way correlated to the intrinsic characteristics of the plant community, can be interpolated to the whole polygon and therefore to all polygons referring to the same phytosociological unit. In terms of planning and application, the results of phytosociological modelling are much more useful when integrated in a database (GIS), in which the different information levels, based on hierarchical criteria, are simulated in multiple polygon segmentations. Phytosociological approach together with GIS allow the production of phytoecological maps about different subjects (theoretical carrying capacity, floristic value, grazing value, productivity, etc.).

In particular, the showed method allows to obtain a first general overview of the forage resource using the theoretical data linked to the phytosociological interpretation of the territory. Subsequently, this overview can be enhanced with actual quantitative data, offering also a qualitative dimension coming from the phytosociological aspects.

Keywords: geosynphytosociological modelling, plant community, forage resource, carrying capacity, grazing management, biodiversity conservation.

References:
Vegetation series as a tool for the assessment of ecosystem services (ESS) of grasslands in Mediterranean Grazing Systems

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Large Scale Grazing Systems (LSGS) represent one of the most widespread land uses in extensive rural areas of the European Union (Caballero et al. 2008). Grasslands in LSGS have been the subject of biodiversity research from micro habitat to European scale. A strong relationship between grazing and biodiversity has been shown, as well as the importance of this property in shaping other aspects of environmental change (Cingolani et al. 2005). Other functions such as soil C sequestration, water balance, fire control, buffer for water purification, maintenance of local livestock breeds, cultural heritage and regional farming skills, production of typical food can be related to the management of LSGS. Nevertheless, the integrated assessment of these properties is closely related to the specific environmental and socio-economic context. The concept of ESS is the basis for approaching multi-functionality from different perspectives.

To assess and make the ESS of secondary grasslands comparable, a clear space-time reference is needed. The concept of vegetation series may support the modelling of the dynamic succession trajectories in relation to grazing and land use intensity and the identification of different ESS benchmarks associated to each dynamic stage, in order to assess the most effective land uses in meeting ESS objectives.

In this paper we illustrate case studies in which the vegetation series model supported the identification of successional trajectories. Chronosequences were used to replace time with space to compare some ESS such as biodiversity and soil C sequestration of contrasting managed grasslands and woody vegetation under the same vegetation series. The results will be discussed in relation to assessed quantitative indicators of ESS of Mediterranean grasslands and to the effectiveness of the proposed approach.

Keywords: chronosequence, grassland management, plant biodiversity, soil C sequestration.

References:
SESSION 2: PHYTOSOCIOLOGY AS PLANT SYNECOLOGY

Chairman: Edoardo Biondi

PROPOSED ORAL PRESENTATIONS
Vegetation and fauna: essential bio-indicators for the assessment of agro-ecosystems

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One of the most important scientific contributions to the application of the Landscape Ecology’s disciplines is represented by the development of indicators to assess environmental quality. In particular, the use of bio-indicators based on flora, vegetation and fauna allowed a better classification of threatened species and habitats, together with a development of specific environmental policies. Despite this, many of the analysis and methods used in several conservation actions showed some important application limits, especially inside modified ecosystems such as farmlands and urban areas. The importance of agro-ecosystems for the conservation of the whole territory has been universally recognized by the most part of scientific and productive sectors. Nonetheless, there is still a lack of knowledge, methods and experimental trials able to provide a sensitive assessment of actual environmental conditions, and of all corrective actions to be taken. This work presents a method to assess environmental quality inside agro-ecosystems; it is based on a system of bio-indicators used as an analysis tool able to take advantage of all potential information brought by different bio-coenosis. Starting from the innovations of the phytosociological dynamic approach, the main objective is to take into account the results provided by vegetational analysis, concerning the description of land units and phyto-coenotic mosaics, and to improve their information capacity through an integration with quantitative data. These data can be obtained by the application of specific vegetation and faunistic bio-indicators created to be used inside agro-ecosystems. Essential faunistic bio-indicators were chosen for their sensitiveness and suitability inside different application contexts; they can also allow to focus on specific environmental factors undetectable with the vegetation analysis, such as the responses of different keystone species to environmental fragmentation and to insecticides.

This kind of interpretation of landscape dynamics, especially inside agro-ecosystems, is coherent with the application of European Agro-environmental Policies (CAP, RDP, Habitat Dir.), and with the main objective of biodiversity conservation (Countdown 2010). The importance of a knowledge base for the assessment of policies effectiveness is also necessary to evaluate sustainable systems for environmental management inside both natural (protected areas) and agricultural systems.

Keywords: vegetation, fauna, bio-indicators, agro-ecosystems.

References:
Plant communities of Sila Mt. (S Italy): syntaxonomy, biogeography and conservation

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The Sila Massif (South Italy), because of its geographical position (in the centre of the Mediterranean region), geology (a granitic “island”) and peculiar bioclimatic characteristics is a territory of remarkable phytogeographic interest. An analysis of mountainous plant communities has been carried out in order to investigate paleogeographic, ecological and anthropic factors that influence flora and vegetation diversity. The flora of Sila consists of more than 800 taxa relatively rich in boreal elements and with some interesting endemisms exclusive of its territory such as Astragalus calabricus, Armeria brutia, Anthemis hydruntina subsp. silensis, Centaurea sarfattiana, Genista silana, Koeleria splendens subsp. brutia, Luzula calabra, Cardamine silana, Knautia dinarica subsp. silana, ecc. On the basis of ecological and phytogeographical analysis (with special attention to the endemic species) some paleogeographic correlations between Calabrian flora and neighbouring territories are emphasized. Data from literature and field studies (1998-2008) have been analyzed in order to clarify syntaxonomic position of the main vegetation types. Querco-Fagetea and Molinio-Arrhenatheretea are the most represented classes in the area due to the climatic and edaphic conditions and a rich group of boreal species are frequent in wet communities belonging to Calluno-Ulicetea, Scheuchzerio-Caricetea fuscae, Montio-Cardaminetea and Littorelletea uniflorae. This “Nordic imprint” of the flora, vegetation and landscape is of special interest and its peculiarities are analyzed from ecological and biogeographical point of view. Mediterranean and Sub-Mediterranean elements prevail in dry grasslands and shrublands, in particular thorny cushion-like communities characterized by Astragalus calabricus show structural similarities with the tragacanthoid vegetation of Irano-Turanian region. Some problems about dynamics of vegetation are discussed such as the role of black pine communities and their relations with beech forests, trends in bogs and wet grasslands and their interaction with pastures. The phytosociological approach has been applied for better characterization of the habitat types, elaboration of conservation strategies and dynamic territorial governance.

Keywords: Calabrian flora, phytosociology, ecological and phytogeographical analysis.
Coenological and syntaxonomical features of *Sesleria gr. juncifolia* in Italy

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It is known that *Sesleria* Scop., is one of the most important genus in the coenological and physiognomical composition of the montane grasslands of the south-European chains. *Sesleria juncifolia* collective complex is an amphi-Adriatic group of species which exhibits a typically disjunct distributional range including the Carso territory in Friuli Venezia-Giulia region (the extreme north-western fringe of the Balkan range of *S. juncifolia* s.l. group) and the Apennine chain from Apuan Alps to Pollino-Orsomarso National Park (with eastern relictual stations in restricted areas of Apulia region). Owing to a taxonomical arrangement which is not yet completely defined, the syntaxonomical scheme of *S. juncifolia* complex vegetation for the Italian Peninsula is still in progress at present and it is open to eventual changing which are depending on the identity of the dominant species. On the basis of the more recent taxonomical papers, however, four species are known to be occurring in the Italian territory, *S. kalnikensis* Jáv., *S. juncifolia* Suffren, *S. apennina* Ujhelyi and *S. calabrica* (Deyl) Di Pietro. These species give rise to several grassland communities belonging both to *Festuco-Brometea* and *Elyno-Seslerietea* and for which a relatively high number of phytosociological associations were proposed. Most of these associations were related to the open dry grasslands of the subalpine belt of the central Apennines, almost exclusively on limestone substrates. On the contrary less is known about the *Sesleria gr. juncifolia* grasslands which characterises the southernmost limit (Basilicata-Calabria regions) of the entire distribution area of this taxonomical group, as well as of those communities which occur on montainous areas characterised by sub-Mediterranean or even true Mediterranean bioclimatic conditions. Finally only very scattered data are available about the *Sesleria gr. juncifolia* communities occurring on substrates which are different from limestone. In the present paper some new *Sesleria gr. juncifolia* are proposed and, as a consequence, a new syntaxonomical framework of the alliance *Seslerion apenninae* Furnari in Bruno & Furnari 1966 in Italy is arranged.

**Keywords:** amphi-Adriatic chorotype, Apennines, dry grasslands, syntaxonomy.
Phytosociological and ecological characterization of *Gentiana lutea* L. in central Apennine, on the basis of Ellenberg indicator values

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A phytosociological and ecological characterization of the central Apenninic populations of *Gentiana lutea* L., one of the most important species in the European Pharmacopoeias, is here proposed. The vegetational context of some selected populations of *G. lutea* have been analyzed from a phytosociological point of view by carrying out a number of relevés according to Braun-Blanquet’s classic methodology (Braun-Blanquet 1979). The relevés classification was carried out by applying some typical techniques of multivariate analysis (Syn-Tax 5.02 package: Podani 1995) and then referred to some well known associations, in order to point out which phytosociological syntaxa are more interested by the presence of large gentian populations. The ecological analysis was mostly based on the use of Ellenberg’s indicator values (Ellenberg 1974, Pignatti 2005) which, although criticised by many, are still widely used in applied plant ecology (Diekmann 2003); field analysis has been done too, as concerns the soil reaction. The use of Ellenberg’s indicators was applied both to presence/absence and to weighted data; ecograms have been drawn, with reference to every single phytosociologic association. Furthermore, the ecological matrix has been analyzed with special reference to the coverage values of the species *G. lutea* in the different environmental conditions. The measured data of the soil reaction have been used to observe the reliability of Ellenberg’s indicator.

In order to analyze the performance of the populations from different sites, some selected traits have been measured, namely: number of seeds per fruit, weight of the seeds, germinability, growth rate of the radicle. Germinability tests have been repeated with pre-treating, both with hormones and low temperature. Finally, some phytochemical analysis have been carried out with special care for the metabolic products (mainly bitter constituents of the gentian roots, such as gentiopicroside, loganic acid and gentisic acid). The qualitative and quantitative differences among the metabolites have been analyzed with reference to the various environmental conditions and vegetational contexts of the investigated sites, in order to point out the chemotypes with a higher potential of application.

**Keywords:** *Gentiana lutea*, phytosociology, Ellenberg indicator values, plant traits, phytochemistry.

**References:**
Floristic variations analysis due to different disturbance intensities in a grassland of Umbria-Marches Apennine (Central Italy)

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The aim of this research work is to study the floristic fluctuations in a grassland connected to different management types to which diverse disturbance intensities correspond. The study area is located in Prati di Ragnolo, which are in the Northern part of Sibillini Mountains (Central Apennine), at about 1450 m a.s.l.

Theoretical framework follows the theories of Grime (1973) about correlation between species richness in a grassland and stress and/or disturbance intensity. The research-base is composed by phytosociological relevés block carried out in three different years and environmental-management situations (mowing and grazing, only mowing, abandon). Collected data have been processed with statistical analysis (cluster analysis and PCoA) and then integrated with ecological parameters (Biondicator Values). Most remarkable outcomes of the whole research are: 1) at three different disturbance intensities and management correspond three distinguished plant communities; 2) moving from a situation of higher disturbance to one of void disturbance, species of big dimensions and with nitrophylous-ruderals strategies arise in cover or appear, while species with smaller dimensions tend to decrease or to disappear; 3) when the grassland is completely abandoned the mean species number for each relevé increases as regards the other two cases; 4) comparing the floristic set between extreme occurrences (Maximum Disturbance vs Void Disturbance) it is possible to observe a species turn-over of about 60%. This last highlight seems to point out as in Temperate field with Mediterranean bioclimatic influences, Grime’s model fits until stress or disturbance moderately fluctuate. When, instead, the variations of one or both these factors considerably increase, the model which better allows to understand the ecologic-vegetation dynamics that are going on seems to be that hypothesized by Whittaker (1975) about the new fluctuated equilibrium or that supposed by Behnke and Scoones (1993) about quasi-equilibrium which expects the alternation between biotic and abiotic factors in the dominance for driving the system.

Keywords: grasslands management, phytosociological relevés, disturbance intensity, floristic richness.

References:
Hydrophytic vegetation aspects in the Nebrodi mountains (Sicily)

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The vegetation of damp areas in the Nebrodi Natural Park was already surveyed in some studies (Brullo et al. 1994). In particular, the various hygro and hydrophytic aspects were referred to associations belonging to the *Phragmitetea* and the *Potamogetonetea* classes respectively. Small lacustrine habitats in Sicily have disappeared almost everywhere and are conserved still today only in the Nebrodi Mountains. They host widely distributed hydrophytes. Some of these plants are rather localized in Sicily, e.g. *Potamogeton polygonifolius* Pourr. and *Utricularia australis* R. Br. The latter occurs also in the Madonie Mountains. Recent analyses revealed some hollows characterized by an accentuated reduction of the water level in summer. In this context *Utricularia vulgaris* L. was found. This species was previously known in Sicily only from the Sicani Mountains and was not recorded recently. In some hollows of the Nebrodi Mountains this species is quite abundant and together with *U. australis* and *Potamogeton natans* L. forms an association, still unpublished, here proposed in the order *Potamogetonalia* with the name *Utriculario-Potamogenetum natantis*.

References:
Contribution to the knowledge of woody vegetation of the Hyblean territory (S Sicily)

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Due to its geological, morphological, bioclimatic and human peculiarities, Hyblean area differs from the rest of Sicilian territory. According Brullo et al. (1995), it belongs to the Hyblean district of Sicilian dominion. Many interesting naturalistic biotopes with an articulated and differentiated vegetation occur in this territory (Pavone et al. 2007). This study is focused on the evergreen sclerophillous shrubby vegetation as well as oak woods characterized by Quercus ilex, Q. suber, Q. virgiliana and Q. amplifolia. A preliminary overview on the latter vegetation type was made by Pavone et al. (2008). Vegetation analysis was carried out following the phytosociological method (Braun-Blanquet 1964). A cluster analysis, using the software Syn-Tax 2000 (Podani 2001), was performed on a matrix of 227 relevés x 128 species, after transforming the Braun-Blanquet values into quantitative values as proposed by Van der Maarel (1979). The hierarchical classification of the similarity matrix allowed to identify different vegetation types, all belonging to the Quercetea ilicis class. For each plant community floristic, synecological and syndinamic features were examined. This study could be an useful tool for management purposes aiming at habitat conservation and to give a scientific support for territorial planning.

Keywords: phytosociology, woody vegetation, Hyblean territory, Sicily.

References:
Vegetation series of the Southern district of the Lattari Mountains (Southern Apennine, Campania)

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The southern sector of the complex of the Lattari Mountains (Amalfi coast) has been investigated in the last years, due to the poor vegetational knowledge of an area of worldwide relevance (Caneva & Cancellieri 2007). This area, despite the relatively high tourist, agricultural and forest exploitation, shows a scattered housing density, still limited and integrated with the natural environment, that allowed its insertion in the UNESCO World Cultural Heritage List.

The area, located between the Gulfs of Naples and Salerno, shows several environmental peculiarities due to the marked orography that gives rise to a high altimetry variability with a speedy increase from see level to 1400 m and a complex presence of several massifs separated from each other by transversal valleys with different depths and extension. These characteristics, together the coast exposure, originate a high pluviometric regime, with close relationships and mosaics between thermomediterranean and temperate bioclimates (Savo et al. 2007).

The area is also characterized by a carbonate rocky outcrops (meso-cenozoic calcareous limestones and dolomites) belonging to the Alburno-Cervati Unit often over hanged by pyroclastic deposits of varying thickness (ashes and pumices often clayed) given to the eruption of Somma-Vesuvio.

The phytocenotic variability has been investigated in synecological and syndynamical terms throughout the reconstruction of the vegetation series within large territories of the peninsula (Ferriere Valley, Regina Major Valley, Sambuco Valley and others). The phytosociological result concerning the several vegetation communities has been correlated to the landscape structure analysis by a hierarchical ecosystem classification (Blasi et al. 2000). This mean allowed the reconstruction of the several series and the recognition of their right spatial distribution, summarized in a Map of Vegetation Series.

The gorge and deep valleys in the coastal district with mesic microclimatic condition (like Ferriere and Porto Valleys) are a system extremely important in the context of the Sorrentine-Amalfi Peninsula, as well as at regional scale. Several calcareous climatophile series have been identified (such as Cyclamino repandi-Querco ilicis sigmetum, Festuco exaltatae-Acero neapolitanae sigmetum, Seslerio-Acero neapolitani sigmetum, Anemono apenninae-Fago sylvaticae sigmetum) and exhibits Amalfi Coast like a territory with high coenological diversification and hosts different endemic, rare and isolated taxa.

Keywords: phytosociology, syndynamics, series.

References:
Syntaxonomical study of the formations with pine of Alep (*Pinus halepensis* Mill.) in Algerian semi-arid bioclimatic stage

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In Algeria the climacic surface of *Pinus halepensis* is located in the semi-arid bioclimatic stages and sub-wet inferior; but it should be noticed that the action of man involved a translation of this surface from south towards north. The thorough degradation of the vegetation cover on the level of the southernmost part of its current surface leads to the installation of unfavorable microclimatic conditions to the development of *P. halepensis*. The syntaxonomical approach by the sigmatist method, made it possible to specify the phytosociological statute of the groups of species compared to the classification established in the Mediterranean. Sampling thus related to the trainings to *P. halepensis* of the Algerian semi-arid bioclimatic stage in its hot, fresh and cold alternatives. This study made it possible to recognize and describe four alliances and eleven associations joining together eighteen sub associations, being integrated either into the class of *Quercetea ilicis* (forest formations) or to that of *Rosmarinetea officinalis* (matorrals). Each described unit of vegetation was put in perspective at the same time in space (staging of the vegetation) and in time (dynamic series of vegetation). The stages of vegetation classically recognized in low Mediterranean area were observed; the described vegetation groupings are attached to five dynamic series.

**Keywords:** *Pinus halepensis*, phytosociology, semi-arid Algerian, syntaxonomy, Algeria.

**References:**
Syntaxonomic analysis of the halo-nitrophilous vegetation (*Pegano-Salsoletea*) in Italy

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The *Pegano-Salsoletea* Br.-Bl & O. Bolòs 1958 class groups perennial halo-nitrophilous shrubby vegetation dominated by succulent Chenopodiaceae with nanophanerophytic or chamaephytic habit, chiefly growing on clayey or marly substrata. These plant communities occur in the Mediterranean, Saharo-Oceanic and Macaronesian regions (Rivas Martinez et al. 2001), in territories characterized by really hot and arid environmental conditions. In this vegetation several xerophilous shrubs belonging to the genera *Salsola, Atriplex, Peganum, Artemisia, Anabasis, Haloxylo* are physiognomically dominant.

These communities were ascribed by Braun-Blanquet & Bolos (1958) to the class *Pegano-Salsoletea*, and afterwards investigated always for the Iberian Peninsula by Peinado et al. (1989) and Rivas Martinez et al. (2001).

Associations belonging to this class are mainly represented in Sicily (Brullo et al. 1985, Brullo & Siracusa 2000), while more sporadically they occur also in Sardinia (Biondi & Mossa 1992) and Southern Italy (Biondi 1988, Biondi et al. 1992). This peculiar woody vegetation is usually linked to infra- and thermomediterranean bioclimatic belts, more rarely mesomediterranean one, with arid or dry ombrotypes.

The *Pegano-Salsoletea* class is represented in Italy by the order *Salsolo vermiculatae-Peganetalia harmalae* Br.-Bl. & O. Bolòs 1954, with two alliances: *Salsolo oppositifoliae-Suaedion verae* Rigual 1972 and *Artemision arborescentis* Géhu & Biondi in Géhu et al. 1986. The first one includes communities occurring in natural and semi-natural habitats with low human disturbance as badlands, coastal cliffs or near salt marshes. The second alliance groups associations linked to anthropogenic or ruderal stands particularly rich in nitrates.

**Keywords:** phytosociology, *Pegano-Salsoletea*, halo-nitrophilous shrubby vegetation, badlands.

**References:**


Bryosociological synopsis for Italy

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This study groups all the bryophyte syntaxa up to now reported from Italy, revised from a nomenclatural and synsystematic point of view according to the International Code of Phytosociological Nomenclature (Weber et al. 2000) and following the syntaxonomic arrangement of Marstaller (2006). Among the surveyed syntaxa we point out some subalpine and alpine associations, occurring on the Alps and radiating to the center of the Mediterranean region in the highest parts of Etna (Privitera & Puglisi 1996, 2004) and Aspromonte; the occurrence of many Mediterranean associations, some of these markedly xerophytic, is likewise significant. At present it is possible to recognize in Italy more than 120 associations referred to 12 phytosociological classes, considering that the bryosociological classes known in literature are only 13. The most widespread class is Barbuletea unguiculatae Mohan 1978, a terricolous, thermophilous and mostly basophilous syntaxon including 41 associations signaled for Italy referred to all the orders and alliances up to now described. The presence of the terricolous, acidophilous and orophilous classes Ceratodonto purpurei-Polytrichetea piliferi Mohan 1978 and Cladonio digitatae-Lepidozietea reptantis Jezek & Vondraček 1962, occurring on the Lombard Alps and the high parts of Etna, is also emphasized. Another terricolous class, including sciophilous syntaxa, is Pleurochaeto squarrosae-Abietinelletea abietinae Marstaller 2002, quite spread in Italy. The saxicolous bryophyte vegetation is represented by the acidophilous class Grimmietea alpestris Hadac & Vondraček in Jezek & Vondraček 1962 and the basophilous classes Grimmietea anodontis Hadac et Vondraček in Jezek et Vondraček 1962, Ctenidietea mollusci v. Hubschmann ex Grgic 1980 and Neckertea complanatae Marstaller 1986. The terri-saxicolous, montane and alpine class Hylocomietea splendentis Marstaller 1992 is represented in Italy by the association Pleurozietum schreberi Wisniewski 1930, surveyed only in the region Trentino Alto Adige. The class Platyhypnidio-Fontinaletea antipyreticae Philippi 1956 groups the hydrophilous and hygro-hydrophilous associations, with the widespread Oxyrrhynchietum rusciformis Gams ex v. Hubschmann 1953. The class Frullanio dilatatae-Leucodontetea sciuroidis Mohan 1978 includes the strictly epiphytic associations, among which Syntrichietum laevipilae Ochsner 1928 and Leptodontio smithii-Leucodontetum sciuroidis Privitera & Puglisi 1996 are widely represented in Italy. Finally, the most peculiar bryosociological class is the endemic Campylopodetea vaporarii Brullo, Privitera & Puglisi 2004 ex Privitera & Puglisi 2006, occurring only in the fumaroles stations of the regions Campania and Sicily.

Keywords: bryophyte, Italy, phytosociology.

References:
Evaluation of vegetation of a Mediterranean littoral area in Alicante (Spain)

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This study covers the investigation and evaluation of the vegetable coating existing in the coastline from the Saline of Agua Amarga until the Santa Pola Cape (Alicante, Spain) as a part of the plan for the coastline arrangement.

To this aim reach this objective the methodology used has been articulated in two main elements:

- The classification of the vegetables communities which are present in the area of study following the phytosociological methodology of the Zürich-Montpellier School (Rivas-Martínez et al. 2001, 2002).

- The use of a SIG in the cartography of the vegetables formations, developing a coating from the photointerpretation of digital orthophoto in which each polygon is assigned with:
  - The existing phytosociological associations, up to a maximum of five, are arranged according to their covering and dominance.
  - The codes of the Habitats Directive, when any of these associations is considered in it (Bartolomé et al., 2005).
  - The capacity to represent other communities, their conservation and their potentiality.
  - The different legal protection measures, if any (LICs, local protected area, maritime and land public area, Coastal demarcation (DPMT), ZEPAs and other natural protected spaces/nature reserves)
  - Global evaluation.

Combining the phytosociological approach and the SIG analysis with the applicable legislation a good tool for the administration and evaluation of the environment is achieved. We obtain the cartography of 376 units which include a total of 76 associations of coastal communities: dunes, halophytics, saltmarshes, saltmeadows, sea cliffs, grassland, sclerophyllous scrub and wetland vegetation. The Habitats Directive considers 40 of these associations and 4 within them are designated as to have a priority. Furthermore 582 vegetables species are also inventoried, 18 of them are endemic and three (of the Limonium genus) have nearly a limited distribution in this area of Alicante.

The final evaluation of the cartographic units obtained may guide the regulation of the activities in this territory, trying to preserve the units with major interest and under higher degree of threat. This approach may lead to the development of a group of measures and actions that allow the regeneration of the units degraded and with good potential in a compatible manner with the rest of uses.

Keywords: coastline, Alicante, phytosociological inventory, GIS, vegetation evaluation/assessment, Habitats Directive.

References:
Botanical recovery models for river restoration in the Guadalquivir Basin

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Nowadays most of the rivers have a high disturbance level. The constant loss of their natural features makes necessary to take action to restore such valuable and sensitive environments. In this framework we present the methodological foundations to develop botanical models that identify common native species occurring along the riverbank to provide a valuable tool for river restoration. First of all a previous study of the physical environment, Bioclimatology and Biogeography has to be performed. This information is essential to establish the edaphophilous series (geoseries) that characterize the Guadalquivir River (Salazar & Valle 2004) and its numerous tributaries in order to identify ecologically uniform stretches (Valle 2007). Once the geosere has been defined for each band and bearing in mind the represented communities, the modelling of restoration can be briefly summarized in the following stages: Obtaining a list of species in each geosere made out of plants that characterize each community. Species selection for restoration considering the more frequent ones. Establishing vegetation bands depending on communities and species requirements. Developing the structure of the different models taking into account Hydric and Hydraulic regimes (Costa 2004). This work has been carried out in the frame of different research contracts funded by the Hydrographic Confederation of the Guadalquivir in agreement with the University of Granada.

Keywords: geoserie, Guadalquivir Basin, models, restoration.

References:
SESSION 2: PHYTOSOCIOLOGY AS PLANT SYNECOLOGY

Chairman: Edoardo Biondi

PROPOSED POSTER PRESENTATIONS
Geosynphytosociological models of plant landscape in a large scale sub-coastal hilly area of the central Adriatic Sea

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The presented research is part of the investigations conducted by the team of Geobotany belonging to the Marche Polytechnic University in order to realize geosynphytosociological models of plant landscape in Italy. The study area is located in the Italian side of the central Adriatic sea, extending in a westerly direction for about 30 km in the plio-Pleistocene hills of the Marche region, whose maximum drop is around 500 m of altitude. The sub-coastal sector is characterized by the mediterranean macrobioclimate, mesomediterranean bioclimatic belt, while in the inner part of this area, it changes to temperate macrobioclimate of the sub-mediterranean variant. A recent phytosociological investigation (Allegrezza et al. 2006) could highlight the high phytocenotic biodiversity of this territory that correlates closely with its geo-morphological variability which are also corresponding microclimatic variations within each lithological and bioclimatic units allowing to enhance the bioindicator value of plant associations. The synphytosociological and geosynphytosociological analysis carried out, have allowed to produce models of plant landscape of the area.

Keywords: phytosociology, landscape models, geomorphology, geosynphytosociology, synphytosociology.

References:
Vegetation and plant landscape of the Pescacci wide landslide (Marchean preapennine, central Italy)

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Here is presented a phytosociological study of vegetation and plant landscape of a Marchean preapennine sector (site’s name is Pescacci) in central Italy, interested by an old wide landslide.

The landslide evolution, during time, determined a progressive alteration of both slope profile and superficial hydrological conditions, creating different edges scarp, steps, trenches, water emergencies, with the consequent increase of floristic and vegetation variety.

At the base of the landslide scarp is very important to highlight the presence of a mixed wood dominated by *Fraxinus oxycarpa* which was not mentioned in a former floristic and phytosociological study.

The phytosociological analysis results confirmed the close relationship between vegetation and geomorphology and the great significance of vegetal associations as bio-indicators. The great floristic and phytocenotic biodiversity that was found, (15 plant community) is tied to the geomorphological diversity determined by the evolution of the landslide. The great geomorphological variety determines the vegetation typology and the dynamic relationship between the associations present. Furthermore, the phytosociological analysis revealed the presence of three wood community types belonging to the Populion albae Br.-Bl. ex Thou 1948, which is rare in the Marchean territory and Italian peninsula and new for the Marchean preapennine. Considering the great phytocenotic biodiversity present in a small territory, the rarity and interesting bio-geographic communities and the presence of three European Natural habitat types (91AA* Eastern white oak wood, 91FO Riparian mixed forests of *Quercus robur*, *Ulmus laevis* and *Ulmus minor*, *Fraxinus excelsior* or *Fraxinus angustifolia*, along the great river (*Ulmenion minoris*) and 91AO Salix alba and Populus nigra galleries), the institution of a new Site of Community Importance (SCI) for the territory in object is recommended.

The proposal of a Site of Community Importance (SCI) and of a Geosite (a team of geologists and geo-morphologists is currently working on creating one), is submitted in order to achieve an integrated overview of the landscape and a better understanding of the complexity of the ecosystem.

Keywords: geomorphology, plant landscape, phytosociology, Site of Community Importance (SCI), geosite.
Structure, dynamics and composition of salt marshes and salt ravines communities dominated by *Tamarix* in the Iberian Peninsula

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*Tamarix* is the main genus in the halophilous groves of the Iberian salt marshes and ravines woodlands. This is a taxonomically complicated genus in which its different species have often been incorrectly identified. In fact, these identification mistakes were often reflected on the syntaxonomy. This study has been developed in different phases. First of all, a phytosociological table is presented, showing the *Tamaricetalia* order in the Iberian Peninsula, whose alliances, *Tamaricion africanae* and *Tamaricion boveanocanariensis*, are dominated by *Tamarix* communities. On second place, the phytosociological methodology was used to describe the composition of those communities. Statistical free code program “R” was used to analyze the data provided by phytosociological surveys. After that, the communities structure is explained showing the differences between both habitats: salt ravines and salt marshes. These differences are due to the kind of flood and its duration, as this is a key factor for the higher or lower soil salt concentration values, and in turn, for the vegetation structure. On the other hand, the different ways by which salt gets into the soil, either by linear currents in salt ravines (or in salty rivers) or by horizontal fluxes in salt marshes, also generate a different vegetation structure. Finally, the different vegetation series succession dynamics for the *Tamarix* salty woodlands are commented.

**Keywords:** *Tamaricetalia*, phytosociology, vegetation structure, vegetation dynamics.
Postcultural vegetation dynamics: Rio Vallone country case study (Po Plain, Italy)

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The aim of this work is to analyse the vegetation dynamics in abandoned fields in a sample area situated in the Rio Vallone neighbourhood (Milan, Italy). The area is located on Pleistocene and Holocene alluvial sediments of the upper Po Plain and covers 1181 hectares.

The temporal changes in the vegetation have been studied according to the chronosequence or space-for-time substitution approach, which consists in the positioning of relevés in sites of different—preferably known—age at given time intervals, assuming that the samples would represent the distinct stages of a temporal series (Pickett 1989, Foster & Tilman 2000). The historical study was realized by comparing orthocorrected aerial photographs of different years (1998, 2003 and 2006).

Fifty-six relevés were made by using the phytosociological approach and two matrices were constructed from the resulting data set in order to analyse the relationships between ecological variables and the different vegetation cluster. Matrices were processed separately (relevés x species and ecological index average values x cluster) through a multivariate analysis approach (PCA) with SYN-TAX 5.0 software (Podani 1995).

The results show that some ecological factors are useful to describe the vegetation dynamics. Cluster distribution seems to be related to only four indexes defined upon ecological gradients: soil moisture value (F); soil pH value (R); soil nutritive matter value (N); and light intensity value (L). Two different dynamic series of vegetation were reconstructed on the basis of historical ecological factors ones.

The alluvial mesophilus series develops from the first herbaceous stage belonging to the Chenopodietalia albi and Onopordetalia acanthii to Robinia pseudacacia dominant woods referable to Fagetalia sylvaticae (Carpinion betuli). The alluvial higrophilus series is more structured and develops from the first herbaceous stage belonging to Bidentetalia tripartiti to a second herbaceous-shrubland stage referable to Onopordetalia acanthii and Convolvuletalia sepium, and eventually to Prunetalia spinosae forest-edge. The last stage of the acidophilus series is represented by woods referable to Quercion robori petraeae.

Keywords: abandoned fields, vegetation dynamics, series of vegetation, ecological factors.

References:
The vegetation of temporary ponds of Sardinia

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The Mediterranean temporary ponds are considered priority habitat in the Directive 92/43/EEC (habitat n. 3170*) and detailed information on their floristic composition and susceptibility to invasive species seems a central issue for their preservation, because the development and maintenance of seasonal vegetation is merely the resultant of the development and maintenance of its component individuals. Sardinia presents fairly large extensions of land where such habitats are still well represented, thought not investigated in depth. Basing on literature and unpublished data, a survey on the current phytosociological knowledge of the temporary ponds of Sardinia is presented. Our field studies led to the first recognition in the island of 22 associations, of which 13 were new.

Out of them, 16 have been ascribed to the Cicendio-Solenopsion laurentiae, grouping ephemeral acidophilous spring vegetation with Mediterranean-Atlantic distribution, one to the Isoetion, that differs from the previous one in having an earlier drying up, and further 6 to the Verbenion supinae, grouping summergreen subnitrophilous prostrate vegetation linked to long-submerged sediments of the Euro-Mediterranean area. Besides of the phytosociological characterization, for each syntaxon the susceptibility to invasive species has been indexed, basing on the following criteria: status of the non-native species according to the classification of Pysek et al. (2004), occurrence and frequency of the non-native species, dispersal strategy of the same, kind of preferred habitat (natural/artificial).

Keywords: alien species, conservation, Isoëto-Nanojuncetea, therophytic communities.

References:
Dynamic of the terrestrial vegetation of the Scandola Nature reserve (Corsica) between 1984 and 2007

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Within the context of the scientific studies held on the Nature reserve of Scandola, the vegetation mapping of the 910ha of the terrestrial part of the reserve was realised in 2007, following the phytosociological typology of Gamisans 1991, Géhu & Biondi 1994, in order to compare its dynamic with the map of 1984 (Gamisans & Muracciole). In 2007, the evolution of the vegetation shows a progression of the Quercus ilex high maquis. Low maquis also progressed by evolution of Cistus communities with elements of low maquis, while pure Cistus communities disappeared. Chasmophytic communities of the inner part of the reserve decreased and were progressively colonised by elements of the low maquis. This analyse stresses the importance of ancient mapping data, in order to characterise medium and long term dynamic trends, as well as the key-role of nature reserves in the assessment of global change effects on the biodiversity.

This vegetation mapping represents a tool for knowledge and management of the nature reserve: reference site about long term dynamic of mediterranean maquis in the context of disparition of traditionnal goat grazing and decrease of grazing due to feral herbivorous; evaluation of non-interventionnist management all over the territory of the reserve which was not affected by fire since several decades; evaluation of the state of conservation of natural and semi-natural habitats.

Keywords: Scandola Nature reserve, vegetation mapping, long term dynamic.

References:
Syntaxonomical revision of *Cynosurion cristati* in the Italian peninsula

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The alliance *Cynosurion cristati* (*Arrhenatheretalia, Molinio-Arrhenatheretea*) was described by Tüxen for the mesophilous grasslands of Central Europe and Alps. It includes secondary communities, dominated by hemicryptophytes, that develop on flat areas from the hilly to the mountain zone, on mesotrophic soils with good water availability. These grasslands are subject to intensive grazing and, usually, to mowing once a year. This alliance has been defined as occurring doubtfully in Italian peninsula by Central European authors (Zuidhoff *et al.* 1995). Also several Italian plant sociologists underlined the need for in-depth studies on this subject because of the differences between Italian and Central European communities referred to this *syntaxon*, whose diagnostic species can occur frequently in other vegetation types. On the other hand, *Cynosurion* coenoses were recognized by Italian vegetation researchers towards the very end of the Peninsula. However, all these authors witnessed a general impoverishment in order and class diagnostic species along with a significant occurrence of species referred to *Festuco-Brometea* (Biondi & Ballelli 1995, Blasi *et al.* 1998). In order to investigate differences and similarities between European and Italian communities, we took into account relevés and synoptic tables from different parts of Europe; and all the relevés tables relevant for an overview of this vegetation type in Italy (Alps, Apennines and Sicily), including original data from Central and Southern Italy. We built a synoptic table with 54 columns that was analysed through multivariate analysis (Podani 2007). The groups highlighted by these analysis were used to compare different communities in terms of chorology and life forms. Based on these groups, a species fidelity measure (Chytrý *et al.* 2002) was used to identify diagnostic species for Italian peninsula. Furthermore, an individual relevés table was built using stratified resampling of phytosociological data (Knollová *et al.* 2005). Our results suggest that the communities surveyed in Central-Northern Apennine can be referred to the alliance *Cynosurion*; while for the coenoses occurring on the Tyrrhenian side of Central and Southern Apennine an autonomous *syntaxon* is needed. In fact, these communities display a further impoverishment in diagnostic species of class and order; on the other hand many species of the classes *Festuco-Brometea, Artemisietea*, and *Tuberarietea* showed higher fidelity indices. For these geographical sector a new alliance is proposed here. The need for a new alliance is confirmed by strong differences in chorological types and life form patterns, that highlights a relevant role of annual and Mediterranean species.

Keywords: mesophilous grasslands, phytosociology, multivariate analysis, fidelity indices.

References:
Phytosociological and distributional researches on the grasslands of the class Lygeo-Stipetea in western Sicily

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The thermo and meso-xerophilous pseudo-steppic vegetation is widespread in the driest areas of the Mediterranean Region and is primarily referred at the class Lygeo-Stipetea. This sintaxon includes communities dominated by several hemicyrptophytes, which are also associated to some geophytes and therophytes. In Sicily this vegetation is distributed from sea level to 1300-1400 m, on different substrates (limestone, gypsum, schists, calcarenites, conglomerates, etc.), within the thermo and mesomediterranean belt dry to subhumid. Principally, are secondary grasslands used for grazing, localized on previously deforested areas, where the periodic burnings play a fundamental role in maintaining these habitats. In fact, the decline of the grazing activities gave origin to dynamic processes with consequential modifications at the physiognomical and structural level, producing the gradually recovery of the climactical forest.

In the ecological succession, grasslands represent one of the more degraded subseral stages of the maquis of Quercetalia calliprini and of the climactical forest of Quercetalia ilicis.

This paper presents the preliminary results of a phytosociological and distributional research on some grassland formations of north-western Sicily spread from coastal to mountain areas (Palermo Mountains, Madonie Mountains, Sicani Mountains, etc.). These aspects are included in the orders Lygeo-Stipetalia (alliance Moricandio-Lygeion) and Hyparrhenietalia hirtae (all. Hyparrhenion hirtae and Avenulo-Ampelodesmion mauritanici), referred to several associations, many of which known in literature (Helictotricho convoluti-Ampelodesmetum mauritanici, Hyparrhenietum hirto-pubescentis, Pennisetetum setacei-Hyparrhenietum hirtae, Asteretum sorrentini, Lygeo-Lavateretum agrigentinae, Lygeo-Eryngietum dichotomi ecc.) (Minissale 1995, Brullo et al. 2002).

The same coenoses are sometimes very common in the territory, as in the case of the grasslands dominated by perennial grasses (Ampelodesmos mauritanicus, Hyparrhenia hirta, Pennisetum setaceum) that colonize the deforested slopes of most reliefs, characterizing large areas of the Sicilian landscape. Other formations show a scattered distribution, as some pioneer communities dominated by Stipa sp. pl., in the mountain ridges (Caldarella & Gianguzzi 2007), and by Aster sorrentini in clayey badlands.

Keywords: grasslands, Lygeo-Stipetea, phytosociology, vegetal landscape, Sicily.

References:
Floristic characteristics of semi-arid old field along a salt gradient

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When farmlands are abandoned the herbaceous species predominate during the first years but are gradually replaced by woody species. In Mediterranean semi-arid environments perennial plant communities that settle can remain for decades after the abandonment (Noy-Meir 1973, Fowler 1986, Lasanta et al. 1995). These communities are straightly influenced by climate, but also by some other features like the availability of seed sources, lithological and edaphic characteristics, topography and orientation, interspecific relationships, human management, etc.

Seven perennial plant communities have been identified in previous studies (Cañadas, 2008) conducted in semi-arid old fields in the Baza Basin (Granada, Spain). Quantitative floristic samplings of all associations were carried out and soil samples were taken for analysis. The study of floristic and edaphic variables confirmed soil determines the establishment of vegetation in old-fields of this territory. In particular, edaphic variables related to salinity, moisture and gravel content accounted for most of the floristic variation according to Canonical Correspondence Analysis (CCA) performed.

This paper focuses on the floristic characteristics of these associations and how salinity influences them. With this aim edaphic and floristic data were analyzed using statistical techniques such as one-way ANOVA and correlation analysis. More than seven thousand individuals were registered in the plots, belonging to 37 species of nanophanerophytes, chamaephytes, graminoid hemicryptophytes and geophytes. From a phytosociological viewpoint the most frequent species were characteristics of Pegano-Salsoletea followed by a remarkable representation of Sarcocornietea fruticosae. Compositae species provided greater abundance values, mainly owed to the role of the genus Artemisia, whereas Chenopodiaceae species offered more coverage. Regarding life-form, most of the taxa recorded were chamaephytes.

Furthermore, results revealed that the communities with more coverage had lower abundance and vice versa. Variables directly related to salinity, as electrical conductivity or ionic content (SO₄, Mg, Ca, Cl), were correlated positively with the coverage but negatively with the richness and abundance. Therefore, communities that had higher species richness and abundance were located in soils of lower salinity, whereas communities characterized by greater coverage settled on saline and highly saline soils. The results identified both communities and species as bioindicators of saline conditions.

Keywords: soil salinity, old fields, coverage, abundance, richness.

References:
Preliminary analysis of overgrazing effects on floristic structure in tropical subdesertic grasslands (Peru)

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It is well known nowadays that the livestock pressure and the herbivores selection represent fundamental factors for the definition of floristic composition of a grasslands (Grime 1973).

Particularly, plant species must develop strategies to ensure the survival of their populations using adaptations as avoidance and tolerance by which they seek to withstand herbivory (Briske 1996, Crofts & Grayson 1999).

The effectiveness of these strategies is not constant but depend of herbivory intensity, so if livestock pressure is very high many of the species present in the plant community should tend to disappear, according to the intermediate disturbance theory (Grime 1973). In these conditions, only entities that are able to avoid the bite of herbivores it should remain or succeed in the plant community.

With the aim to test this hypothesis, this research work shows the first observations in the tropical subdesertic environment (Southern sector of the Peruvian Andes).

In High Andean zone, the breeding of South America domestic camelids are the first economic activity, so the continuous disturbance of herbivores throughout the year induces many floristic changes in plant community.

More particularly the *Tetraglochin strictum* plant community (Canllar) neighbour the Pampa Cañahuas village (Salinas and Aguada Blanca National Reserve - Peru) has been studied. The first results seem to show a model that expects the main presence of species which are able to avoid the herbivores bite, such as spiny or prostrate plants. Another essential adaptation to avoid grazing pressure is represented by clonal reproduction and regeneration strategies. In fact laterally spreading, stoloniferous and rhizomatous species or placement at the soil level of flowers and seeds, often recovers quickly after heavy grazing or damage.

Keywords: livestock pressure, Peruvian Andes, avoidance, tolerance.

References:
Geosynphytosociological landscape analysis of Salinas and Aguada Blanca National Reserve as a tool for actual plant mosaic understanding

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The Salinas and Aguada Blanca National Reserve (Departments of Arequipa and Moquegua) is located in the Southern Peruvian Andes between 2800-6000 m a.s.l. This is a volcanic area characterized by plateau where local people has always exploited the natural resources, especially natural grasslands, which are used for animal husbandry. Since 30-40 years this activity was increased as well as livestock pressure and people requirements.

So, prolonged human activity and wrong grazing management have altered the original plant landscape, thus today there are many problems with interpretation and management of actual plant mosaic.

Beginning from the year 2008, under a joint project between the Department of Environmental Sciences, University of Camerino and the N.G.O. Desco (Reserve Administrator), a research started to clarify the ecological-vegetation framework of the protected area.

Nowadays a broad phytosociological research is going on, in order to define and understand the vegetation series which develop in the study area. Dynamical landscape interpretation has already allowed to propose predictive models for the widespread grassland type existing into the Reserve, fisonomically distinguished by Festuca orthophylla, even if we don't have a definitive sin-sistematic framework.

This study is showing that secondary successional grasslands are originated from removal of high-altitude shrublands called “Tolar”. In these shrublands Festuca orthophylla grows in subordinate pattern with cover values lower than 15-20%, while it becomes dominant in areas without shrubs (cover values 40-60%).

In addition, some grassland community with Festuca orthophylla may be considered of primary origin, while other types come from the removal of Polylepis sp. forests (Queñual). This poster shows the first hypothesis to understand the Salinas and Aguada Blanca National Reserve plant landscape in a dynamic-ecological way.

Keywords: plant landscape, vegetation series, predictive models.
The relict ecosystems of termophilous and laurel forest as biodiversity hotspots in Fuerteventura Island (Canary Islands, Spain)

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A study about the relictic communities of the termophilous (Mayteno-Juniperion canariensis, Oleo cerasiformis-Rhamnetea crenulatae) and laurel-forest (Visneo mocanerae-Apollonion barbujanae, Pruno hixae-Lauretea novocanariensis) vegetation of Fuerteventura is presented. The former are found mainly between 350 and 650 m altitude in the central parts of the island (Betancuria-massif), whereas the latter are confined to very small, abrupt cliff areas situated between 650 and 800 m height at the southern extreme of the island (Jandía-peninsula). These communities are small remnants of two types of vegetation well represented on the central and western Canaries. At present they are only confined in the island to very small localities. Its scarcity is partially related to bioclimatic factors but fundamentally is a consequence of the intense use of the natural resources by humans since the settlement of the islands, which took place from around 2100-2200 years before present until now.

A chorological study of plant-associations belonging to the alliances quoted before, based on Geobotanic Information System (GBOTIS) (Martín Osorio et al. 2005), as well as a synthetic phytosociological table of these associations is carried out. A syntaxonomical scheme and a study of the structure of vegetation are included and a geocatena of the studied areas is submitted.

Keywords: Mediterranean region, GIS, Oleo-Rhamnetea crenulatae, Pruno-Lauretea novocanariensis, relictic ecosystems, biodiversity hotspot.

References:
Phytosociology of mesophyous woods on morainic hills of West Lombardy

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Aim of the present study is the phytosociological definition of the mesophyous oak-hornbeam forests on morainic hills in the provinces of Monza-Brianza, Como and Lecco. This territory is called Brianza and it’s strongly fragmented because of the intense human impact. The area is particularly interesting because it stands between two geological substrata: calcareous in the east part of Lombardy and siliceous in the west part. Totally 154 relevés have been realized, with the presence of Quercus robur and/or Carpinus betulus in the tree stand. After the elaboration with the Cluster Analysis, the three subset of relevés have been included in Carpinion betuli Issler 1931 em. Oberd. 1957 alliance, because of the presence of several west-distributed species like Potentilla sterilis, Carex brizoides, Oxalis acetosella.

Characteristic species of Erythronio-Carpinion (Horvat 1958) Marincek in Mucina et al. (1993), such as Erythronium dens-canis, Crocus neapolitanus, Galanthus nivalis, Lonicera caprifolium, Omphalodes verna ed Helleborus odorus are extremely rare. “Illyricoid” species, e.g. Lamium orvala, Cyclamen purpurascens, Anemone trifolia, Euphorbia carniiola, Aposeris foetida, Hacquetia epipactis, Knautia drymeia, Epimedium alpinum (Poldini 1989) or Ostrya carpinifolia (Mucina et al. 1993) are absent. A new sub-alliance has been introduced, characterised by species distributed mainly in the south part of the Alps, like Doronicum pardalianches, Luzula nivea, Geranium nodosum and Leucojum vernum. Three associations have been described: Symphyto tuberosi-Carpinetum betuli (nova hoc loco) for oak-hornbeam woods rich in geophytes; Holco mollis-Carpinetum betuli (nova hoc loco) for hornbeam-black locust woods rich in acidophyous herbs; Salvio glutinosae-Fraxinetum Oberdorfer 1964 for mixed chestnut woods.

Keywords: mesophiilous oak-hornbeam woods, morainic hills, phytosociology, West Lombardy.

References:
SIVIM, an on-line database system of Iberian and Macaronesian vegetation (http://www.sivim.info)

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SIVIM (in Spanish, Sistema de Información de la Vegetación Ibérica y Macaronésica) is a vegetation data system designed for capturing, hosting, editing, analyzing and outputting georeferenced vegetation data. It was created to be a helping tool in scientific research and assessment of decision making on land planning and management. SIVIM was born in the frame of a national funded research project of the Global Change, Earth Sciences and Biodiversity Program. It was formally open last year with the web site located in the Department of Plant Biology of the University of Barcelona. The programs (servlets) are written completely in the Java language allowing consulting and downloading vegetation data (both inventories and tables) in XML format (compatible with the package VegAna, tools for vegetation analysis and edition, freely available in the same web site). Nowadays, the SIVIM database counts with almost 80,000 phytosociological relevés (mainly from central and northern Spain as well as Balearic islands) containing 1,500,000 floristic records; these latter will be available to being consulted not only in the SIVIM but also in the national (http://www.gbif.es) and international (http://www.gbif.org) GBIF nodes. One of the project goals by the end of 2009 is to reach 100,000 Ibero-Macaronesian vegetation relevés which would represent two thirds of the lower estimation of accessible data in the territory. Unlike other vegetation databases, SIVIM is conceived to offer direct and free online access to the relevés, tables, and floristic, syntaxonomic or bibliographical records through versatile queries. The module Quercus of VegAna allows conversion of vegetation data from XML to other common data formats. To improve the applied uses of the database and broaden the range of its users, all relevés are being georeferenciated (at the accuracy of at least the UTM 10x10 km grid), and the nomenclature of plants updated or even corrected (conserving the original name in any case), according to a taxonomic thesaurus and with the scientific support of regional experts on vegetation and flora. In the immediate future the goals will be to complete the labour of digitization and validation of data, and implement new features like automatic filters for mistake detection, databases with plant attributes and software for modelling species distributions.

Keywords: data bank, relevé, Iberian and Macaronesian vegetation.
Orophilous aspects of relictual vegetation of the class *Rhamno-Prunetea* localized on the Madonie Mountains (NW Sicily)

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The deciduous shrubby mantle communities referred to the class *Rhamno catharticae-Prunetea spinosae* are secondary communities - sometimes permanent - localized in the climactical dominion of the forests of *Querco-Fagetea* and *Quercetea ilicis* or the riparian woodlands of *Salici-Populetea nigrae*. These communities are widespread from the Euro-Siberian to the Mediterranean region, and are linked to rich nutrient humic soils, rocky slopes and screes (Rivas Martinez et al. 2002). In Italy, the class *Rhamno-Prunetea* is represented by the alliances *Cytision sessilifolii*, *Berberidion vulgaris*, *Pruno-Rubion ulmifolii* and *Salici-Viburnion opali*, the latter showing hygrophilous character (Poldini et al. 2002).

As concerns the mountain and submountain shrubby communities of southern-Italy and Sicily - excluding the orophilous vegetation of the class *Pino-Juniperetea* - these have been included so far in the alliance *Pruno-Rubion ulmifolii*. In fact, the communities referred to the others alliances become gradually more scattered on the central Apenninic reliefs, where even the *Berberidion* was known up to Abruzzo mountains of Gran Sasso, Velino, Sirente and Maiella (Cutini et al. 2002).

In this paper it is reported the first record of aspects of primary vegetation of the alliance *Berberidion vulgaris* in northern Sicily, restricted in a limited area of high Madonie mountains. These are relictual fragments localized along the northern slopes of several reliefs, near the screes, detritic cones particularly steep, and are dominated by mesophilous entities of the order *Prunetalia spinosae* and class *Rhamno-Prunetea* (*Lonicera xylosteum*, *Rhamnus catharticus*, *Rubus canescens*, *Euonymus europaeum*, etc.), associated with other species of the alliance *Berberidion* (*Ribes uva-crispa*, *Rosa sicula*), other endemic taxa are present (*Prunus mahaleb* subsp. *cupaniana*, *Berberis aetnensis* and *Sorbus aria* subsp. *cretica*) regarded as gevicariants of the characteristic species of the latter alliance (respectively, *Prunus mahaleb* subsp. *mahaleb*, *Berberis vulgaris* and *Sorbus aria* subsp. *aria*). The presence on the Madonie Mts. of other elements of the *Berberidion* - i.e. *Cotoneaster nebrodensis*, *Rosa montana*, *Rhamnus saxatilis* subsp. *infectorius* and *Amelanchier ovalis* subsp. *embergeri* (vicariant of *A. ovalis* subsp. *ovalis*) - must be considered as a further confirmation of the residual character of the sicilian population of this syntaxon, isolated at the extreme south of its distribution area, where probably it would be referred to a new endemic punctiform suballiance.

Keywords: *Rhamno-Prunetea*, *Berberidion vulgaris*, vegetal landscape, Madonie Mountains, Sicily.

References:


Soil-vegetation relationships in the magnesicolous habitats of the National Park of Sierra Nevada (south of Spain)

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The mountain range of Sierra Nevada presents one of the highest diversity rates of the Mediterranean basin as far as flora is concerned. The altitude, which reaches up to 3,481 a.s.l. on the Mulhacén Peak, makes the territory suitable for a large number of boreo-alpine taxa and a huge number of endemic species. The isolation of the peaks have undoubtedly promoted the speciation of some plant lineages. However, it is not only the high mountain habitats that have induced a peculiar flora. The limestone-dolomite rim, with the prominent examples of Trevenque and Los Alayos, also shows a botanical richness as important comparatively as that of the siliceous core, of a metamorphic character (Mota et al. 1993). In particular, a large number of endemic species grow in the dolomitic and extremely xeric sandy areas. As happens with other kinds of peculiar rocks, such as gypsum and serpentine outcrops, dolomites have given rise to an exclusive flora with obvious adaptive signs induced by the stressing environmental conditions. These hard environmental conditions have probably provoked the ecological isolation causing the occurrence of endemic species. Recent studies suggest that some edaphic factors may ultimately be responsible for all this differentiation and speciation. The factors involved may be either chemical, e.g., the poor water retentive capacity of soil, or physical, e.g., Ca:Mg unbalances (Mota et al. 2008). Serpentines, which are also rich in Mg, share these two features too. As far as the dolomites of Sierra Nevada are concerned, we have studied the soil profile associated to plant relevés made on 25 m\(^2\) sampling plots. For this purpose, we distinguished 3 different kinds of environments: i. holm oak and pine forests, ii. pulvínular shrubs and iii. dwarf scrub communities. Of these three biotopes, the most outstanding adaptations to xericity and the highest rate of endemic species are found in the last one. Our analyses suggest that the edaphic parameters allow a clear distinction between the dwarf scrubs and any other plant community under study. To start with, the soil grain-size grading: the dwarf scrub communities grow on soils with a higher content of gravel and sand and, consequently, with a lower water retentive capacity. In these soils the content of organic matter and total nitrogen are also lower and the C:N ratio is much lower. The pH-values, always above 7, is, in the dwarf scrub communities, sometimes even above 8. In all the cases the Ca:Mg ratio, below 3, is similar to that found in the serpentines.

Keywords: dolomite, endemism, edaphic island, calcium, magnesium.

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Acknowledgments
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Epiphytic bryophyte communities of the Madeiran laurel and ericaceous forests - Host Specificity and phytosociological analysis

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This study proposes to evaluate the composition, distribution, ecology and host specificity of the epiphytic bryophyte flora present in thirteen trees species (Clethra arborea, Erica arborea, Erica platycodon subsp. maderenicola, Heberdenia excelsa, Illex canariensis, Laurus novocanariensis, Myrica faya, Ocotea foetens, Persea indica, Rhamnus glandulosa, Salix canariensis, Sambucus lanceolata and Vaccinium padifolium) from the natural Madeiran Laurisilva forests, in nine selected areas of Madeira’s Island. A co-relational analysis of the non-vascular flora (epiphytic bryophyte) and correspondent phytosociological associations was also made. In the study area, 77 species of bryophyte were found (46 liverworts and 31 mosses), being 2 endemic of Madeira (1 liverworts and 1 moss) and 8 from Macaronesia (4 liverworts and 4 mosses). It was possible to observe that only one bryophyte species was present in all tree species. On the other hand, 29 epiphytic bryophyte (37, 2%) were observed in only one vascular species, and 59, 7% of the bryophyte flora occurs on less than three different tree species. The trees Laurus novocanariensis, Clethra arborea and Ocotea foetens have showed the highest value of epiphytic bryophyte diversity (more than 50% of the bryophyte flora is present on each one of these tree species). The lowest epiphytic bryophyte diversity was found in Illex canariensis, Sambucus lanceolata and Rhamnus glandulosa (with less than 20% of the bryophyte flora). The studied areas “Fajã da Nogueira”, “Montado do Sabugal” and “Montado do Leacock” are representative of the Laurel Forest (Clethra arborea-Ocoteetum foetentis), the “Montado dos Pessegueiros and Lagoa do Fanal” region is representative of the high altitude ericoid woodland (Polysticho falcinelli-Ericion arboreae) and the “Funduras” region is representative of the Mediterranean laurisilva (Semele androgynae-Apollonietum barbujanae). The information obtained in this study has permitted to conclude that, in general, the studied bryophyte flora shows a predominance of Oceanic and Ocean Mediterranean elements, followed by Tempered. The host specificity of epiphytic bryophyte is very considerable and some bryophyte species are exclusive of specific phytosociological communities, so that they can be considered as bioindicators.

Keywords: laurel forests, ericoid woodlands, Bryophytes, Madeiran, Host Specificity.
Failures in the transposition and implementation of the Habitats Directive

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The EU Directive 43/92, known as Habitats Directive, was a giant leap towards the protection of nature in the European Union, the harmonization of relevant criteria and the design of suitable implementation guidelines. However, the transposition of the Directive into everyday routines in connection with very different projects has sometimes revealed as problematic: gaps in the Directive itself, difficulties in the interpretation of the texts, discrepancies in the available sources, etc. Our personal experience in implementing the Habitats Directive during the last years has led us to deal with some troublesome practical cases. There must be, however, similar cases arising from other geographical fields and causing trouble to other experts too. Most probably these cases are not the only ones. Quite understandably, the Directive scope is continental and descriptors are general too, i.e., to be implemented at a European level. For that reason the identification of habitats is a difficult task in many cases, the more so when common names of plants are used, with the ensuing indefinability and the misleading translation into scientific botanical nomenclature (e.g.: 'Oromediterranean endemic moorlands with gorse'). The indefinability derived from the wording itself and its translation into syntaxonomical proposals are also included in this group (e.g.: the interpretation of all communities of the Festucetea indigestae class as 'siliceous Festuca indigesta Iberian grasslands').

Errors arising from the computerization of data. Some habitats have been frequently and mistakenly ascribed to sites where they do not occur. Such mistakes are mostly due to an incorrect transcription of either the numerical codes of habitats or the UTM coordinates. General ascription of contents peculiar to a polygon to the whole surface of the polygon. The studies and assessments of environmental impact often refer to the information which, provided by official agencies in charge, is available on the web. However, the information provided presents in many cases a holistic character and refers to the habitats occurring in a given polygon without accurate indication of the exact location of each of those habitats. Technical failures in the mapping. In many cases the scale is clearly too inaccurate to be used in projects in which only a few metres (0.5 mm on the reference maps) may involve either an impact on priority habitats or the invasion of SCI areas. Discrepancies between official agencies. Administratively and politically the Spanish territory is divided into the so-called 'Comunidades Autónomas' which in many cases have been given responsibilities for the implementation of the Directive 43/92. but is the Spanish Government that must assume and submit the proposals to the European Union. Surprisingly, the limits of the same SCI areas are not always coincidental on the official websites of the different agencies.

Keywords: Habitat Directive, Spain.
Woody vegetation fragments in Melilli area (Syracuse, Southern Italy) and their conservation

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The Melilli territory is located on the South-eastern side of the Sicily island, in the Syracuse province. The study area is situated in an hill region, between 300 and above 400 m a.s.l. Here, since long time, a big part of the territory had been transformed by man’s intervention. The naturalness of the area is very low and the natural woody vegetation is localized in a few sites. The aim of this study is to highlight the remaining woody vegetation on this by man disturbed Mediterranean area and to give some information for its management.

The vegetation was sampled and elaborated according to the standard phytosociological method (Braun-Blanquet 1964); the multivariate analyses (Syntax, Podani 2000) enabled to ordinate recorded assemblages. It was found out that there are several plant communities; they are mostly represented by Mediterranean evergreen vegetation types, which can be classified within the Quercetea ilicis. The more represented woody vegetation type is characterized by Quercus suber; it belongs to the Pistacio-Rhamnetalia alaterni. The high presence of species of this syntaxon and of species belonging to the herbaceous vegetation of the surrounding areas is due to man’s intervention. On some areas there is the Quercus ilex community; it belongs to the Quercetalia ilicis. The lack of species of the surrounding open areas shows a lower man’s disturbance. On a very few areas there is a community characterized by Quercus amplifolia, which belongs to the Pistacio-Rhamnetalia alaterni. Some maquis communities had been identified on by man more disturbed sites; they mostly belong to the Pistacio-Rhamnetalia alaterni. The Euphorbia dendroides maquis is the more representative type of such communities; it is localized on rocky and sunny sites.

A very few fragments of hygrophilous woody communities belonging to Populetalia albae are localized on the river floors. The community characterized by Platanus orientalis, localized on the “torrente Belluzzo”, is of a particular importance due to the rarity of this species.

The results obtained provide useful knowledge for the management and the conservation of the residual woody vegetation of the Melilli area, where there are several protected areas.

Keywords: vegetation, conservation, Sicily.

Literature:
Biogeographical patterns of sand dune vegetation in the Iberian Peninsula

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Coastal areas are among the most specialized habitats in Europe, where sand dunes appear either as a narrow dune cordon that separate the shore from the internal stations marsh brackish, or extended complexes that stretch for several kilometres to the interior. Although geography and climate have been correlated with sand dune vegetation in terms of species richness, life-form or local plant adaptation, few studies are devoted to investigate the variation of sand dune vegetation along broad scales. Since both climatic and geographical factors may influence current distribution of plants assemblages, their exploration could provide crucial information about diversity and biogeography patterns of these habitats. We investigate the effect of geographic and climatic gradients in sand dune vegetation of the Iberian Peninsula, a key biogeographical area to understand the atlantic-mediterranean transitions in Europe. The main objective was to test whether the climate or rather geographical variables correlate with sand dune vegetation types in the Iberian Peninsula. A deep bibliographic revision about *Ammophiletea* class in Spain and Portugal was realized, and 834 relevés were storage and georeferenciated, assigning climatic data from a Iberian Climatic model at 200x200 m grid resolution. All the relevés were classified using TWISNPAN method, dividing the entire dataset into the two main orders widely recognized: *Ammophiletalia* (shifting dunes) and *Crucianelletalia* (stable dunes), which were analysed for separate using Detrended Correspondence Analysis (DCA) ordination. DCA scores were highly correlated to geographical and climatic variables, and permitted to interpret the main vegetation groups (alliances) in relation to environmental variables interactions. However, important differences were detected for the two groups. The main environmental variables correlated with floristic variability in *Ammophiletalia* vegetation were annual precipitation and mean annual temperature, whereas for *Crucianelletalia* the highest correlations were found with longitude and maximum annual temperature. A major homogeneity of shifting dune vegetation was found, explaining the lower number of associations described for *Ammophiletalia* in the Iberian Peninsula. Furthermore, the two main vegetation groups detected in such order could be related to the precipitation gradient along a north-south transect. In contrast, plant communities of stable dunes were highly variable, and a high number of local plant communities could be assessed along the bioclimatic variations, as a possible effect of dispersal restrictions and their position in the landward gradient.

Keywords: *Ammophiletea*, Iberian Peninsula, biogeography, climate.
Gypsophily in plants: notes on the historical background of gypsum outcrop botany

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The close relationships between soil substrates and flora have been a subject of great interest for botanists and ecologists. The gypsum outcrops tend to produce an exclusive flora very rich in endemic species. Not surprisingly the EU Habitats Directive gives priority to these areas. Late in the 18\textsuperscript{th} century Cavanilles was the first known author aware of the relationship between this kind of rocks and their colonizing flora. Later, in the 19\textsuperscript{th} century, Boissier and Wilkomm also made some comments on the plants growing on Spanish gypsum soils. However they failed to strictly distinguish these plants from those peculiar to saline soils. Contejan in France and Macchiati in Italy were then studying the impact of gypsum on plants too. At the end of the century, it was Odón de Buen who made a clear-cut distinction between the flora inhabiting salt marshes and that growing on “calcium sulphate outcrops” in Aragon (Spain). Still in the 19\textsuperscript{th} century, Cockerell and Garcia studied the role of gypsum as fertilizer, but their work also dealt with some wild gypsum outcrops, such as White Sands (USA). In the early 20\textsuperscript{th} century Coville and Mac Dougal followed their suit in the United States too. Back to Spain, Reyes Prosper was the first to use the term "yipsófila" (“gypsophilous”) to refer to those species which “require soil gypsum to thrive”. In Germany Weiss studied the occurrence of floristic elements associated to gypsum outcrops. However, it was Braun-Blanquet, in his influential book on phytosociology, who first used expressions such as “characteristic gypsum plant” or “gypsum-loving species” (he also used “gypsophilous“). In 1941 Johnston published a very influential work in which he used the term “gypsophily”. Disregarding all the preceding authors, many researchers consider Johnston as the founder of gypsum outcrop botany. A year later Rivas Goday launched the nowadays extremely productive Spanish gypsum outcrop botany, with a larger number of disciples. In 1976 gypsophily was already a sufficiently studied phenomenon for Parsons to publish his influential review on it. Research soon spread to countries such as Mexico or Turkey and consolidated in others such as Spain, Italy (Bolonia, Sicily) or the USA. Publications no longer concentrated on vascular plants, but also dealt with lichens and bryophytes. In the last years of the 20\textsuperscript{th} century Meyer's research on the Mojave desert is particularly remarkable. Her contribution encouraged a more ecological approach to gypsophily. In this respect, the literature of the last 20 years on the Spanish gypsum outcrops is most valuable. Certainly, a thorough comprehension of gypsophily is extremely relevant to get to understand not only the diversity and rarity of the Mediterranean flora but also the underlying processes involved in the divergence and isolation on these edaphic archipelagos.

Keywords: gypsophyte, soil, endemism, inland island.

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Medium term effects on the vegetation of a Mediterranean forest after a forest fire with different fire intensities

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A wildfire in a pine plantation in 1994 has been studied and monitored through different sampling moments. It has been selected and sampled the vegetation in some times following the wildfire up to 10 years later. The hypothesis is to test whether the fire intensity in this wildfire determines the resprouting dynamics and the temporal stages of the vegetation. Data from the sample area burned were compared with the control plots which were selected in a contiguous area with the same aspect and morphology but not affected by the wildfire. The pine plantation at the time of the wildfire was not managed by the property or stakeholders. In terms of the space arrangement we observed a change from a lineal arrangement before the wildfire to a chaotic arrangement after the wildfire. Many plants took advantage of the post fire situation, namely Cistus, occupying a larger area than in pre-wildfire conditions. Also the cork oak (Quercus suber) resprouted in a substantial way after the wildfire. Generally speaking a marked change in the status of the forest area has been observed compared with the control area non-burned. Ten years later the forest has experienced an abrupt increase of the vegetative fuel which can be a risk factor leading to a higher intensity fire in the scenario of a new forest wildfire in this study area. A post fire forest management removing or selecting the most abundant fire prone and invasive species should be selected in order to favor some other like the cork oak. A management with the latter objective could lead to a potential development of a mature forest in which cork oak is the dominant species and with a lower risk of high intensity wildfire than in a pine plantation.

Key words: forest fire, Quercus suber, pine plantation, recovery.
Phytosociology and vegetation cartography of a Natura 2000 site near Ajaccio airport (Corsica)

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This site, named Ricanto - Campo dell'Oro, located in the Ajaccio periphery, is included in the Natura 2000 network to preserve the habitats of the coastal site. Indeed, this site is the only place where is living Tyrrhenaria ceratina (Helicidae), a relictual corsican endemic snail in critical danger of extinction. Besides, this site presents some beautiful populations of Linaria flava subsp. sardoa (Scrophulariaceae), a protected and rare cyrno-sardous endemic (Paradis & Piazza 2003).

Geomorphology. The site is a gritty fluvio-marine holocene terrace, high of 3 m, dominant the Gravona stream low plain of flooding. Its previous limit, facing the aerial beach and the sea, is due to the erosion. Indeed, some years, it occurs an important retreat of the terrace, caused by the strong storms, as those of April 1989 and November 2008.

Past and recent impacts. Until 1945, the terrace was only frequented for pastoral activities. After 1945, it has been severely modified by the runways and buildings of the Ajaccio airport. Then, some new impacts occurred: other buildings, exotic species plantation, sand removal, vast parking creation, high frequency of trampling and circulation of vehicles 4x4.

Improvement works. The French Conservatory of the Littoral (CEL) has been charged to improve a part of the terrace. Different works have been achieved in 2001 and 2002: (1) to isolate the site of the road, construction of a 1,3 km low wall, (2) destruction of the parking, followed of its vegetalization by seedling and plantation of sandy species, (3) creation, behind the aerial beach, of a "pseudo-dune", followed of its vegetalization, (4) setting of ganivelles around this "pseudo-dune", in order to prevent the trampling and (5) creation of several footpaths between the road and the beach.

Goals and methods of the survey. To estimate, in 2008, the results of the 2001-2002 improvement works, by phytosociological relevés and a large-scale cartography on enlarged aerial photographs.

Results. The map distinguishes forty cartographic units, of which a lot of mosaics. But only three habitats have a large extension: (1) a Scrophularia ramosissima chamephytic community (Helichryso-Crucianelletalia) (Piazza & Paradis 1998), (2) a Genista salzmannii nanophanerophytic community (Helichryso-Crucianelletalia) and (3) a Sileno sericeae-Vulpinetum fasciculatae (Malcolmietalia) vernal therophytic lawn. The Genista salzmannii nanophanerophytic community is in way of reconstitution and progression.

Keywords: Corsica, impacts, littoral, Malcolmietalia, Natura 2000, phytosociology, vegetation cartography.

References:
A method for representing the spatial distribution of Habitats (Annex I 92/43/EEC) and Centrographic Analysis

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A custom GIS application (built using ESRI’s ArcObjects with Visual Basic for Applications) is presented for querying, analyzing and presenting on distribution maps all the information of Natura 2000 data forms stored in European Natura 2000 Database. The distribution maps are made in points (centroids of the SAC), with scalar symbols proportional to covered surface area (estimated in hectares) from the single habitat in each SAC. These geographic information allow to perform on small-scale primary centrographic analysis, such as: mean centre of distribution and the standard deviational ellipse. These statistical-geographical analysis are useful in describing and interpreting the distribution of the habitats in Italy. The standard deviational ellipse highlights the anisotropy and the predominant direction of the distribution. The mean centre represents the gravity centre of the habitat distribution. This GIS application is a useful nationwide monitoring tool, in fact, allows to realize periodically atlases of Italian habitats and therefore allows to map and quantify evolutionary trends in the distribution of the habitats themselves.

Key words: Natura 2000 data forms, habitat distribution maps, Centrographic Analysis.
Plant landscape of “Navelli plateau” (Abruzzo, Italy)

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An integrated phytosociological study on the vegetation of the tectonic-karst plateau of the Piana di Navelli (AQ) is presented. The climate of the study area corresponds to the lower supratemperate thermo-type and the lower sub-humid ombro-type. The area is very important as biologic corridor between the Gran Sasso-Monti della Laga and the Sirente-Velino Parks. The following vegetation series were identified:

Hilly, calcicolous, sub-continental white oak series (Cytiso sessilifolii-Querco pubescentis sigmetum);

Hilly, calcicolous, mesophilous hop hornbeam series (Melittio melissophylli-Ostryo carpinifoliae sigmetum);

Xerophilous holm oak series (of a Quercus ilex subsp. ilex groupment, actually in phase of syntaxonomic characterization)

White willow igrophilous series (Salicio albae sigmetum).

The phytocoenotic diversity of the area is articulated as follow:

- Cytiso sessilifolii-Quercetum pubescentis woods (Carpinion orientalis, Cytiso sessilifolii-Quercenion pubescentis)
- Melittio melissophylli-Ostryetum carpinifoliae woods (Carpinion orientalis, Laburno anagyroidis-Ostryenion carpinifoliae);
- Quercus ilex subsp. ilex scrub (Carpinion orientalis);
- Fraxino ornii-Populetum tremulae open woods (Corylo-Populion tremulae, Aceri obtusati-Populenion tremulae);
- Spartio juncei-Cytisetum sessilifolii shrub vegetation (Cytision sessilifolii);
- Chamaezytis spinoscentis-Juniperetum oxycedri shrub vegetation (Cytision sessilifolii);
- Ligustrum vulgare and Rubus ulmifolius hedges (Prunetalia spinosas)
- Sideritido italicae-Globularietum meridionalis garigues (Cytiso spinoscentis-Saturejion montanae);
- Asperulo purpureae-Brometum erecti and Lino tommasinii-Stipetum apenninicolaem hemi-cryptophytic pastures (Phleo ambiguip-Bromion erecti);
- Trifolio scabri-Hypochoeridetum achyrophori therophytic pastures (Trachynion distachyae);
- Elymus repens subsp. repens and Dactylis glomerata uncultivated fields vegetation (Convulculo-Agropyro repentinis);
- Bupleuro rotundifolii-Bunietum bulbocastani (Caucalidion lappulae) and Conringio orientalis-Fumarietum officinalis (Fumario-Euphorbion) fields vegetation;
- higrophilous vegetation with rizophytic Potamogeton natans and Ranunculus trichophyllus subsp. trichophyllus groupments, Phragmites australis subsp. australis groves, Salix alba and Populus canadensis open woods.

Keywords: vegetation series, plant associations, Piana di Navelli, Abruzzo, Italy.
Phenological and floristic diversity in agroecosystems: some cases in Emilia-Romagna

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The aim of this study was to investigate the plant biodiversity of semi- and sub-natural vegetation in the intensively cropped plain area of the Emilia-Romagna region. These coenoses (hedgerows between crops, herb margins and strips, ditch banks), where the soil is not exploited, represent valuable reservoirs of biodiversity which are under continuous threat. With the aim of evaluating the contribution of these communities to the biodiversity of agroecosystems, phytosociological and symphenological surveys were conducted in three sites: A) in the lowlands of Emilia (Modena-Reggio Emilia), B) in the area at the foot of the hills between Emilia and Romagna (Bologna), and C) in the Romagna coastal area (Ravenna). Vegetation analyses show both qualitative and quantitative differences among the three areas: the greatest variety in vegetation types and habitats is observed in areas A and B (6-7 different vegetation types), while area C appears to be more monotonous (with a mere 3 types). The results of floristic analyses suggest that the abundance of species (based on the number of species observed in 30 phytosociological relevés for each area), depends to a greater extent on micro-environmental factors and site management than on the territorial context: areas A and B, characterised by a fair variety of habitats, display a wider floristic diversity (approx. 180 species from over 50 families) than area C (approx. 120 species from 32 families). The flora is composed mainly of synanthropic species, with high percentages of annual plants (between 30% and 45%) and sub cosmopolitan plants; however, it is also worth noting the presence of several nemoral and hydrophilic species, hidden away in hedges and along ditches, as well as rare plants (about 10% of the total). Phenological patterns show relationships with the life forms and the synecological features of the plants. The analyses of symphenograms show generally bimodal trends of blooming intensity (varying with coenosis, site and year): the first peak corresponds mostly to the onset of anthesis in woody species and annual grasses, while the second one, taking place between late spring and summer, is due to the perennial grasses.

The relationships between plants and animals were also investigated, in collaboration with several experts. Significant correlations were observed between certain parameters of Lepidoptera (number of species and abundance) and the plant diversity, as well as the abundance of the grass layer (Puppi et al. 2008).

Summing up, in order to preserve and increase biodiversity in the agricultural ecosystems, we have to maintain a network of sub-natural and semi-natural structures. Moreover, these should have a high variety of structural as well as ecological features.

Keywords: phenology, diversity, vegetation, flora, agroecosystems.

References:
Status of National wetlands under the Ramsar and Barcelona Conventions

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The Convention on Wetlands of International Importance especially as waterfowl habitat of birds arose in Ramsar in 1971 by the need to reverse the process of transformation and destruction of wetlands. Despite being passed more than thirty-five years after the signing of the Treaty, the emergency is always present and relevant because of the vulnerability of the habitats characterizing these areas.

In order to fulfil commitments of the contracting Countries, the Ministry for the Environment and Land and Sea has funded the Research Program of the Department S.T.A.T. (University of Molise) on the protection of national wetlands under the Ramsar and Barcelona conventions to check the Status of National wetlands under the Ramsar and Barcelona Conventions.

The assessment of the status of these wetlands is undertaken using technical-scientific information updated during the last year. In detail, the following characters will be described and discussed: 1) ecological changes that have had consequences in the reduction/increase of criteria suitable for the detection of the wetland as a site of international importance, to assess the current situation and possible emergencies; 2) geographic and administrative framework in order to obtain an overview of the Italian situation and identify gaps; 3) types of wetlands (according to the Ramsar Convention’s Wise Use Handbook 14, 3rd edition 2007) to identify which are less well represented; 3) land use as a descriptive parameter of the status to monitor; 4) noteworthy flora following Scoppola & Spampinato (2005) in order to define the role of Ramsar Sites in biodiversity; 5) habitats, flora and fauna of Community interest (according to Habitats Directive, 92/43/EEC) included in the areas in order to define their role in Natura 2000 network; 6) conservation, as a descriptive parameter and to check if the Sites are sufficiently protected.

The thematic maps were created with the ArcGIS software produced by the Environmental Systems Research Institute which has allowed to update the coordinates of the centre of the Sites and altimetry and has highlighted the relationship of the Ramsar Sites with a number of relevant elements. The data relating to the land use has been produced specifically for this project; coverage of the soil has been extrapolated from the correspondent themes pertaining to the Corine Land Cover 2000 coverage produced by APAT (2005), then this map was photointerpreted again.

Keywords: conservation, monitoring, Ramsar sites.

References:
Ecological and phytogeographical features of Southern Apennines *Quercus cerris* and *Quercus frainetto* forests

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In the southern Apennines, deciduous oak forests are widely spread and dominated by *Quercus cerris* and/or *Quercus frainetto*, prevalently on siliceous substrata. Both species are not restricted to a single vegetation belt or phytoclimatic unit, ranging from coastal areas to the inner mountains. In Italy, these communities have been considered phytosociologically belonging to *Quercetalia pubescenti-petraeae* or *Fagetalia sylvatica*. Recently for the Italian peninsula, most of the association dominated by *Q. cerris* or *Q. frainetto* were grouped into *Teucrio siculi-Quercion cerridis* (*Quercetalia pubescenti-petraeae*), an endemic alliance divided in two subunit: *Teucrio-Quercenion cerridis*, for the Central-Northern Apennines, and *Ptilostemo-Quercenion cerridis* for the Southern part (Blasi et al. 2004). Despite in the last 40 years several studies described the communities belonging to *Ptilostemo-Quercenion cerridis*, a complete and clear phytogeographical and ecological characterization is still missing. We analysed a large dataset, including original relevées and the entire available published data, comparing phytogeographical features, distribution, ecology and syntaxonomical classification. Only relevées dominated by *Q. cerris* or *Q. frainetto* were selected and stored in a Turboveg database. Numerical classification and analysis were performed using multivariate methods through Syntax package implemented in JUICE (Tichy 2002). Nomenclature aspects were also taken into account following Weber et al. (2000). Due to ecological and geographical range, *Quercus cerris* and *Q. frainetto* forests showed a large floristic and phytogeographic variation in community composition. Floristic analysis underlined a set of biogeographically relevant species which differentiated the southern Apennines communities from their C-Italian analogous and, at local scale, the coastal-Thyrrenic associations from the inner ones. Two main ecological clusters were individuated: the first belonging to *Fagetalia sylvatica* and the second to *Quercetalia pubescenti-petraeae*. For the first, two principal communities are recognized: *Thalictro aquilegifolii-Quercetum cerridis* and *Physospermo verticillati-Quercetum cerris* (including several sub association) both could be assigned to the alliance *Physospermo verticillati-Quercion cerridis*. For the second one, we recognized the following syntaxa: *Lathyro digitati-Quercetum cerris*, including several subassociation, *Echinopo siculi-Quercetum frainetto*, and *Cytiso-Quercetum frainetto* belonging to *Teucrio-Quercion cerridis* (suballiance *Ptilostemo-Quercenion cerridis*). Furthermore, ecological and phytogeographical analysis suggest that some communities as *Erico arboreae-Quercetum cerridis* and *Lathyro jordanii-Quercetum cerridis* could not be recognized in the study area.

**Keywords:** phytogeography, phytosociology, syntaxonomy.

**References:**
Do plant indicator values for the Italian flora reflect ecological features of plant communities?

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Using plants as biological indicators has many advantages instead of field measurements because they represent an integrated response to environmental variables. Ellenberg' Species indicator values have been widely used in applied plant ecology, especially in Central and Northern Europe (Diekmann 2003). Although there is a growing interest in using them also outside central Europe, several authors appointed that the species indicator values developed at local scale should not be used outside the region for which they were defined. Recently, indicator values was published for the whole Italian flora, providing a potentially useful tool to analyze Mediterranean plant communities (Pignatti 2005). The aim of this study was to examine the extent to which new Ellenberg indicator values, developed for the Italian flora, can be used to characterize environmental conditions also in Mediterranean ecosystems. We tested the new indicator values proposed using phytosociological relevés from a large database (approx. 2,000 relevés) regarding the Cilento National Park vegetation (Southern Apennines, Italy). In the Cilento National Park several types of gradients exist and vegetation communities are usually considered to respond to these ecological variations. In order to test the response of indicator values at community level we considered light (L), temperature (T) soil nitrogen (N) and soil reaction/pH (R) average score and weighted average calculated for each plant communities, in spite of their ordinal nature, considering the discussion in Diekmann (2003). Plant communities was selected from the vegetation database along the prevalent ecological gradient existing in the study area, using abiotic information of land unit classification regarding: soils, substrata, altitude, climate. The correlation between plant communities indicator value and available independent ecological variables was assessed. Furthermore, we compared the results of a PCA ordination with the average scores for the main plant communities found in the Park and performed a statistical analysis about the significance of the results. The outcomes show that, despite some failure and the necessity to broaden the research testing the response of other communities, the proposed indicator values could be a useful tool for a synthetic approach to plant ecology studies and environmental monitoring.

Keywords: Cilento National Park, Ellenberg indicator values, phytosociological data.

References:
Flora, vegetation and management of Fantine wood (Campomarino-CB)

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The Fantine wood, together with the large area of inland sandy dunes, garigues, and wet hollows (called “Fantine”) surrounding it, and with the seaboard dunes and garigues between the Adriatic National road and the sea, represents the most important natural area of the “Foce Saccione-Bonifica Ramitelli” SCI (Habitat code number IT7282217) in the municipal district of Campomarino (CB).

The wood is hygrophilous, partially flooded, dominated by elms (Ulmus minor), southern ashes (Fraxinus oxycarpa), Turkey oaks (Quercus cerris) and white poplars (Populus alba), belonging to the Carici remotae-Fraxinetum oxycarpace Pedrotti 1992 association. Wood margins are characterized by the presence of a mantle dominated by Phillyrea angustifolia and Myrtus communis. In the surrounding area there are different dune habitats with halo-xerophilous vegetation and Mediterranean garigues, together with several wet sandy hollows hosting many important taxa and coenosis considered as interesting both from an ecological and a phyto-geographical point of view. Dry sandy areas are characterized by grasslands with Alkanna tinctoria, Anchusa undulata, Verbascum sinuatum, Verbascum niveum, Evax pygmaea, Euphorbia terracina, Hypocrepis ciliata, Ononis reclinata, Helianthemum salicifolium, Petrorhagia prolifer, Stipa capensis etc. Hollow margins, with wet sandy soils, are dominated by Carex divisa coenosis, while the deeper parts of the “Fantine” are colonized by different helophyte species, such as Carex acutiformis, Cladium mariscus, Iris psedacorus, Euphorbia palustris, Lythrum salicaria, etc (Taffetani 1990, 1991, Taffetani & Biondi 1992).

For what concerns management activities, serious damages to forest vegetation, flora and fauna were caused, at the beginning of 2008, by a landowner who fenced in a wide portion of the wood for animal pasture. Because of this enclosure it is actually impossible to access the area and to check the health status of elm trees affected by Graphium ulmi Schwarz., which have to be treated and monitored in order to prevent disease spread.

Keywords: hygrophilous wood, dune vegetation, conservation and management of SIC areas.

References:
Contribution to the knowledge of the vegetation of the Gorgona Island (Tuscan Archipelago)

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The results of a vegetation survey carried out on Gorgona Island are here presented. Gorgona is the smallest (2.23 km²) and the most northerly island of the Tuscan Archipelago, and it is included in the homonymous National Park area. It is about 33 km from the coast of Leghorn (Livorno), 40 km from Capraia Island and 60 from Corsica; since more than 100 years it has been used as a place of detention. Vegetation has been described by over 80 phytosociological relevés, distributed throughout the island; 18 vegetation types have been singled out at various syntaxonomical levels. From the physiognomic point of view, Gorgona is dominated by Aleppo Pine stands, mostly derived by artificial plantations, and by sclerophyllous maquis in which *Rosmarinus officinalis* plays an important role, especially on the southern rocky coasts. One new endemic association of the sea cliff communities (*Chritmo-Limonietum gorgonae*) has been described.

The interpretation of aerial photos, checked and integrated by means of the vegetation relevés, and the study of spatial distribution of vegetation types recognised on a physiognomical and phytosociological basis, permitted to distinguish several typologies at a scale of 1:10.000 and to build up the island vegetation map, comprising units of natural and seminatural vegetation, as well as land-use units. The vegetation map comprises a total of 16 typologies and is here presented.

Finally, the presence of habitats deserving conservation according to Habitats Directive 92/43 and following revisions, and in conformity with L.R. 56/2000 and following revisions, is pointed out.

Keywords: vegetation map, phytosociology, Gorgona Island, Tuscan Archipelago.
Geobotanical analysis as a tool to assess submediterranean forest ecosystems to define ecological networks: a study-case in Fiastra Valley (Italy)

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Woodland represents the potential ecosystem where the coenosis tend to develop, so a widen analysis was carried out of forest ecosystems which occur as a methodological approach example to plan an ecological network. Vegetation Map of Fiastra and Entogge Valleys was used as database (Marches, Central Italy) and derived maps to support analysis of fauna planning were made. For each woodland type a representative sampling area was selected in which the vertical section of population was studied to allow a graphic and with models representation of spatial organization of each community. Overlapping the informations about woodland management and floristic-structural and bioclimatic features, the Structural woodland ecosystems Map was obtained. From the integration of physionomic-structural informations with those floristic-phytosociological, other two Maps were carried out: Mean density of trees, shrubs and herbaceous layers Map and Mean expected density of Rosaceae occurrence Map. These documents can have a great importance to define the suitability of an area for different fauna species.

On a phytoclimatic and ecological base, the Vegetative time of woodland ecosystems Map was carried out too. It is an important tool to identify the more critical factor for fauna communities livelihood. The poster shows the methodological approach of the research.

Keywords: woodland ecosystems, vegetation derived maps, fauna management.
Methodological approach for modelling the diversity of the Apennines sub-mediterranean forests

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In the Umbria-Marches Apennines the oak-hornbeam forests are the most common ones in the Upper Mesotemperate bioclimatic belt. The high variability of these forests has been underlined by phytosociological research that, however, is not exhaustive to understand all the biodiversity of this forest ecosystem. For this reason it seems to be necessary to implement the study about Ostrya carpinifolia communities. The current state of knowledge reflects a variability at the landscape scale. The aim of this contribution is to characterize the parameters influencing this variability in a hierarchical scheme. At this aim an ecological and phytosociological study in some woodlands (Val d’Aso, Marches Region) has been carried out. After the typification of plant communities, ecological and floristic data of the phytosociological relevés were processed through PCoA to get a first definition of the distributive features of the plant communities under study. Then, with the same aim, the analysis of bioindication values applied to phytosociological data was carried out. The intersection of these data allowed to hypothesize a model of plant communities distribution related to the different environmental conditions. In short, the model emphasizes the hierarchical importance of the considered environmental parameters, showing the relationship between each of them and the different phytosociological units (alliance, suballiance, association, subassociation). This model building will allow the realization of more detailed studies using quantitative data (about soil, forest cover, morphology, etc.), kind of forest management and diachronic analysis of the land use.

Keywords: oak-hornbeam forests, ecological study, phytosociological study, floristic diversity.
SESSION 3: TOWARDS AN ECOLOGICAL CHARACTERIZATION OF MEDITERRANEAN LANDSCAPES

Chairman: Carlo Blasi

INVITED ORAL PRESENTATIONS
The contribution of vegetation science to current environmental issues at the landscape level in the Mediterranean Region

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Nowadays the ecosystem approach represents the primary framework for addressing biodiversity conservation and sustainable development across varying spatial and biological scales. At the landscape level, the expertise of vegetation scientists can play an important role in transdisciplinary investigation of biological diversity and in integrated management of land and natural resources. Issues that particularly require basic knowledge on composition, spatial pattern and dynamics of plant communities include: classification and mapping of ecoregions and landscape units (Blasi et al. 2009, Bailey 2002, Naveh 2001, European Landscape Convention/CoE 2000); planning of natural protected areas (EU Habitats Directive, 1992, Protocol on Specially Protected Areas and Biological Diversity in the Mediterranean, 1999); assessment and monitoring of land use and land cover change (Alphan & Yilmaz, 2005; LUCC International Project/IGBP and IHDP 1995); strengthening of cultural identity (Green & Vos 2001, LINKS International Project/UNESCO 2006); and support for sustainable socio-economic development (Schmitz et al. 2003, Millennium Development Goals/UN 2000).

The landscape phytosociological approach is being used in several Italian research projects dealing with: definition and mapping of ecoregions and land units, assessment of environmental conservation, monitoring of urbanisation impacts, scientific support to modern agricultural strategies, design of land ecological network and ecological evaluation of ecosystem services. In all these projects, vegetation data (communities, series and geosigmeta) have been successfully integrated at different scales with other environmental and geographical information in the framework of landscape ecology and ecosystem geography principles.

Aim of this talk is to promote transdisciplinary methods including vegetation science for identifying, classifying and assessing ecoregions and landscapes in the Mediterranean Region. Experimental models, validated at national level, show indeed their suitability across different spatial scales and over different human impact gradients.

Keywords: landscape phytosociology, ecoregions, land units, biodiversity conservation, sustainable development.

References:
Comparing environmental and biological surrogates for biodiversity at a local scale

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A recent debate concerns the relative merit of the two major types of surrogates for biodiversity, biological surrogates and environmental surrogates. Evidence, in the form of direct comparison of these two surrogate types, is scarce. We conducted a direct comparison of the performance of a series of biological and environmental surrogates, at a local scale (300 km²), which is often the relevant scale for land planning and management. Performance was referred to as the degree of surrogate congruence with spatial pattern of diversity of woody species, of geophytes, and of land snails.

Environmental domains, surrogates based on numerical classification of environmental variables (topography, soil, and vegetation cover), outperformed other environmental surrogates (qualitatively delineated vegetation units and physiographic land types). The environmental surrogates were robust to subjective decisions on number of classes and on input variables that drove the classification. The best biological surrogate was woody species diversity pattern, with performance similar to that of the environmental domains.

Our results support the notion that environmental domains may be reliable and cost-effective surrogates for biodiversity at small scales, particularly in data-poor regions. In a follow-up study, we currently combine both information types to produce bio-environmental surrogates. We are testing three alternative methods of combining environmental and biological data into a single surrogate. Our first results indicate that the hybrid surrogates perform better than both biological and environmental surrogates.

Keywords: species diversity, Mt. Carmel, Israel, conservation.
Vegetation analysis as a tool for ecological characterization of landscapes

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The definition of landscape is “an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors”. Landscape character is defined as a distinct pattern of elements that occur consistently in a particular type of landscape. Particular combinations of geology, landform, soil conditions, and the associated vegetation, land use, field patterns, and human settlement create the character, which makes different landscapes distinct from each other.

It was stated that the word landscape lacked a universal and widely accepted classification system until recently. Many landscape characterization initiatives are based on regional studies which often use region-specific data and methods. The European Landscape Convention has stimulated landscape characterization and mapping landscape types. The legal obligations of the convention state that “Each country has to identify its own landscapes throughout its territory, to analyze their characteristics and the forces and pressures transforming them, to take note of changes, and to assess the landscape thus identified, taking into account the particular values assigned to them by the interested parties and the population concerned.

At present the core data layers with a high spatial resolution: climate, altitude, parent material and land use, are utilized to distinguish different landscape types. Within this methodology CORINE land cover data, soil associations, digital elevation model, and satellite images, are widely used as sources for the classification of landscape character areas. To achieve a holistic landscape characterization, phytosociological data should be used as an essential component. Interpretation of vegetation characteristics is an effective tool for indicating habitat quality and classifying the gradual habitat cline between natural and cultural states. This can help to determine the actual state of the landscapes in order to create management strategies, in particular, delineating the boundaries for protection zones. This paper will mainly focus on the integration of vegetation analysis for the characterization and conservation assessment of Mediterranean landscapes. The role of vegetation science and habitat classification for the landscape conservation and spatial planning will be discussed.

Keywords: Mediterranean landscapes, landscape characterization, habitat classification, vegetation analysis, protected area management.

References:
Landscape from a socio-ecological system perspective

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Landscape is an anthropocentric concept. It is almost always an ethnocentric one. The elements in a place are perceived as such when they are individually focussed by an observer. This, however, combines them in his mind, whether consciously or not, and the whole scene is known as a 'landscape'. The scene can be analysed and divided into sectors, items and elements that can be characterised as a set of variables. Study of the interdependence between these components serves to establish the tendencies of spatial variation in a given region and to differentiate and characterise its landscape types.

Few wholly 'natural' landscapes – that is, free from evident human influence– currently exist. Evident humanisation can be appreciated in most of them. Although landscape structure is frequently determined by geotic – not cultural – environmental factors, such as climate, geomorphology or hydrology, the resulting appearance thereof increasingly results from human activity. In natural landscapes and in rural cultural ones, vegetation tends to constitute a highly relevant reference, and for study of the former ones, this component is therefore decisive with regard to interpretation. Indeed, in these cases vegetation clearly reflects both the influence of natural environmental factors and human management of the landscape.

Correspondence exists between landscape typology and human socioeconomic structure. This correspondence maintains a statistical relationship that can serve to quantitatively describe models of interaction between culture and nature. This relationship changes from one region to another, exhibiting a strong interaction in traditional rural environments and a weak one in other cases; it can be formalised, the predominating factors thereof detected, and change scenarios simulated. This paper presents some cases in landscape ecology (Schmitz et al. 2003, 2004; De Aranzabal et al. 2008) developed by a work group from the Ecology Department of Madrid’s Complutense University.

Keywords: environmental factors, human management of landscape, landscape concept, rural cultural landscape, socio-ecological systems.

References:
Biodiversity and landscape in the Eastern area of the Iberian Peninsula

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The eastern area of the Iberian Peninsula shows a high biotic diversity at landscape level. A high variety of geomorphologic features (high mountains, sedimentary plains, islands, coastal areas with cliffs, beaches and marshes) combines with plant species and communities to build a great diversity of landscapes and one of the areas of highest naturalistic interest in the Western Mediterranean. Human activities have been intense since ancient times and the result is a harmonic combination of natural and anthropic landscapes. To assess the value of these complex landscapes, this territory is analyzed by taking into account the natural biotic components (flora and vegetation) as well as traditional uses and high cultural values (crops, architecture), all these factors being important for landscape conservation and land management.

This talk presents the biotic diversity of the Ibero-Levantine area, with special emphasis on its uniqueness and richness in terms of endemic plant species, plant communities and landscapes. Furthermore, it will show how traditional anthropic landscapes relate to the physical characteristics of the territory (bioclimatic belts, soils, topography).

Keywords: Ibero-Levantine area, traditional landscapes, flora, plant communities.
Phytosociological synrelevée and plant landscape mapping from the theory to the practical application

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The phytosociological method in the study of the plant landscape allows to reach complex predictive models as based on quality-quantity data of high precision and definable through considerably significant statistical analysis. As a study case it is presented a detailed analysis of a coastal area south of Monte Conero (Central Adriatic side of the Italian peninsula).

The study has been carried out through phytosociological, synphytosociological and geosynphytosociological analyses.

The use of recent digital color orthophotos (www.pcn.miniambiente.it) in GIS, made it possible to delimit the recognized phytocoenotic units and then to realize a detailed computerized phytosociological vegetation map.

Numerical mapping in GIS environment, properly designed and implemented using digital terrain models (DTM), has allowed to quantify the coverage of plant associations in relation to the stationary ecological characteristics of geo-surfaces on which they are settled.

This method has permitted to create matrixes of sigmarelevées and geosigmarelevées subsequently processed through cluster analysis programs. So the tesserae, the vegetation series and the plant landscape units (geosigmeta), present on the investigated territory, has been identified and quantified.

Therefore, this methodology allows the modelling of the plant landscape as it correlates different thematic layers, rather than by simple overlay operations, but it takes into account also the value of plant communities as bioindicator in a dynamic, spatial and anthropic meaning. The result is the integrated modelling of the plant landscape having a predictive meaning that involves evolutionary or regressive aspects in precise qualitative-quantitative terms and therefore extremely useful for the management of environmental resources.

Keywords: synphytosociology, synrelevée, landscape ecology.
Patterns of plant population spatial variability in relation to vegetation dynamics: vegetation series matter

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The role of abiotic factors (geology and climate) and human activities in shaping the spatial variability and distribution patterns of plant populations are widely studied. Less is known on the effects of plant-plant and plant-animal interactions in determining the dispersal, establishment and performance of plant species propagules and therefore in conditioning plant population spatial variability.

Plant and animal species composition can be considered constant within a vegetation series in a discrete biogeographical and bioclimatic area: structural and functional traits of communities are therefore biotic factors that play a major role in determining the fate of populations.

Here we analyze how the chorological and functional traits of plant and animal species within vegetation series affect seed dispersal, recruits performance and population fluctuations of some case-study plant species. Comparison among vegetation series in different bioclimatic belts are of great interest to understand mechanisms of plant-plant and plant-animal interaction.

Two case study will be presented: temporal analysis of the population dynamics of an endemic dwarf plant (Centaurea horrida Badarò), living in coastal, thermomediterranean, juniper vegetation series, under different types of land use (Farris et al. 2009) and the spatial analysis of the population dynamics of a temperate, relic tree (Taxus baccata L.) along an altitudinal gradient, within different types of Mediterranean and subMediterranean oak-dominated series (Farris & Filigheddu 2008).

Keywords: competition, facilitation, plant-animal interactions, plant-plant interactions.

References:
SESSION 3: TOWARDS AN ECOLOGICAL CHARACTERIZATION OF MEDITERRANEAN LANDSCAPES

Chairman: Carlo Blasi

PROPOSED ORAL PRESENTATIONS
An environmental classification of Spain

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The rich diversity and complex pattern of Spanish natural environments is revealed by a land classification that is constructed using a statistical procedure for identifying similar environmental units, regardless of their geographic location across the country. This classification is based on a comprehensive set of variables that strongly influence geographic variation in the biotic components of natural ecosystems. The resolution is 1 km². Rather than treating all environments as equally different, the dissimilarity between them is quantified. The resulting 90 strata (68 in Iberian-Balearic Spain, 22 in the Canary Islands) can be aggregated hierarchically depending on the level of generalization that is required.

Although it was primarily constructed as a reference framework for the development of the Natura 2000 network, this classification was conceived as a nationally consistent tool for monitoring, reporting and management of a range of issues, including biodiversity and land uses. The hierarchical structure of the classification facilitates its use at various spatial scales and at different levels of detail, reinforcing its versatility.

Keywords: ecological land classification, Spain, monitoring, stratification, ecological management.
Preliminary ecological basis for the conservation of habitats of community interest in Spain

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We introduce “Preliminary ecological basis for the conservation of habitats of Community interest in Spain”, promoted by the Spanish Ministry of the Environment, Rural and Marine Affairs and due in April 2009. The publication consists of 117 technical reports, one for each habitat of Community interest in Spain. These reports contain information related to habitat’s ecological conservation and management, and, in particular, to their favourable conservation status in accordance with the Habitats Directive (92/43/CEE). Reports include the necessary conceptual elements to characterize each ecosystem, to determine their conservation status and to monitor their evolution over time. As main results, each one has a precise definition of the habitat in Spain, a complete ecological characterization, a protocol to evaluate the structure, function and conservation status of the ecosystem, and its actual conservation status in Spain if it is known.

Keywords: habitats, Habitats Directive, favourable conservation status, ecological characterization, structure, function.
Land forms, land-use and landscapes in Sicily

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Landscape as we perceive it is the product of many different interacting factors: macro-and topoclimatic, lithology, geomorphology, land use and human activities. The evaluation of the relative influence of each one of these factors on vegetation pattern and landscape is strongly dependent from the scale of observation. Hierarchical classification (Blasi et al. 2000) makes scale-related use of these factors as diagnostic attributes: macroclimate (over 1:250,000 scale) defines landscape regions, lithology (1:250,000 scale) defines systems and lithomorphology (1:50,000 scale) defines subsystems. At a finer scale (less than 1:10,000), land forms and land-use are the predominant landscape makers and control landscape dynamics.

This work investigates the influence of land forms on land-use and vegetation pattern. Sicily has been chosen as a case of study. Detailed data for an area of large extent was used to perform a fine scale, statistically significant analysis. The tridimensional model of Sicily, from which slope data is derived, has a 10 meters resolution. Land-use data used for processing is constituted by more than 125,000 polygons and the minimum spatial unit covers 2000 sq.m. The overlay of slope data and land-use data allowed to perform accurate geostatistical analysis aimed at comprehending the relationships that shape landscape. Land cover data has also been regrouped into naturalness classes to evaluate the possible link between land forms, human impact and landscape conservation.

Resulting data demonstrated certain relationships between land forms and land-use. For instance, agricultural systems are all distributed within the 20 degrees slope limit; 97% of crops are concentrated within 10 degrees, due to the limit of mechanized cultivation and harvesting. Woods are distributed on steeper slopes than crops, with a small overlap range corresponding to marginal agricultural areas.

The proposed modelling process produces a valuable database to perform analysis on potential natural vegetation; moreover it allows to identify marginal agricultural systems, particularly prone to potential land-use change.

Keywords: landscape dynamics, land-use change, potential natural vegetation, Sicily.

References:
Using biodiversity action plans to manage high conservation value areas in Portuguese Natura 2000 Network

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A Biodiversity Action Plan (BAP) is a management tool that a) evaluates and monitors wildlife and habitats with regional/local interest, with conservation status (IUCN/ICN Red Book) and included in EU Directives, b) evaluates species with importance in crop protection and soil conservation; c) defines biological indicator groups to assess and monitor the performance of pro-Conservation practices and c) target both crop areas and surroundings, including woodlands, wetlands set-aside areas, inter alia, for proper habitat management. BAP focus strongly in the concept of High Conservation Value Areas (HCVA). HCVA are landscape level units with important natural values, i.e., habitats, fauna, flora, and frequently occur in agroforestry scenarios (The Dehesa and The Montado: Ecoagriculture Land Management Systems in Spain and Portugal. Ecoagriculture Snapshots 9. http://www.ecoagriculture.org/documents/files/doc_68.pdf.). The first BAP began in March 2006 and by now AmBioDiv manages 15 BAP, with high incidence on Natura 2000 Network sites. The BAP’s main goal is to establish a Biodiversity baseline which will allow the definition of management guidelines towards Biodiversity no net loss or net positive gain. The results from the ‘Habitat Approach’ are to be presented and discussed. The Habitat Approach method was based on the analysis of plant communities (Braun-Blanquet 1979). The most relevant habitats were: Oak Montado forests, mixed woodlands, streamsides, scrublands, meadows, aquatic communities (Rivas-Martínez 2002). Some of the highlights regarding HCVA and plant communities that correspond to Biodiversity Hotspots are: Malcata HCVA - Quercus pyrenaica oaklands with a rich understory including endemisms such as Broteroi Peony (Paeonia broteroi) and Plantain Leopardbane (Doronicum plantagineum), with Strawberry-tree (Arbutus unedo) and Butcher’s broom (Ruscus aculeatus) also present (Arbuto unedonis-Quercetum pyrenaicae); Valongo, Alvaao/Marao HCVA’s - Portuguese endemism Murbeckiella sousae was found on the understory of Common Alder (Alnus glutinosa) woodlands, (Osundo-Alnio); Nisa and Sao Mamede HCVA - most significant orchid meadows of Serapias cordigera and Serapias lingua, (Festuco-Brometea), and scrubland (Phillyreo angustifoliae-Arbutetum unedonis); Tejo Internacional HCVA - Holm oaklands (Pyro bourgaeanae-Quercetum rotundifoliae), rocky slope communities (Selaginello denticulatae-Anogrammetum leptophyllae) and Cape Myrtle scrublands (Pyro bourgaeanae-Flueggeetum tinctoriae); Monchique HCVA - Common Rhododendron (Osmundo-Campanuletum primulifolii) and the Oleander (Rubio ulmifolii-Nerietum oleandri) were present only for some small areas.

Keywords: Mediterranean hotspots, high conservation value areas, biodiversity, action plan, plant ecology.

References:
Two Mediterranean landscape types and their high-biodiversity interface as candidates for a “landscape red list”

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Landscapes can be viewed as one of the levels in which biodiversity is hierarchically arranged, but their features and patterns can be disrupted by human influence more easily than the properties of single communities or populations. Hence, it may prove important to develop lists of endangered landscapes – analogous to species Red Lists and to Natura 2000 habitat lists.

Among the landscape systems (sensu Blasi et al. 2000) of the Mediterranean region of NW Lazio, two are particularly distinctive and biodiversity rich: the clayey-carbonate turbidite system and the pyroclastic-flow system. The former, due to peculiar pedological features that are unfavorable to agriculture and led to public property of land, shows a typical low density of human settlements (to an extent usually found in Italy only at much higher altitudes), and is therefore composed of communities with high diversity of fauna and flora. The latter is characterized by unique land forms: flat plateaux divided by gorges with vertical slopes and flat bottoms. The occurrence of gorges – along with transitional bioclimate – led to a typical and rich combination of plant communities: in each gorge a complex toposequence occurs, ranging in a very narrow space from Fagus sylvatica extrazonal stands to xerophilous evergreen shrublands (Scoppola & Filibeck 2008a, 2008b). Structural patterns of both landscapes are nowadays endangered, due to causes rooted in social changes, traditional agriculture abandonment and lack of urban planning. The two landscape types are in touch with each other through a long, geologically-driven boundary, which is very distinctive of the SW part of Viterbo province. Such an interface influenced through centuries the shape and location of urban settlements, and originated a belt particularly rich in plant biodiversity: during a floristic survey in a small area (1,000 hectares) placed right across the boundary, nearly 1,000 species were found, including many Red List taxa (Scoppola & Filibeck 2008b).

For centuries, traditional land use practices have been enhancing the differences in land-cover patterns on the two sides, hence increasing both visual distinctiveness and biodiversity across the interface. Instead, present-day development is blurring fast this diversity. Hence, we argue that this landscape interface as well constitutes a feature worth to be protected at landscape level.

Keywords: biodiversity, hierarchical land classification, landscape boundaries, landscape protection.

References:
Can natural and cultural Mediterranean landscapes be in conflict?

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We studied residual non-riparian natural oak forest communities in a peripheral Mediterranean area of the centre-northern Portugal. Although relatively small (20x10 km2), the area includes a wide altitudinal range (50-900 m) which determines a steep temperature gradient; the precipitation gradient is also abrupt, due to both altitude and rain shadow effect of nearby mountains. This environmental heterogeneity explains the high number of forest types that characterize the region (four non-riparian forests, one is described for the first time in this work). Using bioclimatic indices we predicted the potential distribution of all the encountered forest types using an environmental envelope model. The predicted areas where then compared with land-use maps, in order to understand preferential land-uses within each forest type. We found land-uses significantly related to forest types and we highlight the Quercus faginea subsp. faginea forests, whose potential area have been almost completely occupied by vineyards that belong to the Alto Douro Wine Region (recently integrated in the UNESCO World Heritage Cultural Landscapes). This forest is far the most endangered among the occurring ones revealing an interesting conflict between natural and cultural landscape.

Keywords: Quercus forest, environmental envelope model, land-use, Alto Douro Wine Region.
Urbanisation and biodiversity: integrated vegetation analysis for identifying and evaluating ecosystem services in a Mediterranean metropolis

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Focal areas selected to achieve the 2010 biodiversity target include the maintenance and improvement of ecosystem integrity and ecosystem goods and services. At the same time environmental quality and human well-being in urban and periurban areas represent topics of worldwide interest, because of the increasing rate of urban population, which in the Mediterranean-rim countries could reach up to 75% by 2030 (http://www.planbleu.org). Several international and local strategies, such as the Mediterranean Sustainable Regional Strategy Development (MSSD, 2005), consider biodiversity conservation and sustainable development in densely populated areas among their priority actions. These strategies require not only the monetary value estimate but also the ecological identification and evaluation of availability and stability of ecosystem goods and services at local level. Only few researches have been already published on this topic (UNU/IAS Work. Paper No 105/2003 on Urban Ecosystems and the Millennium Ecosystem Assessment), some for North-European and Mediterranean cities (Bolund & Hunhammar 1999, Gulinck et al. 2001).

In this talk, we promote the use of vegetation and land cover data as biodiversity indicators of pressure, state and impact for ecosystem goods and services in urban and periurban landscapes. In the case study of the Municipality of Rome, a Mediterranean metropolis with a long history of care for biodiversity conservation and sustainable development (Giacomini 1981, Blasi et al. 2008), recent landscape phytosociological researches have been addressed towards typification of plant communities, modelling of vegetation series, ecological land classification, design of land ecological network and analysis of land cover change (Blasi et al. 2005, Capotorti et al. 2005). The results of these investigations have been employed for the identification and ecological evaluation of some locally relevant ecosystem services - such as habitat provision, conservation of species diversity, urban climate regulation, recreational and cultural values– and provide experimental evidence of the bioindication potential of plant communities and vegetation series.

Keywords: urban and periurban areas, Rome Municipality, biodiversity indicators, local ecosystem services

References:
SESSION 3: TOWARDS AN ECOLOGICAL CHARACTERIZATION OF MEDITERRANEAN LANDSCAPES

Chairman: Carlo Blasi

PROPOSED POSTER PRESENTATIONS
The landscape dynamics of the canarian laurel forest after the end of traditional use. The Anaga’s pattern (Tenerife, Spain)

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The great floristic relationship and structural affinity with some mediterranean forests shows the close paleobiogeographical link of the canarian laurel forest with the mediterranean area. These characters and a similar rural mountain culture help to understand the similarity of its landscape with that of the wettest places in the mediterranean environment.

The laurel forest covers the most of the northern slope, the summit meeting and the highest sectors of the Anaga’s southern slope, but its location, its area and the geography that defines its landscape have undergone significant changes since XVIth century. After the Tenerife Island conquest, the Anaga’s laurel forest suffered intensive forestry and most of the forest was replaced by agricultural fields. At the end of the XIXth century began to leave the agricultural activity of the least accessible places and of the sites with poorer soils. The forest resources exploitation declined also and became more selective, focusing especially on the watersheds, where the main ways were and that were rich in the best species for vegetal charcoal production (Erica platycodon and E. arborea) (Arozena et al. 2008a). The gradual loss of economic value of forest resources and of agricultural lands finished at the end the XXth century, when creating the Anaga’s Rural Park. The low traditional activity that remains not allows understanding the present landscape, which should be understood for the most as a changing cultural heritage of the last century.

There is a dominant trend to the landscape homogenization, only interfered by natural disturbances of increasing impact (Arozena et al. 2008b), but the characters of the natural landscape of the Anaga’s laurel forest are unknown still with precision. The vegetal composition, the structure and the distribution of forest communities indicate that this historical human process has not been homogeneous, and that its variants are reflected in three main types of forest landscape, corresponding to specific Anaga’s areas. Each of them is characterized, especially, for specific forest mosaics. This paper is part of the project research of the Spanish National Plan I+D+I: Hombre y dinámica del paisaje forestal en Anaga (Tenerife, Islas Canarias). Aprovechamiento y dinámica histórica de los paisajes forestales españoles: SEJ2006-15029-C03-03.

Keywords: landscape dynamics, forest landscape, laurel forest, Anaga’s Park Rural, Tenerife, Canary Islands, Spain.

References:
The effect of the relationship between topography and human action in canarian laurel forest landscape. The pattern of Taborno (Anaga, Tenerife, Spain)

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Anaga is an ancient volcanic massif with a rough and very hilly relief. This massif is like a roof-water, with a lineal summit between 650 and 1,020 meters and with two main slopes highly inclined. The torrential erosion has worked differentially due to diversity of the local volcanic structures, and the relief shows often abrupt changes of slope, sometimes of very small area.

These topographic features are visible at different analysis scales and have been critical in lie of the Anaga´s landscape and in the past and current forest dynamics landscape. In the most isolated small villages, the self-sufficiency agriculture are perfectly adapted to the topography and small agricultural islands, more or less flat and surrounded by forest and shrub, reached the Anaga´s summit during the greatest demographic pressure. In the late nineteenth and early twentieth century began to reduce the need for agricultural products and the first to be abandoned are the most distant orchards from village settlement and them with the higher slope and lower surface. Gradually, the forest closed these spaces and the typical old landscape of the hits lower band goes down from the summit, nearer to the small villages. It began a recolonization process that has continued until today, recreating gradually at a lower altitude the type of forest mosaic characteristic of the summit in the past. The growing boom in the production of vegetal charcoal, from the XIXth century and during most of the XXth century, imprints its own landscape over that generated by the historical agricultural process. This new phase was characterized by obtaining the raw material in the summit and in the outstanding relieves of the slopes (Arozena 2005). Each of these phases intuitive planning land use has left its imprint on the current landscape of the Anaga’s laurel forest, whose patchwork of communities represents a true palimpsest. One of its main features is the existence the different dynamic forest states that are very spatially linked to changes in terrain slope and in soil depth and continuity.

The forest geography of header Taborno Ravine is a model of the secular human adaptation to relief features and to peculiar properties and life strategies of various tree species of the laurel forest. The aim of this paper is to recognize in detail one of the three patterns of the Anaga’s laurel forest landscape, differentiated by their history, and characterized in another research presented also in 45º International Congress of SISV & FIP. This paper is too close linked with the project research of the Spanish National Plan I+D+I: Hombre y dinámica del paisaje forestal en Anaga (Tenerife, Islas Canarias). Aprovechamiento y dinámica histórica de los paisajes forestales españoles: SEJ2006-15029-C03-03.

Keywords: landscape dynamics, forest palimpsest, laurel forest, Taborno, Anaga Tenerife, Canary Islands, Spain.

References:
The geo-environmental coastal units over different scale of analysis: from the plan to the project for the sustainable management of the beach system

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The environmental and ecological characterization of the coastal landscape, to the different scale of analysis, represents an important thematic synthesis which is able to define the actions for the specific Plans or Projects of sustainable development.

In the present paper is illustrated the methodological interscale approach through which are analyzed and recognized the different geo-environmental units that structure some of the most meaningful ecosystem composed from beach, dune and wetland along the coast of Sardinia.

The geo-environmental coastal unit is a useful tool for the integrated coastal zone management, since they represent an effective tool of interdisciplinary cognitive synthesis, useful for the individualization of direction and criterions for the Plan or the Project reported to the local context.

The study has been applied in the Domus de Maria and Villasimius coastal area, respectively situated in the south-western and south-oriental sector of Sardinia. The recognition of the geo-environmental units is based on the integrated analysis of the geomorphological, geobotanic and urban components and on their mutual relationships.

The geo-environmental units constitute the territorial matrix of reference in the Coastal Use Planning, Management Planning of the sites Nature 2000, and for the executive Projects of improvement in the Chia and Porto Giunco dunes (respectively situated in Domus de Maria and Villasimius coastal area).

The identification of the geo-environmental coastal unit is functional to the:
- Ecological and landscape characterization of the coastal area;
- Identification of homogeneous lands inside which specific forms and evolutionary trials are recognized;
- Evaluation of the degree of sensibility for the different uses of the beach;
- Construction of a directive and rules for the sustainable fruition of the beach system.

Keywords: geo-environmental, units, management, coastal area, beach system.
First observations about morpho-sedimentological and vegetational aspects of the dune field of S. Ena – Sa Chitta and Iscra Ruja coast (NE- Sardinia)

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The aim of this project is the study of the evolution of the dune field of Capo Comino, between S. Ena-Sa Chitta and Iscra Ruja, by the integration of sedimentological, morphological and vegetational data. This approach has been already used in northern Sardinia (Platamona – SS) where we obtained very good results to understanding the evolution of the dune field and also to establish the quality and naturality of this area (Balduzzi et al. 2004, Vagge et al. 2007). The target is to fix the elements for a future monitoring.

Our idea is to test the model in a non-anthropized coastline, that presents different local conditions.

In the first phase of this work we will analyze the general characteristics of the area like the bioclimate, the wind-wave climate, the mapping of the dune field by aerial photography analysis and their final cartographic representation. The second phase will imply several field measurements to study vegetational aspects (by phytosociological methods) in order to establish the present phytocenosis, their ecology and dynamic. It will be also possible to obtain several morphological and sedimentological data in order to highlight the characteristics of the sedimentary environment and the aeolian transport.

The integration of vegetational, sedimentological and morphological data will be obtain by the analysis of several transects carried out along the lines of dominant winds, that will outline the dune field. Vegetational data and sedimentological samples will be collect along these transects to allow a correct interpretation about coastline evolution.

The previous vegetational and sedimentological data, the satellite and cartographic reliefs and field measurements have already allowed to establish that, even if the anthropic impact is not so considerable, the dune field had some modifications and a considerable erosive process due to several factors (not in the least the natural sea ingression due to storm events). Erosion processes seem to hit the beach, in particular in the central sector that is subjected to the storms coming from the Tyrrenian Sea. The most wide and high dunes are located in the southern sector of the beach where the dune field have its maximum extension and the phytocenosis have good quality and naturality. The back dune is occupied by some agricultural land uses that sometimes were be taken from the levelling of the dune field and were cultivated in the last few years.

Keywords: coastal dunes, morphology, phytosociology, sedimentology, remote sensing, NE-Sardinia.

References:
Modelling rural landscape functionality: the case study of Spoleto district (Umbria - Italy)

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As a part of the project “Umbria Region Ecological Network - II phase”, a model for rural landscape quality assessment was carried out in order to evaluate the actual conservation state of rural macroecosystems, highlight the critical aspects in maintaining landscape ecological integrity and understand how to increase rural ecosystems functionality with the aim to preserve local biodiversity and to assure biopermeability for faunistic populations. The study area, made up for the 46 % of rural ecosystems, corresponds to the territory belonging to 7 Municipalities located in the Southern part of the Province of Perugia (Umbria - Italy): Montefalco, Campello sul Clitunno, Trevi, Giano dell’Umbria, Castel Ritaldi, Massa Martana and Spoleto.

After the selection of suitable indicators of rural landscape functionality and the definition of a scale of scores to be assigned in order to evaluate this set of indicators, an index called Rural Landscape Functionality Index (RLFI) was developed. The range of possible scores of RLFI was divided into 8 classes, characterized by different levels of ecological functionality. Then a grid made up of cells of 1 x 1 km (surface of 100 hectares) was overlapped on the study area. Each cell was given a score according to the above said methodology and was attributed to a quality class. At the end, a “Map of rural landscape functionality” (scale 1: 100.000) showing the distribution of rural quality classes in the study area was carried out. This map allowed to detect the most critical areas to be suggested to carry out specific projects aimed at improving environmental quality and ecosystems functionality. It can also be seen as a useful model for the implementation of the ecological network in the whole Umbrian territory.

Keywords: rural landscape, ecosystems functionality.
Ecological characterization of Colfiorito Marsh for the editing of a management plan for *Phragmitetum vulgaris* aimed at biodiversity conservation

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Vegetation structural heterogeneity is one of the most important factors which determine the highest expression of floristic and faunistic biodiversity in marshy ecosystems. Colfiorito Marsh (Umbria - Italy) is a wetland subjected during the last decades to many conservation measures (Ramsar site, SCI, SPA, IBA, Regional Park, etc.). Also in this wetland the conservation of the mosaic made up of waters, marshy habitats with a dominance of *Phragmites australis* or *Schoenoplectus lacustris*, wet meadows and riparial brushes, is a necessary premise for marsh biodiversity conservation.

In Colfiorito Marsh the cane thicket (*Phragmitetum vulgaris*) represents the typical helophitic vegetation and the most characteristic and spread ecosystem, which however can be considered as an ecologically monotonous monoculture, tending to replace the original vegetation mosaic. The natural silting processes of water bodies and the socio-economic processes leading to the abandonment of mowing of wet and marshy meadows, cause as a matter of fact a quick expansion of the cane thicket that tends progressively to spread to all the areas with phreatic sheet located less than 50-70 cm below the soil level and to all the aquatic environments whose water sheet depth doesn’t exceed 150-170 cm. This phenomenon is likely to cause heavy modifications of botanic and faunistic components. With the aim to understand what is the best landscape and ecological structure for marsh biodiversity conservation, “Colfiorito Regional Park” has charged Camerino University (Environmental Sciences and Molecular, Cellular and Animal Biology Departments) to develop a management plan for the plant community dominated by ditch reed (*Phragmites australis*). This contribution is aimed to explain the preliminary work carried out to analyze the changes of marsh vegetation cover from the post-war period until nowadays, evaluate the potential evapotraspiration of cane thicket and correlate the historic vegetation changes with floristic and faunistic populations, in order to understand which has been, during the last decades, the marsh “landscape status” endowed with the greatest floristic and faunistic biodiversity level.

**Keywords:** wetland ecology, biodiversity conservation.
Spatial distribution of rainfall trends in Spain (1961-2006)

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The main objective of this work was to study the rainfall trends in Spain at monthly, seasonal and annual time-scale during the period (1961-2006). In order to achieve this purpose monthly precipitation data from 553 weather stations distributed over the country have been analysed by applying different statistical tools. Magnitude of trends was derived from the slopes of the regression lines using the least squares method while the statistical significance was calculated with the non-parametric Mann-Kendall test. Different interpolation techniques were tested to generate rainfall trend surfaces using ESRI’s Geostatistical Analyst Extension. The cross-validation statistics revealed that Ordinary Kriging was the best suitable method for interpolation precipitation tendencies in Spain. A generalized decrease of rainfall has been noticed in January, February, March, April and June with significant negative trends of 72.34%, 60.27% and 23.28% respectively during February, June and March in the whole territory. At seasonal time scale, more than 40% of Spain showed significant rainfall decreases in winter and summer. In contrast to this, positive trends have been mainly detected in May, August, September and October with percentages of significance higher than 30% in August and October. Autumn has also shown precipitation increases in more than 65% of weather stations. At annual scale precipitation has tended to diminish from 1961 to 2006 in 18% of territory with a significance percentage of 33.4%. It has been also confirmed in this study that combination of classic trend tests and spatially interpolation techniques improve the spatio-temporal interpretation of detected tendencies.

Keywords: rainfall trends, Spain, Mannn-Kendall, interpolation techniques, ArcGIs.
Isolated wetlands: using focal species to restore connectivity

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Wetland rich regions, for their nature, represent networks of habitats suitable for the wetland-related fauna surrounded by an adverse matrix. In our landscape, this matrix has been replaced by anthropic elements (such as agricultural, urban and industrial areas), which seem to be more adverse to the movement of the fauna if compared to the original natural matrix. Adding to this, most of the elements that comprise the modern wetland network are artificial and made for specific purpose, such as irrigation or waste water treatments.

In our work, we want to investigate the relation that exists between wetlands and the surrounding matrix. To do this we select focal species from the breeding avifauna strictly connected to wetlands, and we check their presence during the breeding season in different kinds of wetland along a wilderness gradient. The incidence data are then related to different landscape metrics, calculated using the spatial analysis software FRAGSTATS, and to qualitative measure of the matrix. The results of this first step are interpreted to identify which of the spatial aspects we consider more influent. Finally, we transpose this aspect on a “suitability map” used to identify the existing, and the possible, element acting as “connectors” between the bigger and natural wetland persisting in the studied territory.

The aim of this work is to identify which are the spatial features of the many small and artificial wetlands spread in our anthropogenic landscape that play a functional role in a local network of wetland. The results of this work are expected to be a starting point for the development of a better integration of wetlands’ conservation’s needs in the agricultural policy of the territory.

The area object of this study is included in the Simeto river basin, which is part of the Sicilian Ecological Network proposed by the Nature Conservation and Ecological Networks Research Group of the University of Catania. For the purpose of the study, we select ten small lakes, ponds and slow flowing channels located between three majors wetlands the “Oasi del Simeto”, “Biviere di Lentini” and “Ponte Barca”.

Keywords: ecological network, isolated wetlands, ecological landscape.
Characterization of vegetation landscape of Castel Volturno Nature Reserve (Campania region, Southern Italy)

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The Castel Volturno Nature Reserve, founded with D.M. 13/07/1977 and managed from Corpo Forestale dello Stato, is a flat sandy coastal area (of about 300 ha) located to north in Naples. Despite the presence of several disturbance factors (e.g. coastal erosion, tourist pressure) the Reserve represents one of the few and more important areas of Campania region where geoforms and vegetation zonation along the sea-inland gradient have been relatively well preserved. The vegetation is characterized by different successional stages of plant communities starting from low embryo dunes and halophytic habitats followed by sclerophyllous shrublands, Quercus ilex stands or Pinus pinea plantations and small scattered nucleus of hygrophilous habitats. This vegetation successional gradient is superimposed by a mosaic of plant patches related to fire occurrence that contribute to the maintenance of high habitat and species biodiversity both at plant and seed bank levels (Esposito et al. 1999, 2006). According to the 92/43 CEE Directive purposes, part of this area was included in the Natura 2000 Site Pineta di Patria (IT 8010021), extending for about 313 ha. Moreover in a recent study (Esposito & Filesi 2007) the presence of the 2210 habitat Crucianellion maritimae fixed beach dunes has been assessed and their relative plant communities, including bryophyte layer, have been analyzed to better understand its synthaxonomical and syndynamical characters. Despite the importance of the area in terms of presence of Nature 2000 habitats and its biodiversity high value, only some specialized and analytical ecological research were carried out, but no studies to characterize the whole vegetation of the area are reported. This research aimed to investigate the vegetation of the Castel Volturno Nature Reserve at two scale levels. At community level on the basis of phytosociological sampling carried out according to the geomorphology of dune systems to characterize its synthaxonomic, syndynamic and synecological properties to evidence the relationships between plant coenosis and local dune morphology. Moreover at landscape level a study of vegetation dynamic have been performed on the basis of the analysis of aerial photos of the last decades. The obtained results can be used as a fundamental basis to suggest more concrete definitions strategies for the habitat management and conservation plan.

Keywords: Mediterranean coastal vegetation, syntaxonomy, syndynamic, conservation, Natura 2000.

References:
The ecological network of Rovigo district

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Rovigo district is entirely in the plain but, instead of this, it is marked by particularly strong physical factors. The two chief rivers of Italy (Po and Adige) fix long the boundaries of the district. Fossil dunes, actually very far from the sea, present some patches very well preserved, with peculiar geomorphological and botanical aspects. On the one hand the big Alpine rivers have played a considerable role as ecological corridors between the mountains and the sea. On the other hand the ancient Adriatic coastline made easier, in a period warmer than today, northwards migrations of Mediterranean species. The north-Adriatic sandy coastal system (included fossil dunes and Po delta) plays a very important role for nature and biodiversity conservation (Gamper et al. 2008), especially because of its particular climatic features: it is the only strip in the whole Mediterranean basin being included in the Temperate climatic Region (Rivas-Martínez et al. 2001). These three natural corridors intersect the Po delta, one of the few advancing coastline Italy, in spite of subsidence. The considerable contribution of freshwater and sediment facilitates sand-bank making, produces coastline advancing and new habitats building, particularly new lagoons and bays: in Italy there aren’t further similar events at least not so extended. For these factors, in addition to biogeographic and bioclimatic features, the Po delta can be considered a biodiversity hot-spot in the Mediterranean area. Ecological network efficiency can be estimated at two levels: - Corridors and stepping stones functionality as regards as species spreading and habitat conservation - Land mosaic balance in terms of diffuse natural elements. The ecological network of Rovigo district receives the carrying structure from the Venetian ecological network and enriches its drawing. Its aim is to contribute to the right regional planning and to favour the environmental design focused on environmental factor and landscape potentiality: for this end the ecological network identifies homogeneous geomorphologic units for reforestation, construction of wetlands, restoration and rehabilitation projects. Moreover, it suggests artificial basins planning, in accordance with “Guidelines for the prediction of flood risk” and proposes ecological compensation measures.

Keywords: ecological network, ecological compensation, fossil dunes, North-Adriatic coastal dunes, Po delta.

References:
Historical evolution of almond landscape in the Velino south slope (Abruzzo, Italy)

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European Landscape Convention (2000) recognizes landscape as an important element of cultural, ecological, environmental and social processes, and, no less important a relevant economical resource (Blasi & Carranza 2000). On this basic statement, landscape may ensure life quality and human well-being. Nevertheless, landscapes are in continuous transformation as a result of both natural processes and anthropogenic disturbance. The need to manage and plan these transformation processes and to protect landscape values has therefore become a priority. The aim of EU measures is the maintenance of the traditional agricultural cultivation, preservation of environment, development of countryside tourism and conservation of biodiversity and habitats. This study is addressed to determine temporal and spatial variations in distribution of the almond orchards in the Velino south slope, in order to evaluate the degree of homogenization and the contraction of almond landscape, a typical cultural landscape that is decreasing all along the inner valleys of the Abruzzi region. This research is part of the SAFENUT European project. Within the Council Regulation (EC) N. 870/2004 AGRI GEN RES, that established a community program on the conservation, characterization and utilization of genetic resources in agriculture, the project represents an effort to coordinate the almond genetic resources to share them in a more efficient manner, focusing on the recovery of old traditional endangered almond genotypes. One of the main objectives of the project is the survey of traditional agricultural practices, land use, orchards structure and organization in the Mediterranean basin. The study area covers approximately 80 km²; and extends from the town of Massa d’Albe on the west to the municipal district of Celano on the east, and it is located approximately 20 km south of Mt Velino. The area has been selected as it represents the typical rural landscape in mountainous environment, where about 500 ha of almond orchards are still preserved. In order to evaluate landscape changes in this area over the last 50 years, the aerial photo set available for the years 1954 and 2006 respectively, were analyzed and location given by means of the GIS in order to create and analyze the spatial database and produce landscape maps for subsequent statistical analyses. Environmental data, such as elevation, slope and morphological features of the area were also included in the data base. Land use/cover information was extracted from the Region Abruzzo Land Use and the Corine Land Cover (Level 4) classification system. A specific spatial index (shape, density and abundance) was used to evaluate landscape heterogeneity. The evaluation of changes in land use are of high relevance for the identification of measures of protection of almond orchards, for a better understanding of the historical evolution of traditional agricultural practices and, finally, for recovering local-historical memory on landscape uses and practices.

Keywords: almond, landscape, evolution, land use, Abruzzo, Italy.

References:
Coastal halophilous, sand dune, dry-river-bed and salt-marsh vegetation of Fuerteventura (Canary Islands, Spain)

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In this paper we present a study of the littoral, sand dune, dry-river-bed (wadi) and salt-marsh vegetation of Fuerteventura. Inside the Canarian subregion of the Mediterranean biogeographical region (Rivas-Martínez et al. 2007), the special orographic features of Fuerteventura, with altitudes not surpassing 807 m above sea level, large plains partially covered with organic sand, broad, shallow ravines (wadis) and long tracts of low, sandy coasts, make this island a hot-spot of sintaxa belonging to the phytosociological alliances *Traganion moquinii, Tamaricion boveano-canariensis, Frankenio ericifoliae-Astydamion latifoliæ, Phoenicion canariensis, Sarcocornion fruticosae, Arthrocnemion macrostachyi, Suaedion verae* and *Thero-Suaedion*. This last alliance is mentioned here for the first time for the Canary Islands.

We present a chorological study of 10 plant communities to association level, belonging to the alliances numbered above, based on Geobotanic Information System GBOTIS, (Martín Osorio et al. 2005) as well as a synthetic phytosociological table of these associations. We also include a syntaxonomical scheme and a study of the structure of vegetation, and we describe the geocatena present in the study area.

Keywords: mediterranean biogeographical region, GIS, Fuerteventura, halopsammophilous vegetation, syntaxonomical biodiversity hotspot.

References:
The landscape of the manna ashes in Sicily

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The manna ashes are related to wild species of the genus Fraxinus, namely F. ornus (true manna ash) and F. angustifolia (narrow leaved ash). About two centuries ago, several varieties of such species, selected in ancient times, were widely cultivated for extracting the manna drug. This represented a remarkable economic resource for the region. Manna was extracted mainly for pharmacological industry, but today it has became a herbal product. Irrespective of the processes that reduced this cultivation to the lowest extent, the manna ash landscape is a remarkable peculiarity in the frame of the Mediterranean agro-systems. It is still kept alive as a relict cultivation within a very restricted area on the northern slope of the Madonie Mountains, in the countryside of Castelbuono and Pollina, at the eastern border of the Palermo province (Northern Central Sicily) (Raimondo et al. 1995). Taking into account that most of the ash crops are presently abandoned or under agricultural replacement, the need of conserving such unique landscape is pointed out here (Raimondo 1980).

Keywords: Fraxinus, Italy, Madonie Mountainis, pharmacological industry

References:
Assessing preliminary ecological information from field and GIS data using a statistical approach

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Riparian vegetation of Mediterranean areas generally displays a pronounced spatial variability in species and communities richness, composition and density from headwaters to lowlands. Linking diversity in number of species and life-forms to environmental gradients, vegetation and landscape features can be an important guide in the development of conservation and restoration strategies. Comprehensive surveys over large geographical areas are needed to determine the spatial variability of plant species along a river. Extensive field surveys are, however, costly in terms of practical limitations, time and money.

In this study we test if it is possible to extract the main environmental features of a Mediterranean river using floristic information recorded by stratified random sampling of the area and a set of environmental data derived both by GIS tools and plant ecological information.

Several studies focused on the relationship between environmental variables and river plant distribution. However, multivariate analyses have become popular and enabled more reliable information on which environmental factors are important.

The use of field data and GIS-derived data, in combination with ordination techniques, was largely applied in ecological studies and resulted in a good discrimination between distributional patterns of plant groups and richness along rivers. Moreover, this methods would provide a rapid understanding of controlling environmental factors.

Through the analysis of environmental data together with field data using statistical procedures, we provide a preliminary and cost-effective basic knowledge of the ecological features of the area, that could be useful for a better planning of further studies.

Here we present the preliminary results obtained for Santa Lucia river (Sardinia, Italy). We perform TWINSPAN and DCA to detect groups of plots with homogeneous plant species composition and their location in a multivariate space. Then, applying CCA analysis we want to point out what are the most important environmental factors that play a role in determining plot composition of groups and plant species variability along longitudinal/altitudinal gradient of river.

Keywords: riparian vegetation, stratified random sampling, univariate and multivariate analyses, Sardinia.
Can geomorphology influence floristic distribution and continuity along a river corridor? A case study in Sardinia (Italy)

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River corridors are recognized as linear landscapes in which environmental features changes gradually from headwater to mouth (see River Continuum Concept, Vannote et al. 1980). Many authors underline how exist environmental factors that deeply influence plant species distribution along river. In this study we examined riparian vegetation in relation to fluvial geomorphology along Santa Lucia river (SW Sardinia, Italy), where the morphology is influenced to a large degree by the underlying mixed bedrock-alluvial geology (Van Coller et al. 1997). We wondered if: 1) could bedrock/alluvial presence affect the distribution of biological and ecological plant traits and species richness along a river; 2) could the geology of the area influence the floristic continuum of the river corridor. We used a stratified random sampling design, considering only floodplain, and recording all vascular plants species (presence/absence). The influence of geology on floristic patterns was tested using different statistical techniques in order to determine if there was consistency in results using multiple procedures. We performed both univariate and multivariate analyses, and also applied Wilson-Shmida index to test species turnover along the river, and Søresen index to test similarity between groups of plots.

The results obtained from the various analytical techniques we applied were in close agreement. The study indicated that along bedrock influenced rivers such as Santa Lucia river, the fluvial geomorphology more than the chemistry features of different geology is a critical component for vegetation distribution patterns. Particularly DCA, TWINSPAN and t-test for species richness underlined the existence of distinct floristic zones in the study area that had a strong correspondence (tested with Søresen index) with bedrock/alluvial geological types. The geomorphological discontinuum is reflected also in changes in species richness and ecology (significative variation of Ellenberg indicator values) but not in life forms (and the resulting vegetation structure). Moreover, the change of geology and, overall, geomorphology marked an high species turnover (reflected by the high values of the Wilson–Shmida index) probably linked also to a different degree of human disturbance. In conclusion, we can say that in the Santa Lucia river case, the floristic continuity (and the River Continuum Concept) can’t be considered a reliable representation of the stream.

Keywords: bedrock/alluvial, univariate/multivariate statistic, Wilson & Shmida Index, Søresen Index, Sardinia.

References:
Lichens and risk of desertification in Mediterranean areas

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This research has to be considered as part of the FISR MICENA project (Complex model for understanding the evolution of natural and agricultural ecosystems related to climatic changes into Mediterranean area). It has been proposed a scientific topic aiming to estimate the possible use of lichens as indicators of desertification courses specifically concerning Mediterranean areas. They have been published results of four researches producing scientific evidences made between 2006 and 2008 in desert areas in West Sardinia, where the human presence and its consequences is allegedly very low therefore it’s much easier to highlight better the effect of climatic parameters on vegetation composed mainly or completely by lichens; the recent publication, regarding Region Sardinia, about predicting models of desertification, also allows us to throw a better light on the possible connection between signes of environmental risks and the ecological answers given by different types of lichens as natural potential indicators. Valuations about different levels of the presence of lichens (epiphytic and epilithic) have been obtained through random layered samplings.

Apart from the climatic parameters, more than 50 environmental other parameters related to different substrate and different large spatial scales have been found and analysed, from the micro-evidence to the land-cover, in order to study and check the predicting power of all these parameters on the diversity of lichens. Also, groups of species related to different levels of desertification risk have been learnt and the effects of the environmental parameters on the climatic factors evaluated. Their distribution, as ecological answer given by climatic variants, could be used through systems analysis built on variable scales to monitor on a long term the effects of climatic changes on the Mediterranean eco-system liable to desertification risks.

Keywords: Sardinia, desertification risks, climate change.
Habitat cartography from Tinto River basin

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Habitat cartography, based on real vegetation of the territory, is considered necessary to establish basis for the management, restoration and any other grade of land management. Besides, this cartography is a fundamental tool for the interpretation of potential vegetation of the territory.

This fact acquires special interest in Tinto River basin, where converge two main characteristics that make this territory a unique system. First, the extreme acidity and high concentrations of metals in its waters spread out along 80 km from the source, characterizing the riparian vegetation. Second, the intense grade of degradation present in the whole basin, due to the effects of mining activity, known in this region for more than 5000 years, and the results of chemical, cattle farming and agriculture industries.

In this study we present the revision of the cartographed units from the habitat map of the hydrographic basin of Tinto river 1:50000 scale, resulted in compliance of the Directiva 92/43/CEE law.

Methodology employed was the collection of information directly in the field, using phytosociological relevés following the classic phytosociological methodology from Zurich-Montpellier school. Information was treated and contrasted with data published from this territory and nearby areas, and finally presented as floristic tables.

We have distinguished a total of 149 polygons that include habitats which correspond to climactical forest and their scrub serial communities, edaphohigrophilus, edafoxerophilus, salt-marsh and coastal sand dune vegetation.

Keywords: Tinto river, habitat, cartography.
Habitat loss, fragmentation and quality in and around Italian Natura 2000 sites

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Habitat fragmentation is widely recognised as a major pressure on biodiversity in Europe, and a distinct process from habitat loss (Fahrig 2003). Although traditionally protected area management has focused on within site management in order to ensure protection of the biota, evidence from ecological theory and practice suggests that the structure and quality of the surrounding matrix is as important as the protected area itself (Turner 2005). In addition it is important to understand historical changes in order to underpin future mitigation strategies.

As part of the EU FP6 COCONUT project, we quantified fragmentation patterns in and around selected Natura 2000 sites, using existing land cover datasets, to assess changes through time for 10 sites in three geographical regions in Italy. We used three time slices to measure changes between 1950 and 1990 (prior to N2K establishment) and 1990 and 2000 (after N2K establishment). Using a series of commonly employed landscape metrics (McGarigal et al. 2002) fragmentation was measured as increase in patch numbers, decrease in patch size and increase in isolation of patches. In addition we looked at changes in habitat quality for plants, birds, butterflies and bees diversity as evaluated by a team of Mediterranean experts.

We found evidence for fragmentation in all three regions we examined, though the patterns differed between regions and between habitats. There was increased fragmentation historically (1950-1990) and also more recently (1990-2000) though generally less so since Natura 2000 establishment. There was a similar trend in habitat quality for most of the sites with habitat mainly around the N2K sites deteriorating between 1950 and 2000. The quantification of fragmentation patterns and changes in habitat quality, can assist with the identification of those areas most at risk and provide evidence to prioritize conservation activities, such as the management of land in and around Natura 2000 sites.

Keywords: Mediterranean, protected areas, plants, birds, bees, butterflies.

References:
McGarigal K., Cushman S.A., Neel M.C., Ene E. 2002. FRAGSTATS: Spatial Pattern Analysis Program for Categorical Maps. Computer software program produced by the authors at the University of Massachusetts, Amherst.
Ecological characterization of the Natura 2000 network in Spain

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The Natura 2000 network in Spain consists of 1380 Sites of Community Interest (SCI) and 512 Special Protection Areas for Birds (SPA) (2006 April version), which cover about a quarter of the national territory. The present work sets out an ecological characterization of Natura 2000 network to facilitate its planning and management. The characterization is based on the analysis of relevant information available on ecological systems included in the network. Natura 2000 is the most important conservation effort being implemented in Spain. The main purpose of this ecological characterization is the knowledge of the natural value that encloses the Spanish Natura 2000 network. Moreover, how effective is this network of protected areas for representing the Spanish biodiversity? The answer to this question requires a comparison of existing biodiversity information within and outside the Natura 2000 network.

Keywords: Natura 2000, biodiversity, conservation, Spain.
Vegetation – environment relationships in the Regional Park of Euganean Hills (Veneto, Italy)

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The volcanic complex of Euganean Hills is a group of about one hundred hilltops, whose height varies from 80 m up to 602 m above sea level, very similar to an archipelago rising from the flat Venetian plain. They are a Regional Park of Veneto District (from 1989) and a site of Nature 2000 Network (from 1998). The variety of geological and lithological features, the presence of soils with different origins and chemical compositions, the particular geomorphologies, the microclimatic situations, the historical background (during Quaternary they seem to be glacial refugia, where many species were able to survive), the human presence (attested since the mid Palaeolithic) and the historical land use transformations created different ecological stands. For their species and communities richness and, in particular, for the amount of rare and threatened species and habitat, Euganean Hills can be identified as one of the most important area in Veneto from the botanical point of view.

The phytosociological investigations allowed us to carry out the vegetation map of Euganean District. The aim of the our study is to identify the relationship among the different plant communities and the principal environmental features: the present work summarize the first results.

A database with geomorphological, lithological and pedological data has been carried out using G.I.S. tools (IdrisiGIS, ArcGIS): layers of vegetation, lithology, pedology, DEM and its topographic derivatives (slope, aspect and insolation) were combined to see if there are remarkable statistical correlations among these parameters.

Keywords: Euganean Hills, vegetation map, environmental features, DEM.
SIDE EVENT 1: PLANTS SPECIES AND COMMUNITIES IN THE MEDITERRANEAN MINING AREAS: BIODIVERSITY, LANDSCAPE EVOLUTION AND THEIR USE IN PHYTOREMEDIATION

Chairman: Mauro Casti

INVITED ORAL PRESENTATIONS
Metallophytes: a unique biological resource for mine site remediation, ecological restoration and phytomining

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Metallophytes – plants that have evolved on metal-enriched soils – have key ‘values’ that must drive research on their unique properties, and ultimately their conservation. The ability of metallophytes to tolerate extreme metal concentrations commends them as the optimal choice for ecological restoration of mineral wastes and metal-contaminated sites. Metallophytes have also spawned several novel phytotechnologies, including phytoextraction and phytomining. Action towards conserving the global metallophyte resource base is imperative because many species are under threat of extinction from mining activities. This has been identified as a priority in the Mining, Minerals and Sustainable Development (MMSD) Project of the Global Mining Initiative in 2002, but positive responses from the minerals industry have been slow. The last decade has however seen an ever-increasing interest in metal-tolerant and metal-accumulating plants both from an academic standpoint and their use in restoration and phytostabilization. Few studies have highlighted the need to conserve these species. This paper identifies future research needs for the conservation and utilization of the global metallophyte biodiversity with some specific examples from mediterranean Europe.

Keywords: metallophytes, phytotechnologies, phytoextraction, phytomining, phytostabilization, ecological restoration.
Mine wastes restoration and conservation of rare metallophytes in a Site of Community Importance (SCI): “M. Linas-Margarani” (SW-Sardinia)

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In this work is analyzed the area of Marganai Forest, included in a Site of Community Importance (SCI), designated as protected area under the “Habitats” Directive (Council Directive 92/43/EEC). This territory is very important both for its natural features and its mining story vestiges. In fact, the main area is occupied by dense olm oak wood and along the streams and on the rocky ridges rare endemic plants are present. However, many scattered abandoned mines exist in this territory, among which, the biggest are in the valley bottom. The main mine of this area is “Sa Duchessa”, whereas “Barraxiutta” is important because of the industrial treatment of the minerals, that produced a big quantity of red muds that now form the most pollutant dumps in the considered area.

In spite of the environmental damages and the risks for the human health produced by the mining site, the wastes are very important for their biodiversity richness, due to the presence of a typical colonizing flora and vegetation. Several rare endemic species can be considered metallophytes, given the high concentration in toxic metals that they tolerate.

Among these, it has to be quoted first *Linum muelleri*, an endemic exclusive of SW-Sardinia, protected as priority species by the “Habitats” Directive. *Genista sulcitana* is another exclusive species of Iglesiente, whilst *Iberis integerrima* and *Echium anchooides* are Sardinian endemics. *Epipactis tremolsii* and *Angallis monelli* are very important plants from the biogeographic point of view. Finally, *Santolina insularis*, *Ptilostemon casabonae*, *Bellium bellidoides*, *Scrophularia canina* subsp. *bicolor*, *Helichrysum microphyllum* subsp. *tyrrhenicum* and *Euphorbia pithyusa* subsp. *cupanii* are endemics with a wider distribution area.


The most metal-tolerant species seem to be *Epipactis tremolsii*, *Iberis integerrima* and *Echium anchooides*, which can grow in fine substrata with more than 30,000 mg/kg Pb and 40,000 mg/kg Zn (ATI-IFRAS, 2008). *Euphorbio cupanii-Santolinetum insularis* is also present on very polluted pebbly wastes.

The existing restoration plan of the area is to remove the most of the mining dump and collect all the materials in a single place. However, appropriate measures for the conservation of the biodiversity will be taken. The less dangerous dumps for the human and environmental health will be let in place; moreover, in some case special garden will be made with substrata suitable for the survival of the most threatened plants.

**Keywords:** Sardinia, Marganai, endemics, metallophytes, mining areas, environmental restoration.

**References:**
Phytoremediation application to the Sulcis Iglesiente heavy metals contaminated areas

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The remediation of mining areas represents a relevant environmental problem in all Europe. The high concentration of heavy metals and the lack of nutrients determines the desertification of wide areas (Conesa et al. 2007). In Sardinia (Italy) the poor management of Montevecchio – Ingurtosu mining district after mine closure caused the dispersion of high amounts of contaminants by wind and water erosion on wide areas (Dessì et al. 1999). The wide extension of the contaminated area and the high level of contamination by heavy metals make the application of phytoextraction feasible for this area. The environmental risk related to the presence of heavy metals can be evaluated by determining the bioavailable metal fraction in soil. The Department of Geoengineering and Environmental Technologies of the University of Cagliari carried out experiments of phytoextraction and assisted phytoextraction both with plants having a high biomass production (Mirabilis jalapa) and with native species (Cistus salviifolius, Scrophularia canina and Teucrium flavum). Easily biodegradable chelating agents were applied in laboratory experiences (MGDA - methylglycine diacetic acid, S,S-EDDS - [S, S]-ethylenediaminedisuccinic acid, IDSA - iminodisuccinic acid). The ability of the plant species to tolerate and accumulate heavy metals demonstrated the applicability of phytoextraction to the abandoned mining areas remediation. Some field experiments were performed both on continuous phytoextraction and phytostabilization, the latter using amendments like compost and zeolites was carried out in the area of Campo Pisano.

Keywords: phytoremediation, mining areas, native species, amendments, zeolites, compost, chelating agents.

References:
Serpentine habitats of Portugal: lessons for remediation and conservation

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Serpentine or ultramafic soils are distributed all over the world. These soils are characterized by high levels of Ni, Cr and sometimes Co, and contain low levels of essential nutrients such as N, P, K and Ca. Nickel can cause toxicity in serpentine soils due to its high solubility in the soil solution. Serpentine outcrops have been referred to as barrens because they are often sparsely vegetated and extremely poor in essential nutrients and thus they are not of much agricultural value. They can generally be distinguished by their grey-green or reddish rocky soils and shrubby or stunted vegetation with small leathery leaves. Finally, serpentine soils are thin. This means there is less substrate on which nutrients and water can be held and made available to plants. The unique features of serpentine soils led to the evolution of a characteristic flora consisting of many endemics. Plant species found on serpentine soils include species that respond differently on their ability to uptake or exclude a variety of metals.

The most relevant serpentine habitats of Portugal are located in the NE region of Bragança, covering about 8,000 ha, with a characteristic geology and flora. In this area, an assessment of heavy metal accumulation and partitioning in plants and microbes was conducted as a contribution to develop a community approach for mine remediation. Phytoremediation, defined as the use of green plants to remove pollutants from the environment or to render them harmless, is being considered as a new highly promising technology for the remediation of polluted sites. The success of the phytoremediation process, whereby metals are effectively removed from soil, is dependent on an adequate yield of plants and on the efficient transfer of metals from the roots of the plants into their shoots.

Some plant species (hyperaccumulators) growing in heavy metal-contaminated sites have been found with the ability to accumulate unusually high concentrations of heavy metals without impacting on their growth and development. However, most hyperaccumulators identified so far are not suitable for field phytoremediation applications due to their small biomass and slow growth. Moreover, the metals at elevated levels are generally toxic to most plants impairing their metabolism and reducing plant growth. These properties have an adverse impact on the potential for metal phytoextraction and restrict the employment of this technology. Thus, the development of phytoremediation strategies for heavy metal-contaminated soils is necessary. In this regard, interactions among metals, microbes and plants have attracted attention because of the biotechnological potential of microorganisms for metal removal directly from polluted medium or the possible role on plant growth promotion in metal contaminated soils.

The significance of serpentine plant and microbial communities and possible use for in situ remediation and need for conservation will be presented.

Keywords: serpentine ecology, Portugal.
SIDE EVENT 1: PLANTS SPECIES AND COMMUNITIES IN THE MEDITERRANEAN MINING AREAS: BIODIVERSITY, LANDSCAPE EVOLUTION AND THEIR USE IN PHYTOREMEDIATION

Chairman: Mauro Casti

PROPOSED POSTER PRESENTATIONS
Vegetation of the mine fields Touissite, Boubker and Oued El Heimer and species with potential in phytoremediation

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The present study is a contribution to the knowledge of the vegetation of the mining zones of Touissite, Boubker and Oued El Heimer in the mountains of Debdou (Eastern area of Morocco). The general characteristics of the vegetation of the area are pointed out and the zone of study is located in its bioclimatic and phytoecological context. A short history of the mining of the area supplements this presentation.

The characterization of the vegetation of the mining zones was carried out from 36 samples of vegetation and 74 identified species. From the floristic point of view, these species are distributed between 23 families but of which 67% belong only to 5 families (Asteraceae, Fabaceae, Poaceae, Brassicaceae and Lamiaceae). The analysis of the data (DCA and hierarchical classification) made it possible to identify four communities named by the dominant species (Noaea mucronata, Rosmarinus eriocalyx, Hirschfeldia incana and Ammophila arenaria). These communities are differentiated by the floristic composition, the specific richness and the indices of diversity. The distribution of the communities is determined by the nature of the soil and the degree of contamination by heavy metals.

The research of the tolerant and/or hyper-accumulating plants of heavy metals appears among the principal objectives of our study. A biogeochemical approach was carried out and the contamination of the soils and the plants by heavy metals (Pb, Zn and Cd) was highlighted. The results obtained show a strong contamination about 253 ppm of Cd and up to 12175 ppm of Pb in the soils in the area of Wadi El Heimer. Several species show a heavy metal tolerance and have a real potential for uses in phytostabilisation. The contents observed at Hirschfeldia incana show that it is a potentially hyper-accumulating species.

Keywords: East Morocco, mine areas, vegetation, Pb, Cd, tolerance, accumulation.
Do exist specific traits in gypsophytes? An essay on the Iberian species

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Some soils formed out of certain kind of rocks (dolomites, serpentines, gypsum) may give rise to special adaptive syndromes in plants in close relationship with them (Merlo et al. 1998). Those areas are linked to the occurrence of a special flora that usually records an important degree of endemism.

Gypsophites are species that exclusively occur in gypsum soils, those widely distributed in gypsum outcrops of a large region either those restricted to a local gypsum area (Palacio et al. 2007). However, the features of the gypsum habitat which provide the selective force for the evolution of gypsophile endemics have not been clearly identified (Powell & Turner 1977) neither distinguished from limestone syndromes.

The main aim of this study is to identify the major morphological and ecological traits of the gypsophites in the semi-arid Mediterranean climate of the Iberian Peninsula.

For this purpose we selected a number of features (Family, distribution, biotype, pollination, dispersal, flowering period and morphological characters) from a set of more than 50 exclusive gypsophites to be compared afterwards with a pool of randomly selected typical Mediterranean thyme scrublands species belonging to the same families in order to avoid taxonomical differences.

As a result a detailed list featuring more than 50 exclusive gypsophites is provided. We discuss the main features of the gypsophytes in relation to the calcicolous plant species.

Keywords: calcicolous flora, biotype, dispersal, distribution, flowering, gypsophytes, pollination.

References:
Plant species patterns for monitoring slope stability and for planning future recovery actions in the Carrara marble quarries (Apuan Alps, Italy)

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In quarry restoration, the vegetation cover plays a key role due to its ecological significance in the habitat reconstruction and for its aesthetic function on landscape. Vegetation cover can also reduce effectiveness of geomorphologic processes operating on slopes and soil erosion.

The present study has been carried out in dump deposits of both abandoned and active quarries of the Carrara marble. Carrara marble quarries represent a very interesting site to study environmental impacts due to excavation, both for the conservation problems related to the closeness of a Natural Park rich in endemic species and for the geomorphologic hazards induced by quarrying activities.

We aimed to highlight the relationships between plant communities and different “ravaneti” deposits classified according to four geomorphologic disturbance/stability classes. By means of vegetation plots linked to ecological variables and Ellenberg indicator values, a floristic-ecological investigation has been carried out in 67 quarry sites. Species/environmental variables matrix were analyzed by CCA.

Preliminary results showed that many plant species growing within dump deposits are characterized by a highly dynamic response to disturbance due to geomorphologic hazard (debris flow processes and surface erosion). Human-induced geomorphologic processes influence the spread and colonization of some alien plant species in this environment. A set of native plant species (among which some endemic protected ones), highly tolerant to geomorphologic disturbance, has been individuated for the use in future restoration projects in abandoned quarries.

Keywords: alien species, conservation strategy, landform-vegetation unit, biodiversity, restoration ecology.
Use in phytoremediation of three plant species growing on contaminated mine tailings in Iglesiente (SW Sardinia)

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The accumulation of trace elements in plant tissues depends largely upon the concentrations of such elements in the soil, on their level of bioavailability and the physiological strategy of the species themselves. Interaction between these three factors is complex and has received little attention to date. We have analysed the relationship between total and extractable (with EDTA, calcium chloride and deionized water) Zn, Pb and Cu concentrations in the soil and the capacity of three plant species to absorb and accumulate these elements in their leaves. The study was undertaken in a highly contaminated mining area at Sulcis-Iglesiente in southwest Sardinia (Italy), where we took samples of the leaves of Dittrichia viscosa, Cistus salviifolius and Euphorbia pithyusa subsp. cupanii and samples of the soil beneath each of them at depths of 0-30 and 30-60 cm, both in contaminated mine tailings and surrounding areas. All the trace-element concentrations found exceeded the limits established for uncontaminated soils in most European legislation. Due to the anthropic origin of the soil materials the results varied considerably. The bioavailability of the trace elements was mainly related to the calcium-carbonate content and the crystalline and amorphous forms of iron in the soil. The proportion of Zn in the leaves of the three plant species studied was highest, followed by Pb and finally Cu. The leaves of Dittrichia viscosa contained the highest concentrations of trace elements and this species may be considered as being a “phytoextractor” in soils where the trace element concentrations are not too high. Euphorbia pithyusa subsp. cupanii had low trace-element concentrations in its leaves despite growing in highly contaminated soils, and so might be used as a “phytostabilizer”. Finally, Cistus salviifolius although would not grow in the most contaminated soil, could not be considered as a bioindicator, because it tolerates concentration in toxic metal in substrata that exceed the legal limits for uncontaminated soils.

Keywords: phytorextraction, phytostabilization, trace elements, total concentrations, single extraction, carbonate soils, Dittrichia viscosa, Cistus salviifolius, Euphorbia pithyusa subsp. cupanii.
Preliminary results on recovery gypsum outcrops vegetation in Escúzar (Granada, SE Spain), effect of soil composition and seed mixture

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There is no doubt that gypsum environments have a special ecological interest. Since natural processes of succession seem slowed down due to climatic and edaphic limitations it is necessary to take action to recover these spaces when disturbed. Some previous works have focused on the processes of succession in abandoned gypsum quarries (Mota et al. 2003, 2004) or have studied factors affecting germination and establishment of gypsophytes (Escudero et al. 1999, 2000). Furthermore, competition between gypsophytes species and other species typically used in restoration work has been analysed (e.g. Matesanz & Valladares 2007). However, results are still not sufficient to solve problems related to the recovery of the gypsum vegetation.

This work presents a field experiment in Escúzar (Granada, SE Spain) to optimize the results of the future restoration plan of gypsum quarries. The experiment was carried out with a factorial design including two main factors: soil composition and seed mixture. Four soil treatments were prepared: topsoil removal (1), raw gypsum (2), gypsum exploitation by-product (3) and organic layer removal prior to the quarrying activity (4). With regard to the species, 3 different mixtures of seeds have been used, aside of a control treatment: gypsophytes species (1), gypsophytes and other species of native scrub (2); and gypsophytes and colonizing species (3). The seeding was conducted in plots of 25 m² (5 replicates x 4 soil treatments x 4 mixtures of seeds = total 80 plots), using a density of 100 seeds per square meter.

The plots were sampled periodically to estimate: richness, density, cover, diversity, survival and growth. These data are accompanied by edaphic variables (pH, % gypsum, organic C, P, K, SO₄, humidity, etc.). Preliminary results will help us to select the most appropriate soil preparation and seed mixture to recover the gypsum vegetation on disturbed mining areas.

This work is carried out in the frame of a research contract called “Study of the ecological basis for restoration of gypsum vegetation in the quarries of Ventas de Huelma and Escúzar” funded by KNAUF GMBH, Branch Spain in agreement with the University of Granada.

Keywords: gypsophytes, gypsum quarries, recovery, seed mixture, soil composition.

References:
Studying the effects and impacts of mining activities on the presence and distribution of halophile plants in the Llobregat river (Catalonia, Spain)

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The Llobregat river source is at the Pyrenees ranges and flows into the Mediterranean Sea, south of Barcelona city (Spain). The river has a length of 170 km and an annual average discharge of 18 m³/s at the gauging station of Castellbell. In its middle reaches the river flows across the erosion basin of the Bages where mining activity takes place to extract potassium hydroxide (Suria and Sallent). The mining activity is carried out at deep levels, but on the surroundings of the industry at the surface levels a tip accumulates thousands of wastes from the mining activity with a high saline level. Moreover during extraction, treatment and transport processes of the potassium hydroxide, a large amount of the wastes are spread throughout the landscape. The hypothesis of this study is to test this activity as the cause of the high level of salts found in the waters of the Llobregat River and also in the streams and road margins of the surroundings of the mining industry. The methodology proposed to test the hypothesis is with the measurements of the electrical conductivity of the river waters jointly with the study and sampling of the presence and distribution of the halophile vegetative species on the riparian landscape and riverine environment. Thus the main aim of this study is to assess the presence of the salts from the mining activity and its impacts on the flora and vegetative landscape. It has been measured and analyzed the data series of the conductivity from the river collected at the gaging station of Castellbell. We have already confirm that the average day values of conductivity range between 1.000 and 2.000 μS/cm, although the maximum instantaneous value reached 6.000 μS/cm. We have also observed that the water electrical conductivity increased during floods, likely due to the increase of waste water flowing into the river during rainstorms. Data of flora and vegetation has been collected with fieldwork. Flora was sampled in sections of 1 km along the river banks; logging in each section the total amount of plants on the banks, distinguishing the presence as localized, frequent or abundant. Vegetation has been studied with phytosociology inventories. The highest interest sections have been studied in greater detail, making large scale maps and profiles. Preliminary results indicate the presence of a large number of halophile species, some of them abundantly present, as Glaucium flavum, Tamarix africana and T. canariensis. Mostly results showed that in riparian forest with species like Alnus glutinosa, Populus alba and Fraxinus angustifolia the halophile species are hardly present. Especially these halophile species are localized on rocks on the stream bed, peripheral ponds and on bare areas of vegetation on the river banks.

Keywords: conductivity, corology, halophile vegetation, Llobregat, riparian forest.
Phytoremediation potential of wild plants for multi-metal contaminated soils in Apulia region, Southern Italy

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In the framework of a phytoremediation project in Apulia region for remediation of heavy metal contaminated soils (Cr in particular), natural plants that grew wildly on the studied area were evaluated. The studied area was contaminated with heavy metals (Cd, Cr, Cu, Ni, Pb, Zn) because of an inadequate disposal of a variety of wastes of different origin. Total contents of metals in soils generally exceeded the maximum levels indicated in Italian and European regulations, especially Cr and Zn. Although the extractable fraction was element-dependent, the metal immobilization was enhanced by the components of soils. Maximum mobilizable fractions (% DTPA of total content) were 30% Cd, 0.01% Cr, 11.5% Cu, 4.1% Ni, 13.3% Pb and 13.8% Zn. The selected plants were: Carduus pycnocephalus L. (Asteraceae), Dasypyrum villosum (L.) Borbas (Poaceae), Ferula communis L. (Apiaceae), Silybum marianum (L.) Gaertner. (Asteraceae), Sinapis arvensis L. (Brassicaceae) and Stipa austroitalica Martinowsky subsp. austroitalica (Poaceae). The present study showed that spontaneous plants naturally founded in the described areas could colonize and survive in sites with multiple pollution (mainly Cr, Pb and Zn) of a wide range of metals concentrations in soil. The general trend of metal accumulation in plants was Zn > Cu > Cr > Pb > Ni > Cd and statically accumulation differences were found to largely depend on plant species. Thus, metal uptake and translocation different strategies were suggested. With exclusion of S. austroitalica subsp. austroitalica and D. villosum, tolerance mechanisms for C. pycnocephalus, S. marianum and S. arvensis were discovered. The metal contents in the epigeal portion of these species were within the values of normal plants and below phytotoxic levels, hence faraway from phytoextraction applicability (Baker and Brooks 1989, Reeves 1988). These species can be considered as metal excluder or tolerant plants with ability of growing in soils with a wide range of heavy metal concentrations, mainly immobilized by soil conditions. Therefore, in these contaminated sites they can be considered for phytostabilization technique (Vangronsveld & Cunningham 1998, USEPA 1997). In conclusion, most of the examined plants grew well under adverse environmental conditions, which would be of a great advantage if used for restoration of vegetation in contaminated sites of the studied area.

Keywords: phytoremediation, heavy metals, Apulia region.

References:
Plant colonization and fungi on a contaminated serpentine site

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The study evaluated the relationships among the serpentine soil from a waste rock dump of the abandoned Libiola sulphide mine (NW Italy), the pioneer vegetation and fungal flora. Moreover, we sought to select tolerant species for future reclamation activities of the mine area, mainly characterized by Fe-Cu–sulphide mineralized pillow basalts with minor serpentinites, gabbros, and ophiolitic breccias (Marescotti et al. 2008). We identified the tolerance of various species to environmental conditions and evaluated physical or chemical factors that influenced the first plants and fungi to colonize this stressful environment. Several sampling sites were identified in the rock dump from characterization of surface or near-surface oxidation zone and vegetation type. Sampling sites were analyzed for slope, pH, mineralogy, soil chemistry, floristic and fungal composition and the percent coverage of each plant species. Preliminary screening for Ni concentration in plant tissue with dimethylglyoxime (DMG test) did not reveal the presence of hyperaccumulators, with the exception of *Thlaspi caerulescens* J. & C. Presl, well-known metal hyperaccumulator (Assunção et al. 2003), and *Alyssoides utriculata* (L.) Medik. As concerns fungi, two macrofungal species [*Scleroderma polyrhizum* (J.F. Gmel.) Pers. and *Thelephora terrestris* Ehrh.] showed a remarkable accumulation of Cu and Ag, respectively.

The surveyed vegetation represents an early-successional plant community characterized by an extremely poor flora, probably related to the high concentration of trace elements which represent a limiting and selecting factor for plant colonization (Antonovics et al. 1971).

The flora of the first stages of colonization are characterized by species that have not been anthropogenically introduced, such as the dominant *Deschampsia flexuosa* that is present in the surrounding natural vegetation of the area.

At sites where Cr and Ni decrease and Zn, V and Cd increase we found the second step of plant colonization characterized by few species with high coverage. The more developed soils do not have steep slopes and probably represent a first mature soil, also exhibiting higher species diversity and representing the third stage.

This work has enabled us to characterize chemically and floristically plant pioneer stages within fungal flora in this mine landfill, to develop a future land restoration of degraded serpentine site minimizing interventions and costs.

Keywords: Libiola Mine, serpentinite, pioneer vegetation, fungi, chemical and physical factors.

References:
Vegetation dynamics in quarry areas of Campania

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Mining activity causes deep ecosystem modifications, removing both the vegetation and the soil and altering in a permanent way the topography of the mining area; the result is a moon-like environment where very hard conditions for natural colonization can be find. In spite of the national and regional laws providing for their reclamation at the end of mining exploitation, these areas are often abandoned without any restoration. In these areas, vegetation dynamical processes as primary succession (Miles 1979) can be observed. Other than for scientific purpose, the analysis of these processes can have an applicative value in terms of restoration ecology, being the spontaneous revegetation an useful and cheap instrument to restore degraded areas (Prach & Pysek 2001).

In this research the analysis of spontaneous plant communities colonizing no more exploited areas in several quarries of Campania region is presented. In each considered quarry the vegetation samplings were carried out in the three main physiographical elements:

- quarry face: vertical and sub-vertical cliffs resulting from the extraction of rocky materials;
- scree slope: different in size grained material at the bottom of the cliffs resulting from the erosion and collapse of the above cliff;
- quarry floor: horizontal landform mainly used during mine exploitation for the transport and storage of the extracted material.

In each stand the main environmental characteristics (altitude, slope, aspect) were recorded as well as both horizontal and vertical structure of the different layers (tree, shrubs and herbs) of the existing vegetation. Floristic composition was then assessed and cover-abundance value for each observed species was recorded according to the standard phytosociological approach (Kent & Coker 1992) using the Braun-Blanquet scale modified by Van der Maarel (1979), in order to analyse them with statistics. The resulting raw data matrix was processed by mean of a multivariate approach (classification and ordination). Species characteristics (life forms, chorology, protection value) were used as interpretative tools to better investigate the resulting dendrograms and PCA diagrams. Results are also discussed in terms of species diversity and types of recorded habitats. This study represents a contribution to increase the knowledge of the vegetation dynamics in degraded areas in Campania region to be used for their reclamation.

Keywords: primary succession, multivariate analysis, restoration ecology.

References:
Fungi and plants in contaminated sulphide mine soil in Libiola (NW-Italy)

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Up to 1962, the Libiola mine was one of the most important sites for copper and iron mining in Italy (Marescotti et al. 2008). Now, this mine site is completely abandoned and presents serious environmental problems due to supergenic sulphide oxidation (Acid Mine Drainage process), erosion of waste deposits, and easily accessible mine adits, which continuously discharge strong acid waters (Marescotti & Carbone 2003). Previous studies in this area (Marescotti et al. 2008) testify that the majority of soil related to waste rocks exceeds commercial and industrial limit concentrations for Cr, Cu, Ni and V. The area in which the mine is located presents different successional plant communities ranging from herbaceous to arboreal stages (Marsili et al. submitted); the latter is represented by few Pinus pinaster Aiton. Such a scarce vegetation is due to the lack of nutrients and to ionic toxicity associated with heavy metals (Shu et al. 2005), which are leached in the environment because of the low soil pH (Lasat 2000). The aim of this study is to evaluate the presence of micro- and macrofungi related to higher plant communities and their potential for bioaccumulation. A screening test with dimethylglyoxime (DMG) was carried out on higher plants to highlight possible Ni accumulation in plant tissue. Positive plants, macrofungi, and their respective soils were analyzed for trace elements content with inductively coupled plasma-mass spectrometry (ICP-MS). Soil samples belonging to Alyssoides utriculata (L.) Medik (DMG positive) rhizosphere and other randomly selected soils were examined, with dilution plate technique (Gams 1987), to determine microfungal flora. The vast majority of isolated colonies belonged to the genus Penicillium, a common feature for copper contaminated mine soils (Gadd 2007), while occurrence of other genera, including Aspergillus, Clonostachys, Trichoderma, and Botrytis was significantly lower. However, the number of Colony-Forming Units (CFUs) varied greatly among the different samples plated; most strikingly, microfungi in the rhizosphere of Ni-accumulating specimens of A. utriculata were scarce in comparison to other samples. As concerns macrofungi, a great number of Scleroderma polyrhizum (J.F. Gmel.) Pers. and Thelephora terrestris Ehrh. sporomata were collected during the surveys. These species showed a remarkable accumulation of Cu and Ag, respectively. Such results suggest the use of these plants and fungi for developing experimental protocols for bioremediation.

Keywords: microfungi, macrofungi, higher plants, bioaccumulation, copper, nickel, silver

References:
SIDE EVENT 2: IMPORTANT PLANT AREAS IN ITALY AND IN THE MEDITERRANEAN CONTEXT

Chairperson: Michela Marignani

INVITED ORAL PRESENTATIONS
IPA identification and conservation in south east Europe: data rich, data poor and engaging civil society in plant conservation action.

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291 Important Plant Areas (IPAs) were identified in Bulgaria (125), Croatia (97), Macedonia FYR (42) and Montenegro (27), using the standard IPA methodology based on the presence of threatened species, threatened habitat and species richness. The quantity, quality and availability of data varied across the four countries, necessitating a flexible approach to identifying sites. Significant new site based data were recorded within the publicly accessible IPA web database. These data include distribution and location on species and habitats present on each IPA, as well as protection status, threats and land use.

IPAs in south east Europe contain diverse mosaics of habitats, with forest and grassland habitats being the most frequent and dominant. Across all IPAs 152 habitats officially recognized as threatened in Europe are found and 378 regionally threatened plant and fungus species, from official lists. IPAs also contain a wealth of other plant diversity, unique to the Balkan region. Some of these endemic Balkan plant taxa are threatened at European level, but not currently recognized by existing European legislation.

South east European IPAs are largely intact compared to those in western Europe, however they are subject to a number of threats that are growing in intensity, including tourism and infrastructure development (affecting 51% of IPAs), poor forestry practices (43%), land abandonment (34%) and climate change. The latter remains difficult to quantify. 59% of these IPAs remain unprotected at national level, though many (up to 90% in some countries) should qualify for protection through EU legislation if this legislation is fully implemented by those countries when they accede to the EU.

The policy framework already exists to safeguard the diversity of IPAs in south East Europe, through nature conservation legislation and sectoral policy. However these policies are not being implemented and enforced on the ground. IPAs in south east Europe have been used to engage and inspire local communities to act positively for conservation. Short term, plant focused, very low budget pilot projects, have succeeded in reaching out to many audiences. These are small but tangible steps forward in engaging both botanical partners and civil society in conservation action on the ground, led by the value people place on plants and plant resources.

Key words: South East Europe, Important Plant Areas (IPAs), plant diversity, conservation policy and practice.
The IPAs programme in Italy: from data to mapping

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The Important Plant Areas in Italy project, promoted by the Italian Ministry for the Environment, Nature Protection Directorate through a programme aimed at mapping the IPAs, represents an important contribution to the planning of strategies designed to enhance biodiversity conservation (Blasi et al. 2009). The national working group, coordinated by the Inter-university research centre for “Biodiversity, Plant sociology and Landscape ecology” of the “Sapienza” University of Rome and composed of a network of 100 botanical experts who work in universities, public and private institutions and other related professions, was set up to obtain original information and draw up a detailed, nationwide picture of the situation in Italy.

Important Plant Areas were identified on the basis of a range of taxonomic groups, such as vascular plants, bryophytes, freshwater algae, lichens and fungi, in order to promote an integrated model of knowledge for the conservation of plant diversity. Information was collected on 1,393 species of vascular plants, with a total of 9,745 recordings. A total of 1,087 records of species and sites of interest were provided for the other taxonomic groups, with 182 overall species. With 13,979 confirmed records, regarding 168 different types, the habitats provide, together with the vascular species, the most important database for the identification of IPAs.

Each of the selected vascular plants and habitats was assigned a conservation value on a regional basis. An approach based on the overlapping of the species and habitat maps was used to identify the most important areas for plant diversity and to pinpoint any “hotspots” of richness and diversity.

The IPAs definition process was composed of two subsequent phases. First, a cell classification was defined at the regional level by considering the total number of vascular species and habitats as well as the number of vascular species and habitats assigned a high regional conservation value by the experts; this classification was based on the cells whose sides measure 10 km. The cells with a high conservation value are therefore those characterised by the highest number of vascular species of high regional conservation value (conservation value criterion) within a given region, and/or by the highest number of vascular species and habitats (richness criterion).

Hence, polygons were defined within the cells of high conservation value and/or containing high vascular species and habitat richness. These IPA polygons were outlined using the data provided by the regional experts on vascular plant species, habitats and other taxonomic groups.

A total of 320 IPAs were identified in Italy (including 8 fresh water algae community sites), covering approximately 15% of the country.

Keywords: plant conservation, site selection, national scale.

References:
Role of cryptogams in the definition of Italian IPAs

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One of the main intrinsic worths of the “Important Plant Areas programme” aimed to protect the plant diversity is the allocation of the same importance given to higher plants to cryptogams, while providing considerable freedom of action for the implementation of the program by individual countries.

Italy is one of the few nations that has responded to the call in a comprehensive manner, with sufficient information to try to include all the groups in the definition of the areas. However, difficulties were encountered at various operational levels. As for the selection of IPAs’ species, failure to use of cryptogams in European Conventions and Directives dedicated to the protection of habitats and species (Appendix I of the Bern Convention, Annexes II and IV of the Habitats Directive) has determined as result a) fragmented and incomplete knowledge about their distribution, especially in southern Europe, b) the almost total absence of lichens in the IUCN global Red List, c) outdated and incomplete European red lists (Sérusiaux 1989). Even at a national scale it has only been able to refer to unofficial red lists (Nimis & Martellos 2008) or based only on data from the literature (Aleffi & Cortini Pedrotti 1992).

The habitat of reference was attributed ex-novo, using the EUNIS classification, on the base of literature data and the samples stored in Italians herbaria. However, the definition of the species of national interest for the identification of IPAs may be considered complete: 85 bryophytes among mosses and liverworts, 24 species of Sphagnum, 72 of lichens. Of these, 27 bryophytes and 13 lichens would need further investigation.

On this basis, although not yet comprehensive the information on the actual distribution of species, 21 critical areas for long-term preservation of vitality of lichen natural populations have been proposed, including an archaeological area (Tusculum) considered representative for the species colonizing cultural heritages; 19 are the areas identified for conservation of bryophytes.

The criteria for the definition are: a) the site contains significant populations of one or more species that are of European or global conservation interest and b) that are interesting at a national level, c) the site has a very diverse flora and highly representative in relation to its biogeographical zone, d) the site is an outstanding example of a habitats of European or global conservation interest e) the site was the subject of a complete floristic investigation.

Keywords: biodiversity, bryophytes, lichens, IPAs.

References:
The Important Plant Areas program from a mycological point of view: an experience at regional level, in the European context.

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Conservation of biodiversity has nowadays acquired a widespread credibility and after the Rio Convention many world, national and local initiatives have been established with the goal to reduce or halt the current loss of biodiversity mainly in respect to habitats, plants and animals. Fungi were generally overlooked in nature conservation activities even if their ecological importance is well-known. As a consequence, habitat conservation provides protection for all existing organisms in the selected site, but not always these areas are of great conservation value also for fungi.

Thanks to the IPA program, a target of the European Plant Conservation Strategies (2002-2007; 2008-2014), also the so-called lower plants are included among the actors. A good background of information with reliable data on distribution, ecology and threat status is needed in order to apply the 3 IPA criteria: threat, richness, habitat. In respect to botany and zoology, unfortunately, mycology has been explored much less and this because the high diversity of fungi, the various difficulties in studying them and the very low numbers of mycologists.

The publication of lists of threatened species is needed to support the conservation actions and to allow the application of Criterion A for the IPA selection.

In spite of the fundamental work of the European Council for the Conservation of Fungi (ECCF), only a third of European countries has now an official Red List of fungi while Croatia is the only one within the Mediterranean Biogeographical Zone. A European Red List for larger fungi is still lacking, but a list of candidates of threatened European fungi is now available on-line.

Some experiences on the designation of Important Mycological/Fungi Areas (IMA/IFA) as in the Netherlands and the UK or different approaches selecting by means of wood-inhabiting indicator species highly valuable sites for fungi as in central-north Europe can be mentioned.

In Tuscany first attempts to apply the IPA criteria to the Regnum Fungi dates back to the first years of the new millennium, but the participation at the national IPA project has been fundamental.

In this work the 3 IPA criteria are analyzed from a mycological point of view and difficulties and new proposals are reported. So the use of the recently published Tuscan Red List of macromycetes, in addition to the 33 fungal species proposed by ECCF for inclusion in the Bern Convention, is discussed.

Keywords: key-areas, macromycetes, conservation.
SIDE EVENT 2: IMPORTANT PLANT AREAS IN ITALY AND IN THE MEDITERRANEAN CONTEXT

Chairperson: Michela Marignani

PROPOSED POSTER PRESENTATIONS
Floristic richness in the Valencian Community area (western Mediterranean, Spain)

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Valencian Community is a territory with great richness of plant species (ORCA 1985-2003, Mateo & Crespo 2003), as a result of the biogeographical history and the geomorphological and climatic variability of the area. During the last years a compilation of all bibliographic information and data field have been executed, and a data base (Idubeda) has been developed in order to manage the 700,000 floristic references. After a data cleanup process, the software used has enabled us to calculate the number of the taxa and the floristic references corresponding to each 10 x 10 km UTMGRS grid. Furthermore, the cartographic module allows us to make maps where the distribution of this biodiversity is showed graphically. In addition to provide the basic database information, the physical and biological reasons, responsible for the unequal biodiversity distribution in the studied territory (Serra et al. 2003), are also discussed. Moreover, the information is analyzed as well in order to assess the level of the floristic knowledge of the whole territory.

Keywords: Valencian Community, floristic richness, distribution maps, chorology, biogeography.

References:
Assessing plant diversity in a network of protected areas: quantitative tools for diversity monitoring and reserve selection.

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Assessing the effects of the spatial components on species diversity represents an important step to evaluate the conservation efficiency in a network of protected areas. A clear evaluation on how $\alpha$, $\beta$, and $\gamma$ diversity are partitioned among and within spatial (and temporal) scales can help to drive decision-making and to provide methods for monitoring species diversity. Moving from these concepts, a probabilistic sample was here applied to: i) quantify plant species diversity within the network of the protected areas existing in the Siena Province and ii) evaluate the effect on diversity of two new protected areas to the existing reserve network.

Focusing on both common species and those defined as “focal species” (i.e. included in regional, national or continental “red” lists), our results indicated that species richness differed among the considered protected areas given the same sampling effort. Diversity partitioning indicated that most of the diversity within the network was represented by large-scale $\beta$-diversity, i.e., the turnover in species composition among reserves. Moreover, total $\beta$-diversity was decomposed in two components: $\beta_{\text{Area}}$ (due to the differences in area among reserves) and $\beta_{\text{replacement}}$ (due to the compositional differences across protected areas). $\beta_{\text{Area}}$ was particularly important for both common and focal species, while $\beta_{\text{replacement}}$ was the most important factor for focal species.

Noteworthy, the analyzed variation in diversity components due to the inclusion of the two new natural reserves (Ripa d’Orcia and Bogatto) resulted in a proportional increase in $\beta_{\text{Area}}$ for the whole network, and, on the other hand, in a reduction for $\beta_{\text{replacement}}$ diversity component.

The proposed approaches demonstrated an implicit capability to quantitatively assess the criteria for the selection and the inclusion of protected areas in a network of natural reserves.

Keywords: biodiversity monitoring, plant diversity, focal species, reserve selection, Siena province.
The continental coastline of Leghorn province as tyrrenical Important Plants Area: first results

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The coastal zone is the portion of land immediately adjacent to the sea where, along the Italian coast, we can find many Habitats of Community Importance and identify Important Plants Areas. Basically grouped into two geomorphologic types, the "high" rocky coasts and the "low" sand coastline, these zone often show a typical flora with localized or rare entity and diversified phytocoenosis. Nevertheless, for many decades, there is a deep and unceasing work of processing of these systems (Fedra & Feoli 1998, Biondi 1998, AA.VV. 1991).

It becomes increasingly important, as well as the flora and vegetational characterization of these habitats, their precise localization also for the knowledge of their state of anthropogenic alteration. For this, it is important not only the protection of the best preserved areas but especially the management of those processed.

In this context, we report the first results of a survey carried out along the continental coastal area of the Province of Leghorn, in a coastline of 300 meters in depth.

The floristic-vegetational surveys carried out and the identification of habitats of Community Importance was followed by the resolution of the main units of the coastal landscape in which, on selected sample areas, were carried out orthogonal transect to the coastline for the measurement of a synthetic index of anthropogenic disturbance.

The presence of many floristic emergencies in addition to identification of 12 habitats of Community Importance defines this coastal sector as an important plants area. Simultaneously detected anthropogenic alteration determines the planning for an urgent and constant monitoring.

References:
The vascular flora of the Iglesias valley (SW-Sardinia)

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A contribution to the knowledge of the vascular flora of the “Iglesias Valley” is here reported. This area, corresponding to the catchments basin of Rio San Giorgio and Sa Masa marsh, includes both natural and heavily degraded areas and is characterized by a high biodiversity. The natural habitats include sandy dunes and wetlands in the coast and sclerophyllous woods and maquis in the inland. The most important environmental damages depend on the mining activity, practised for thousands of years and now abandoned. A considerable part of the flora occurring in the study area consists in metallophytes that colonize highly polluted substrata, which were produced or altered by the industry of the extraction and treatment of minerals. About 40% of the whole flora can also be found on the mine dumps.

In the present survey, 664 taxonomic units have been recorded. The surveyed taxa belong to 89 families and 356 genera. The top three families are: Asteraceae (76 taxa, 11.4% of the total), Fabaceae (73 taxa, 11.0%) and Poaceae (66 taxa, 9.9%). The most represented genera are: Carex (12 taxa), Trifolium and Medicago (11 taxa each).

The biological spectrum highlights the remarkable Mediterranean connotation of the investigated district, being the therophytes 39.2% of the whole flora, followed by the hemicryptophytes (24.8%). The chorologic spectrum is dominated by the Mediterranean chorotype (53.2%), including circum-Mediterranean (34.8%), endemic (8.4%) and W-Mediterranean taxa (7.2%). Further 16.6% of the surveyed taxa have a wider distribution range, but centred, however, in the Mediterranean region.

Concerning the endemics, 56 taxa have been found. Asteraceae and Fabaceae resulted the richest families in endemic taxa (9 and 5 units respectively). Most of the recorded endemics have a Cymo-Sardinian or a Sardinian distribution (15 units each); with reference to the biogeographic units of the Mediterranean region, they belong to the Cymo-Sardinian province and to the Sardinian subprovince respectively. The presence of two exclusive species (Linum muelleri and Limonium merxmuelleri) allows to refer this area to the biogeographic subsector of Iglesiente (Sulcis-Iglesiente sector).

Keywords: endemics, mining areas, vascular flora, Sardinia, Sulcis-Iglesiente.
Important Plant Areas in Poland

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IPAs are the most important places in the world for wild plant diversity, that can be protected and managed as specific sites. To ensure the conservation of all the world’s most important plant areas, the IPA program aims to identify and protect a network of the best sites for plant conservation, identified using globally consistent criteria. The criteria include rarity and threat: endemism, species richness and threatened habitats. This program contributes to implement the EU Natura 2000 Network, the Bern Convention and Emerald Network, and the Ramsar Convention. Moreover, it is important also for the Countdown 2010 target established by the World Summit on Sustainable Development.

In May 2005 a three year project on producing IPA inventories in seven central and eastern European countries was successfully concluded. Among the countries involved, there was Poland.

At first, 289 sites (identified from national/landscape parks and from the preliminary Natura 2000 list) were selected in Poland as potential IPA sites, but after a detailed analysis only 116 of them were established, for a total area of more that 2,000,000 ha. Among these, 97 sites are (whole or in part) included in Protected areas. Poland’s natural and semi-natural habitats consist mainly of several types of forest, mown or grazed grasslands, including small areas of warm, dry, steppe-like grassland, as well as vast areas of swamps and peat bogs. The country also harbours two Centres of Plant Diversity, the Carpathians and the Bialowieski Forest.

The Tatra Mountains, located on the border of Poland and Slovakia and the highest arc in the Carpathians, are an important area in central Europe for their geological, climatic and biological diversity. 28 habitat types and 7 species of European importance are present in the area. Moreover, this is the only site in Poland where several endemic plant associations and tens of plant and fungi species can be found.

The Bialowieski is the oldest park in Poland (established in 1921). Primeval forest is the last patch of natural lowland forest and one of the most important of Europe, retaining its natural character and complex structure. Bialowieski National Park harbours more than 50 various plant communities, more than 1000 vascular species and 250 species of mosses. Most of these plant species are native and often rare, being the relicts of primary forests. Fungi are represented by 3,000 species including 450 mushrooms.

Keywords: IPA, Poland, Tatra Mountains, Bialowieski.

References:
The role of water sources in dune diversity

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Coastal dunes might apparently look homogeneous due to the dominant sand cover, but in fact they offer an array of geomorphological features, soil types and environmental processes. García Novo (2004) considered dune habitats as environmental islands as wind speed, sand advance, particle transport, soil moisture availability and temperature regimes produce a range of terrestrial environments, giving rise to heterogeneity and diversity at different spatial scales.

The Asperillo dune system is located in the Southwest of Spain and it belongs to the Parks of Doñana. It is formed by stabilized sands corresponding to two depositional periods, one of Holocene age and one of consolidated, older dunes of Pleistocene age, forming an active cliff that might reach 50 m height and extending landward for some 2 km (Díaz Barradas & Muñoz Reinoso 1992). The morphological activity of the cliff is intense due to wave undercutting, groundwater seepage and wind, causing landslides, mass wasting and slope washing.

With the idea of dunes as environmental islands, the purpose of this study was to analyse the structure and diversity of the vegetation of the Asperillo across a coastal sector of 30 km from Torre la Higuera to Mazagón. This study was focussed on the coastal fringe from the base of the cliff to the mean tide line, especially looking for specific points where geomorphological structures and water sources from the cliff have formed spots of higher diversity.

Vegetation cover was estimated with a point-intercepted method over eight two-three hundred meter transects, parallel to the cliff, distributed across the study area. Ten meter lines were considered as a plot for numerical analysis. Data were analyzed by Correspondence and Discriminant multivariate analysis and diversity was calculated with Shannon index at different spatial scales, α or plot diversity, γ or transect diversity and β as a measurement of heterogeneity as the ratio between γ and α diversities.

Results supported the hypothesis of dunes as environmental islands; discriminant analysis clearly has showed the patchy structure of vegetation, diversity reached maximum figures in the transition between humid and dry areas.

Keywords: coastal dunes, discriminant analysis, environmental islands, plant diversity.

References:
Natural resources in National Park of Babor, North of Algeria

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National Park of Babor is an exceptional natural environment, in fact it contains important floristic features in all vegetation strata. In our present work we tried to give an exhaustive list of endemic plants in the mountains.

Keywords: Babor Natural Park, endemic.
Plants biodiversity of Sierra de Albarracín (Teruel, Spain)

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This work provides a summary of the floristic vascular analysis of Sierra de Albarracín (Mateo 2008), located in the southwest of the Teruel region (S Aragón, Spain), a specially relevant area in terms of biodiversity, and one of the areas with highest number of species per 10x10 UTMGRS grid, together with the regions of Sierra de Gúdar and Sierra de Javalambre. The research analyses the distribution of taxa in the main botanical groups, families, genera and species, the classification of floristic elements, biotypes and their relative abundance. This catalogue gathers 1603 taxa, which represent 73% of the flora of the Teruel (Mateo 1990, López Udías 2000) region and 51% of the whole of the Aragon region (Gómez-García 2009). 74 taxa are new to the Sierra and 31 of them for the Teruel region (Barrera 1985, Mateo 1990, López Udías 2000). 5 new taxa are particularly described in this study. A comprehensive analysis of the catalogue, confirms Compositae with 219 taxa and Gramineae with 144 species as the most represented families. Carex (33), Trifolium (25) and Hieracium (24) are the most represented genera, with especial interest in Carex which is represented in Albarracín by all the species known in the Teruel region. Biotypes studies reveal a predominance of hemicryptophytes (39,9%) and therophytes (29,5%) over the rest of biotypes. The analysis of the floristic elements points out the Mediterranean origin prevalent among all taxa (48%), being particularly frequent (296, which represented 38% of the total) the taxa from western Mediterranean. The endemic elements appear in a relatively high percentage (16%). It is also notably high the number of very rare species (173, which represent a 9%).

Keywords: flora, vascular plants, chorology, Teruel, Spain.

References:
Grazing effects in the spatial distribution between *Retama monosperma* and *Thymus carnosus*

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Grazing plays a prominent role driving patch ecosystem structure. Selective grazing influences plants demographic process, modifying some patterns of plant distribution, e.g. seed germination, seedling establishment, plant mortality or biotic interaction. Thus, changes in the spatial patterns of vegetation can vary, indirectly, the ecosystem functioning (Cipriotti et al. 2005). In this study we considered two endemic dune plants located in a protected area in the southwest of Spain, in the province of Huelva: *Retama monosperma* that, at present, dominates the inland dunes and shows an invasive behaviour, and *Thymus carnosus* inserted as an endangered species by the Law for the Protection of Flora and Fauna in Andalusia (Gallego et al. 2006). Protection of territory provides grazing prohibition in the area, but both species also coexist in a part of territory subject to goat and sheep grazing. Their interaction was examined considering the type of spatial pattern of the association that can give information on the underlining environmental factors driving the process of association. We mapped vegetation in two distinct areas, one heavily grazed and another lightly grazed, analysing for each individual its position in the plot, its canopy diameters, and height. Plot spatial structure was determined between both species using the O-ring statistic, which was carried out to establish the association pattern (Wiegand et al. 2004). Results show a random distribution between *R. monosperma* and *T. carnosus* in the light-grazing area. Where the pressure of grazing was present, a marked repulsion was shown; this trend can be attributed to livestock and its trampling, preferring *R. monosperma* as aliment.

**Keywords:** O-ring statistic, spatial analysis, *Retama monosperma*, *Thymus carnosus*.

**References:**
Study of Plant Diversity Hotspots in Catalonia (Spain)

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Plant diversity hotspots on a global scale are well identified, but smaller local hotspots must be identified within these for an effective conservation of plants on global and local scales (Murray-Smith et al. 2008). We used the distribution of 3234 vascular plants to indicate areas of plant diversity of Catalonia (Spain). Catalonia is a region situated on the north-eastern corner of the Iberian Peninsula and covers an area of approximately 31,980 sq. km. Catalonia presents a wide range of phytogeographic features mainly due to the presence of the Pyrenees in the north and the Mediterranean Sea on the east. This provides the existence of numerous relief units, causing high climate variability, which allows us to consider this area as very interesting from a biodiversity standpoint (Pausas et al. 2003). The basic unit of our study is the UTM grid (Universal Transverse Mercator) of 10 km on each side. Catalonia is divided into 295 UTM cells of 10x10 km which contain data for geographical, climatic and geological variables. In order to identify biodiversity hotspots we applied a Fisher discriminant linear analysis (Fisher 1936) and a logistic regression analysis (Generalized Linear Models with binomial distribution and logit-link function; McCullagh & Nelder 1997) to a database of plant specimens (Biodiversity Database of Catalonia) obtaining two predictive species-distribution models for all the plant species recorded and two maps of a number of species observed per grid. We identified primarily four areas which concentrated the greatest species richness: the Pyrenees, the Pre-Pyrenees, the pre-costal mountain range and the coastal range. On the other hand, the areas with lower species richness corresponded to areas of the interior, which may be due to a lower sampling effort. Finally, the observed occurrences of species and occurrences of species predicted by the models were consistent in identifying areas with the greatest number of species [R=0,7506 (discriminant analysis) R=0,8189 (logistic regression)].

Keywords: hotspots, biodiversity, Catalonia.

References:
Diversity of endemic plants and plant communities of the Greater Caucasus

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The Caucasus is the area between the Black and Caspian Seas. It includes the highest mountain ranges between the Himalayas and Rocky Mountains: the Greater and Lesser Caucasus. The area supports about 6400 species of vascular plants, of which 1500 species are endemic. The number of Caucasus endemic species occurring in Georgia amounts to 900. The high mountain (1800-4000 m a.i.s.) endemic flora of the Greater Caucasus is represented by 483 species on the territory of Georgia; 223 of these endemics occur on the Western Greater Caucasus, 402 on the Central Greater Caucasus and 234 on the Eastern Greater Caucasus. According to the number of endemic species, the following families are leading on the Greater Caucasus: Asteraceae (92), Apiaceae (39), Rosaceae (38), Campanulaceae (37), Caryophyllaceae (29), Brassicaceae (26) and the leading genera are: Campanula (36), Cirsium (16), Ranunculus (15), Heracleum (13), Primula (10), Delphinium (10). A remarkable number of the families and genera are Mediterranean.

The high mountain endemics are related to various communities (petrophyte – rock-stone-scree biotope, high mountain woody plant communities, subalpine tall herbaceous communities, high mountain meadows, Rhododendron shrubland, alpine carpets) and different lithological conditions (granite, limestone, marly, porphyrite, clay). Petrophyte communities are distinguished by high degree of endemism: 54%, i.e. 259 species of the Caucasus endemics are found in these communities. Caucasian endemic genera: Symphyoloma, Trigonocaryum, Mandenovia, Paedorotella, Charesia, Pseudobetckaea are related to rocks and scree. Limestone communities are represented by Scutellaria helenae, Draba imeretica, D. mingrelica, Paedorotella pontica, Campanula dzaaku, C. fonderwisii, Ranunculus helenae etc.; slate communities by Silene humilis, Vavilovia formosa, Campanula petrophyla, C. argunensis, C. sosnowskyi, Jurinea filifolia, Tephroseris karjaginii, Saxifraga ruprechtiana, Eunomia rotundifolia. Marly communities by Campanula hypopolia. Limestone communities are mainly distributed in the botanical-geographical province of Colchis (West Georgia).

The major part of the endemic species are spread in subalpine belt and only 20-30% of species are restricted to alpine and subnival belts; only a few species (Cerastium kazbek, Silene humilis, Pseudobetckaea caucasica) occur close to 4000 m a.s.l.(Mts. Kazbegi, Tebulo, Kachu, Diklo). Species found at high altitudes are fewer in number but these altitudes are characterized by higher level of endemism. The phenomenon should be explained by ecological and geographic isolation of the high mountain ecosystems of the Greater Caucasus.

Keywords: Caucasus, high mountain areas, endemic plants, plant communities, lithological conditions.

References:
Definition of methodologies to develop genetic reserves for landraces in central Italy: model strategy for setting conservation areas in Europe

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Plant genetic resources for food and agriculture are a subset of biodiversity and an essential basis for food security and human welfare. Protection of genetic resources in situ and access to a broad genetic variation are the cornerstones of a sustainable use of plant biodiversity in agricultural production systems. Landraces (LRs) are traditionally grown crop distinct from modern varieties. Their traits can easily be introgressed into breeding pools. Equally crop wild relatives (CWRs) are a source of novel genetic variation and are increasingly used for crop improvement through breeding since many decades. Both LRs and CWRs are increasingly threatened with erosion or extinction by unsustainable agro-environmental management and ecosystem instability.

The AEGRO European project (http://aegro.bafz.de/) focuses on the development of conservation strategies for both CWRs that occur in natural or semi-natural habitats and LRs that are often found in traditional farming systems. In the frame of this project, the aim of our work was to analyse the central Italy situation as a case study, in order to recommend an efficient strategy to establish and implement LR conservation areas in EU member states.

As a first step, an inventory of LRs existing in central Italy has been created including data on LRs taxonomy and on the biogeography of the cultivation sites. On the base of the collected data, LRs have been mapped by using orthophoto map and GIS program, in order to visualize and analyse the density and the distribution of LR cultivation areas. Thereafter, criteria have been elaborated to be taken into account in delimitating areas which are the richest in LRs in order to restrict the number and the dimensions of sites to recommend for conservation activities. The minimum number of criteria which allow the maximum inclusion of diversity has been identified.

Moreover, considering that CWRs are essential for new genetic variability introduction into the cultivated gene pools, for the areas where LRs belonging to the *Brassica* genus are grown, the presence of their CWRs has also been assessed (see poster of Barocco et al.). This allowed to identify the Most Appropriate Areas (MAA) for Plant Genetic Resource conservation.

The result is a recommended strategy that can serve as a plan for other European states interested in developing and implementing their own policies of LR conservation. However, the drafted model strategy for setting conservation areas needs to be tested in other biogeographic regions in Europe where inventories of LRs have been already established. This step will evaluate the efficiency of the developed strategy in capturing the maximum of LR diversity on a regional level, with the aim of protecting genetic resources for future use.

Keywords: genetic resources, landraces, crop wild relatives, in situ conservation, protected areas.
SIDE EVENT 3: ORIGINS OF PLANTS ENDEMIC TO THE CORSO-SARDINIAN MICROPLATE: AN INTEGRATIVE PHYLOGENETIC APPROACH

Chairperson: Elena Conti

INVITED ORAL PRESENTATIONS
Dating the origin of plant endemics to the Corso-Sardinian Plate: a window on the biogeography of the Western Mediterranean Basin

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Despite the remarkable species-richness of the Mediterranean flora, relatively few studies have investigated the temporal and spatial origins of this extraordinary diversity. Within the Mediterranean basin, the islands of Corsica and Sardinia have been identified as one of the areas with the highest endemism, hence they play a key role for understanding the evolution of Mediterranean diversity. Furthermore, the well-known geologic history of the Corso-Sardinian microplate, marked by the Late Oligocene split from northeastern Spain and southern France, and proposed land bridges with central Italy in the Miocene and northwestern Italy in the Pleistocene, provides the necessary framework to investigate the relative contribution of land connections and over-water dispersal to the assembly of their endemic flora. In our study, we investigate the origins of a selected group of Corso-Sardinian endemics in *Rutaceae*, *Araceae*, and *Boraginaceae* through a combination of phylogenetic analysis, molecular dating, and ancestral area reconstruction. After a review of the geologic history of the Corso-Sardinian microplate, will integrate results from the mentioned lines of evidence to elucidate the origin and likely migration routes of three endemics in *Araceae* and eight endemics in *Boraginaceae*, while Gabriele Salvo will review the origin of island endemics of *Ruta* in a separate talk.

**Keywords:** biogeography, vicariance, dispersal, plate movement, molecular dating, ancestral areas.
The history of flora, vegetation and climate in the Mediterranean area during the Messinian salinity crisis according to pollen records

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The Upper Neogene land vegetation left a sensitive record of regional and global environmental changes in the Mediterranean area. The palynological evidence based on floristic, vegetation and climatic data contributes significantly to the reconstruction of the spatial and temporal modifications affecting the terrestrial ecosystems from the onset of the Messinian salinity crisis (MSC, at ca 5.9 Ma) to the re-establishment of open marine conditions at the onset of the Pliocene (at 5.33 Ma). The contribution of palynology in the understanding of causes and effects of the MSC was summarized in the well known sentence: “climate was dry before, during and after the MSC”. This idea was supported by later palynological studies still carried out in Sicilian deposits. The stratigraphic record of vegetation and climatic changes from other Italian sites completed the picture. In Northern Apennines, the occurrence of a prevalent humid, subtropical to warm temperate climate pointed out major differences (in both temperature and moisture values) with respect to the coeval sections from Southern Italy, confirming the existence of climatic gradients, at least from the Messinian. Such climatic gradients within the Mediterranean provide evidence of more complex climate scenarios than that predicting an overall aridity which is relevant for both regional and global palaeoenvironmental syntheses including reconstructions of atmospheric and oceanic circulations. It is equally important to stress that the MSC does not produce dramatic effects on flora and vegetation which on the contrary suffer their major changes later, in coincidence with the phase of maximal expansion of the Arctic glaciation and the start of glacial/interglacial cycles at 2.6 Ma. Nevertheless in the course of Messinian some significant floristic events have been detected, e.g. the last appearance of *Avicennia*, a mangrove element and the northward expansion of *Lygeum*, a steppe element. The pollen records, from several sites covering the time interval before, during and after the MSC, will be also analyzed in order to elucidate both the history of floristic assemblages and the present exceptional plant biodiversity of the Mediterranean.

**Keywords**: pollen, flora vegetation, climate, Messinian Salinity Crisis, Mediterranean.
Flora Corsica: an analysis of the data

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Flora Corsica shows that the islands flora is composed of 2680 taxa. An analysis of the floristic data highlights the relations between the Corsican flora and that of the neighbouring areas, and helps us to understand the colonization mechanisms of the plants. The results show that 85% of the indigenous Corsican flora is shared with peninsular Italy, but only 65.5 % is shared with Sardinia. On the other hand, the endemic flora of Corsica is closely related with the Sardinian, and with the Balearic flora. The highest proportion of endemic taxa are localized in the highest altitudinal levels (mainly in the oromediterranean, subalpine and alpine vegetation belts), but the highest absolute number of endemic taxa is found in the montane belt followed by the supra- and mesomediterranean vegetation belts. The endemic taxa are less rare than the non-endemic ones, and they show broader ecological amplitude, with the ability to occupy several vegetation belts and more different habitats. The origin of the endemic flora (in a broad sense) is seemingly more related with the mediterranean elements than with the holarctic elements, except for the strictly Corsican endemics (which grow mainly in the alpine and subalpine belts). These apparently contradictory results seem to reflect a complex colonization process corresponding to different periods: 1) an old colonization period, during the Oligocene, which happened before the geographical drift of the Corso-Sardinian entity, 2) a second colonization period which occurred during the messinian salinity crisis, 3) both supplemented by long distance dispersal occurrences. The drastic effects of the glaciation periods can still be seen with the remaining populations of several very rare species (refuge zones).

Keywords: Tyrrhenian island, vascular flora, endemic taxa.
Molecular dating and biogeography of *Ruta* L. (*Rutaceae*): a case study from the Mediterranean basin

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Understanding the origin of island endemics is a central task of historical biogeography. Recent advances in molecular dating techniques (e.g., modelling fossil calibrations) and model-based range reconstruction methods (e.g., incorporation of geological knowledge into the analysis) provide a rigorous framework in which to address important biogeographic questions. This is crucial to determine the relative contribution of different biogeographic processes (e.g., vicariance, geodispersal, long-distance dispersal) to the origin of island endemics. The Mediterranean basin, with its complex but well-known history of micro-plate movements and climatic oscillations, provides the geological backdrop for the diversification of *Ruta*. This genus includes four species with a peri-Mediterranean distribution and five island endemics: *R. corsica* and *R. lamarmorae*, restricted to Corsica and Sardinia, and *R. pinnata*, *R. microcarpa*, and *R. oreojasme*, restricted to the Canary Islands. Phylogenetic, molecular dating, and ancestral range reconstruction analyses were carried out to investigate the extent to which past geological connections and climatic history of the Mediterranean basin explain the current distribution of species in *Ruta*. The origin of *Ruta* greatly predates the onset of Mediterranean climate; hence, this genus can be considered as a relict element of the once widespread “Tertiary geo-flora”. The origin of *R. corsica* and *R. lamarmorae*, postulated to be of a vicariant nature due to the split of the Corso-Sardinian (C-S) microplate from the Iberian peninsula during the Oligocene, is better explained by geodispersal following the collision of the C-S microplate with the Apulian plate during the middle Miocene. The formation of the Strait of Bonifacio, separating Corsica and Sardinia, is too old to have promoted vicariant speciation between *R. corsica* and *R. lamarmorae*, as previously hypothesized. The divergence between these two taxa is better understood in the context of eustatic changes associated with the Messinian Salinity Crisis. Finally, the monophyly of the species endemic to the Canary Islands indicates a single origin of the lineage, driven by long-distance dispersal, followed by diversification within the archipelago.

**Keywords**: Hercynian massif, land corridors, Messinian Salinity Crisis, Pleistocene glaciations, Bonifacio Strait.
SIDE EVENT 3: ORIGINS OF PLANTS ENDemic TO THE CORSO-SARDINIAN MICROPLATE: AN INTEGRATIVE PHYLOGENETIC APPROACH

Chairperson: Elena Conti

PROPOSED POSTER PRESENTATIONS
Assessing genetic variability in a narrow endemic species with two very close populations: the case of *Lamyropsis microcephala* in Sardinia

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*Lamyropsis microcephala* (Moris) Dittrich & Greuter (*Asteraceae*) is an endemic and threatened species growing only in two sites (Fonni and Desulo) of the Gennargentu massif (Sardinia, Italy). A rapid reduction of its distribution, in particular for the few individuals founded in Fonni (NU), due to intense grazing and increasing of touristic activities, has occurred. Such reduction could lead to a loss of genetic richness, compromising species survival. For these reasons the species has been included in 2005 among the “Top 50” threatened plants species of the Mediterranean Area and considered more recently in the SBI Italian red listing initiative.

In order to describe the level of genetic variability and to verify their genetic relationships, the only two localities existing in nature were sampled and analysed by Inter-Simple Sequence Repeat (I-SSR) markers. Preliminary molecular analyses, carried out by using six primer combinations, produced a total of 64 bands, 32 of which (50%) were polymorphic.

A significant degree of differentiation between the two localities was found, suggesting to consider them as two distinct populations. The estimates of Nei’s heterozigosity (Hₑ), were 0.070 for the Fonni and 0.108 for the Desulo populations. In addition, the highest value of Shannon’s diversity index was found into the largest population (Desulo). AMOVA values, obtained by I-SSR data, showed that 64% of the total variation is attributed to the individuals within populations, while 36% is due to differences among populations (P < 0.01). Preliminary results also highlighted scarce gene flow between the analysed populations (Nm = 0.821).

The values of genetic diversity within and between the two *L. microcephala* populations could be used to propose effective conservation strategies such as the use of a selected germplasm of the species for population reinforcement or reintroduction in suitable areas of Gennargentu massif.

**Keywords:** *Asteraceae*, clonal species, conservation, genetic variability, paleoendemic, Sardinia.
Pollinator convergence and the nature of species' boundaries in sympatric Sardinian Ophrys (Orchidaceae)

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In the sexually deceptive orchids of the Ophrys genus, species isolation is generally considered ethological and occurs via different, specific pollinators (Coyne & Orr 2004), but there are cases in which Ophrys species can share a common pollinator and differ in pollen placement on the body of the insect. In that condition, species are expected to be reproductively isolated through a pre-mating mechanical barrier. Here, the relative contribution of pre- versus post-mating barriers to gene flow among two Ophrys species that share a common pollinator and can occur in sympatry is studied. A natural hybrid zone on Sardinia between O. eleonorae and O. incubacea, sharing the bee Andrena morio (Delforge 2005) as pollinator, was investigated by analysing floral traits involved in pollinator attraction as odour extracts both for non-active and active compounds (Stöckl et al. 2007) and for labellum morphology. The genetic architecture of the hybrid zone was also estimated with AFLP markers, and pollination fitness and seed set of both parental species and their hybrids in the sympatric zone were estimated by controlled crosses. Although hybrids were intermediate between parental species in labellum morphology and non-active odour compounds, both parental species and hybrids produced a similar odour bouquet for active compounds. However, hybrids produced significantly lower fruit and seed set than parental species, and the genetic architecture of the hybrid zone suggests that they were mostly first-generation hybrids. The two parental species hybridize in sympathy as a consequence of pollinator overlap and weak mechanical isolation, but post-zygotic barriers reduce hybrid frequency and fitness, and prevent extensive introgression. These results highlight a significant contribution of late post-mating barriers, such as chromosomal divergence, for maintaining reproductive isolation, in an orchid group for which pre-mating barriers are often considered predominant.

Keywords: AFLP, floral scent, hybrid zone, fitness, Ophrys eleonorae, Ophrys incubacea, reproductive isolation.

References:
Floristic researches in Sardinian wetlands: preliminary data on salient species and new records

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In Sardinia focused floristic researches in wetlands were carried out till the first decades of XXth century, and secondary in 80s, but only with point studies and for a low number of areas. Consequently, wet habitats are still now not sufficiently considered from the biodiversity, ecological and conservation point of view. Focused studies are in progress to investigate floristic and vegetational aspects of Sardinian coastal and inland wetlands. Preliminary data on salient species new records are hereby showed.

New described species for Sardinia: Hypericum scruglii Bacch. & Brullo.
New species for Sardinia: Senecio fontanicola Grulich & Hodalova; Veronica praecox All. and Lemna valdiviana Phil. potentially invasive in some wet habitats.
New records for endemic species: Artemisia campestris L. subsp. variabilis (Ten.) Greuter; Borago morisiana Bigazzi & Ricceri; B. pygmaea (DC) Chater & Greuter; Delphinium gracile DC.; Lavatera triloba L. subsp. pallescens (Moris) Nyman; Myosotis soleirolii Godr.; Monotropa hypopitys L.; Ranunculus cymbalarifolius Moris; Rhamnus persicifolius Moris; Soleirolia soleirolii (Req.) Dandy.
New records for alien species: Azolla filiculoides Lam.; Eichhornia crassipes (Mart.) Solms; Lemna minuta Kunth.

Researches on Sardinian wetlands are currently in progress. Particularly, more studies about biology, ecology and conservation of these species are required, in order to precisely assess the risk of these strongly threatened habitats of Sardinia.

Keywords: alien flora, conservation, endemics, threatened species, wet habitat.
Genetic diversity and structure of the Corso-Sardinian endemic *Mercurialis corsica* Cosson (*Euphorbiaceae*): conservation implications in Corsica

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*Mercurialis corsica* Cosson is a rare endemic *Euphorbiaceae* scattered to Corsica and Sardinia, but populations are located across a wide ecological range, from the coast to ca. 1100 m a.s.l. In Corsica, this dioecious shrub is characterized by a strong decrease of population number since the last century as well as a high variability of population size and male/female ratios among populations. Previous karyological counts exhibit some variations of the chromosome number (2n = 66, 68, 69) which may indicate a certain degree of divergence between populations.

The aims of this study are to examine (i) the spatial organization of the genetic diversity for Corsican populations of *M. corsica* in relation with population location and structure, ecological and biological characteristics, (ii) their relation to Sardinian populations, and (iii) to elaborate conservation strategies taking into account its evolutive history and its current dynamic.

Both chloroplastic and ribosomal DNA intergenic spacers (trnL-F, MatK, ETS and ITS) with AFLP markers indicate some "conflicts" between molecular markers, and thus different interpretation about the emerging geographical genetic structure. According to the AFLP markers, we find a high differentiation between the Corsican Cape populations and all the others populations whereas the variance among the others Corsican populations is reduced. Furthermore, ETS and ITS sequences do not permit to distinguish any rDNA polymorphism, whereas cpDNA sequences reveal the divergence of western Corsican populations (in particular the populations of Arbori, Lopigna and Salice) and in a lesser degree the isolation of the Corsican Cape populations. Our preliminary results related to some Sardinian populations suggest the absence of divergence between Corso-Sardinian populations.

With a better understanding of the evolutive processes at the origin of the current distribution pattern of *M. corsica*, it could be privileged an in situ preservation of a maximum of populations reflecting the ecogeographic and the genetic variability of this species. Therefore, it could already be distinguished two main evolutionaty significant units to preserve in priority: the Corsican Cape and the others insular populations.

Keywords: Corso-Sardinian endemism, genetic diversity, phylogeographical structure, Mediterranean islands.
Germination ecology of *Ferula arrigonii* and *F. communis* (*Apiaceae*): a comparative approach

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The genus *Ferula* (*Apiaceae*) is represented in Sardinia by *F. communis* L. s.l. and *F. arrigonii* Bocchieri. The two species are very similar but *F. communis* is widespread in the Mediterranean basin, whereas *F. arrigonii* is endemic to Sardinia and Corsica. In Sardinia *F. communis* is quite common in the all the island and in particular in its central areas, whereas *F. arrigonii* is located in few populations near the coasts and in the small islands. Whereas several studies have been carried out on *F. communis*, the ecology of *F. arrigonii* is, at date, not well known.

In this study the germination ecology of both species was investigated. In particular germination test were carried out on three Sardinian populations of *F. communis* and two Sardinian and one Corsican population of *F. arrigonii*. The effects of a range of constant temperatures (10, 15 and 20°C) and one alternating temperature regime (20/10°C) and light on germination, as well as the effect of a pre-chilling period and the application of KNO₃ (0.20%) and GA₃ (120 ppm) were investigated.

The experimental trials carried out allowed characterizing the germination requirements of both species and the comparison of the achieved results may be helpful to explain the differences on their distributions.

**Keywords:** endemic, widespread species, Sardinia, seed dormancy, seed germination.
SIDE EVENT 4: CONSERVATION STUDIES ON THREATENED PLANTS IN THE MEDITERRANEAN AREA

Chairman: Giuseppe Fenu

INVITED ORAL PRESENTATIONS
Plant conservation strategies in the Mediterranean hotspot

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There is consensus in the scientific community that the current massive degradation of habitat and extinction of many of the Earth’s biotas is unprecedented and is taking place on a catastrophically short timescale (Novacek & Cleland 2001). Human actions are causing a biodiversity crisis, with species extinction rates up to 1000 times higher than background (Pimm et al. 1995, Brooks et al. 2006).

Conservation strategies represent a crucial issue in the Mediterranean biome because this area, which represents only 2% of the world’s surface, houses 20% of the world’s total floristic richness (Medail & Quezel 1999).

The Mediterranean basin has been recognised as one of the priority regions for conservation in Europe and it has been identified as one of the 25 most important biodiversity hotspots of the planet (Myers et al. 2000). Nevertheless, the highest levels of protection were detected in Australia, South Africa and California (from 9–11%), and the lowest levels (<1%) in Chile and the Mediterranean Basin (Underwood et al. 2009).

Achieving a balance between biodiversity conservation and human development is an important conservation strategy for the Mediterranean area.

The objectives of this session is to highlight the importance of in situ and ex situ approaches on the preservation of threatened, rare and endemic plants in the Mediterranean area, where anthropic activities play a pivotal role.

This session is focused on in situ researches like population studies as well as ex situ analysis like seed preservation and germination ecology studies.

Key words: threatened plants, Mediterranean species, conservation strategies.

Bibliografia:


Reproductive biology, seed ecophysiology and conservation of Mediterranean plants in a changing climate

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Changing climate, including the increasing unpredictability of climatic extremes, is providing a continual threat to plant biodiversity with significant impacts predicted and measured in many regions, including the Mediterranean area. Climate is a major determinant for the phenology, distribution and interaction of plants, with species exhibiting specific adaptations that reflect their changing micro-climatic conditions. Of the various environmental parameters impacting on plant responses, temperature has been the most thoroughly investigated and modelled. We review here the impact of temperature on key processes in plants, in particular reproductive biology and seed ecophysiology. Seed responses contribute significantly to population responses via altered germinability, dormancy loss kinetics, seed vigour, seed bank dynamics and seedling establishment. Determined inter-species variation in these seed quality traits in response to temperature indicate that there will be winners and losers as a result of climate change. However, baseline data on the modelling of seed responses is still limited to a few species, indicating the need for greater characterisation of thresholds and rate parameters across environmental gradients. Such understanding should enhance predicted impacts of climate change on (in situ) populations. Nonetheless, many species in the Mediterranean biodiversity hotspots remain under threat of extinction. We advocate an integrated approach to in situ and ex situ conservation, including the storage of seeds and reflect on current successes in the seed banking of threatened plants from the Mediterranean region. This work was supported by the Millennium Seed Bank Project.

Keywords: seed biology, Millennium Seed Bank project, climate change, threatened species, hotspots.
Ex situ conservation at the Plant Germplasm Bank-UPM (Technical University of Madrid) related with the Global Strategy for Plant Conservation

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Three objectives of the Global Strategy for Plant Conservation are related to ex situ conservation: first, the development of protocols for plant conservation and sustainable use, based on research and practical experience (objective III); second, 60% of threatened plant species should be stored in accessible ex situ collections, preferably in the country of origin (objective VIII); and 70% of the genetic diversity of crops and other socioeconomically valuable species should be conserved (objective IX). The Plant Germplasm Bank of the Technical University of Madrid (UPM) is an ex situ facility that, for the last forty years, has been devoted to the conservation of threaten Iberian flora and wild species of Brassicaceae, an important crop family in the Mediterranean basin. The main objective of this facility is the long-term conservation of plant germplasm but also to ensure the availability of the material to be used in conservation programs or research. The viability of samples of 14 Vulnerable (VU) Spanish species was evaluated after 32-34 years of storage; final germination percentages ranged from 90% to 55%. Currently, the Plant Germplasm Bank-UPM stores 23.7% of the threatened Spanish flora (objectives III and VIII). Besides, 1027 taxa of wild Brassicaceae are preserved (objective IX).

Keywords: GSPC, Spain, in situ and ex situ conservation, seedbanking, Plant Germplasm Bank-UPM.
Population biology and conservation of Mediterranean endemics: studies on the rare *Dianthus guliae* Janka

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An array of ecological and human factors has improved landscape heterogeneity and dynamics in the Mediterranean. This favored local adaptation and divergence of plant populations, as testified by the richness of narrow endemics in Mediterranean flora (Thompson 2005). However, small plant populations subjected to increasing isolation and fragmentation may undergo a higher extinction risk (Reed 2005, Leimu et al. 2006). By softening or exacerbating detriments due to unsuitable demographic conditions, mating components play a crucial role in driving the fate of small/isolated plant populations, toward persistence (and, possibly, speciation) or extinction (Kalisz et al. 2004, Honnay & Jacquemyn 2007, Kennedy & Elle 2008). Information regarding reproductive traits (e.g. selfing ability, sensitivity to inbreeding depression) is critical for understanding the reasons of different species/populations responses to potentially detrimental conditions (i.e. small population size, isolation, fragmentation). The evaluation of such aspects of plant biology would improve risk assessment procedures, as well as conservation measures. We are studying relationships between reproductive traits and proneness to extinction in *Dianthus guliae* Janka, the unique yellow carnation of Italian flora (Peruzzi & Gargano 2006). *D. guliae* is a rare endemic of the Italian Peninsula that disappeared from many areas of occurrence, and is very likely for further extinction at the southern border of its range, where the species was found only in one stand. Experimental work is carried out on plants cultivated in the field, and at the Botanical Garden of the Università della Calabria. We are investigating whether components of reproductive biology might increase the species extinction likelihood when constrained by demographically unsuitable conditions (e.g. small populations, low pollination efficiency). Especially, we are looking to biological components influencing the species’ sensitiveness to a) pollen limitation, b) inbreeding depression, c) predation. Moreover, since reintroduction might be required to warranty plant persistence at the southern boundary of its range, we are evaluating the best way for selecting and cultivating individuals to be reintroduced. To this end we are considering occurrence/extent of genetic drift between isolated populations, and influence of inbreeding depression at different stages of plants life-cycle and under different growth contexts.

**Keywords:** *Dianthus*, extinction risk, inbreeding depression, mating system, pollen limitation, reintroduction.

**References:**
SIDE EVENT 4: CONSERVATION STUDIES ON THREATENED PLANTS IN THE MEDITERRANEAN AREA

Chairman: Giuseppe Fenu

PROPOSED POSTER PRESENTATIONS
Transitory aerial seed bank in *Anthemis chrysantha* (*Compositae*), an endemic species from SE Spain

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*Anthemis* L. is the second largest genus in *Compositae*, with more than 210 species that occur in the Mediterranean region, southwest Asia, and eastern Africa. About 62 species of this genus are distributed in Europe, 14 of them occur in the Iberian Peninsula. *Anthemis chrysantha* J. Gay is an annual species endemic from Spain and North of Africa which is only known on the algerian costal region and in the coast of Cartagena (Murcia, SE Spain).

According to the IUCN categories this species is classified as Critically Endangered (CR). Although the endanger degree of the species is very high, studies do not exist based on its biology and ecology (life history attributes).

From field observation we hypothesized about the presence of a transitory aerial seed bank because achenes could persist for many months on the dead plants. The aim of this study is to test this hypothesis and study the quantitative value of this bank. Three consecutive annual cycles were studied, from 2006 to 2009, and four sampling were made from each cycle (three in 2006).

First, to estimate the density of plants per square meter, 50 quadrats (1m² each) were censused in each sampling along five 100-m transects. Plots were censused in June, when all individuals were in flower and the definite population size can be estimated, and later in November, February and May. The total number of inflorescences per plant was estimated in those plots. The inflorescences were counted *in situ* by a non destructive sampling. Then, the number of achenes per inflorescence was estimated in each sampling from 30 mature inflorescences randomly collected. Finally, the total number of achenes/m² was calculated using the following formula:

\[
\text{Total nº of achenes/m}^2 = (\text{nº plants/m}^2) \times (\text{nº inflorescences/plant}) \times (\text{nº achenes/inflorescence})
\]

The first annual sampling (June) show the total achenes production during each cycle. In this month, the mean values of inflorescences/plant, achenes/inflorescence and plants/m² were different depending on the year. However, the number of achenes/m² in 2006 and 2007 was similar finally: 19,869 and 21,193.30 achenes/m², respectively. But in 2008 it was lower than the previous (1,742.50 achenes/m²). This fact is related to the spring precipitation. In 2006 and 2007 the precipitation accumulated in March and April was 36.5 mm and 65.1 mm respectively, but in 2008 it was only 5.4 mm.

According to the results from each sampling, the achenes persisted in the plant and they were going to disperse gradually throughout the autumn and winter. Eight months after the achenes maturity between 1,600 and 25 achenes/m² still persisted in the plants, depending on the year. Besides, in May it was possible to find achenes in some inflorescence so the aerial seed bank can remain during one year.

**Keywords:** *Anthemis*, aerial seed bank, endangered species, SE Spain.
Autoecology and Life History of *Astragalus nitidiflorus*, a critically endangered species of SE Spain

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The genus *Astragalus* is represented by ca. 3000 taxa in the world and is distributed in semi-arid steppe regions. In the Iberian Peninsula there are 41 described species of *Astragalus*, nine of which are endemics. Among these endemic species, *A. nitidiflorus* Jiménez Mun. & Pau (*Leguminosae*) is a local endemism of the province of Murcia (SE Spain). It is a perennial herbaceous species that was collected in 1909 and described by Jiménez Munuera and Pau. Since then it has not been recorded until a few individual plants were observed in 2003 near Cartagena (Murcia province). Therefore, this species was first classified as extinct and actually as Critically Endangered in accordance with IUCN criteria. The reappearance of this species has awakened the interest of environmental managers because the reasons for its precarious situation are unclear due to no information exists about the factors that affect this species. Therefore, in order to design and implement an effective conservation programme, understanding the ecology and the life history of *A. nitidiflorus* is needed.

In the present paper we describe the ecology and the life history of the species and discuss the implications for the management and conservation of the species. In the presence area of the species soils type and climatic conditions were studied as well as the plant communities. Life cycle and biotic interactions were studied also in order to describe the life history of the species.

Field observation indicates that *A. nitidiflorus* is a short-lived herbaceous plant with a growth period lasting from the beginning of autumn until the summer of the following year (it lives three or four years). Flowering is in the spring, beginning in March and continuing until the end of May. The flowers are visited by bees such as *Osmia tricornis* Latreille and *Apis mellifera* L. The fruit take about two months to ripen. The dispersion unit is the fruit, an indehiscent legume which contains up to 19 seeds.

As regards biotic interactions in the species, apart from the presence of the above mentioned pollinators, pre-dispersive predation of the seeds by *Bruchophagus astragali* Fedoseeeva has been observed. At the beginning of vegetative growth (autumn), the leaves are consumed by larvae of the butterfly *Colias crocea* F. Furcroy, although little damage results. Generally, cattle avoid the plant, as do small wild rodents such as rabbit.

The plant occurs in the first stages of the plant succession in old fields and in bordering of intensively tilled almond crops. Tillage practice prevents the expansion of the species. When agricultural activity ceases, *A. nitidiflorus* forms part of the colonizer herbaceous communities in the old fields. However, no *A. nitidiflorus* plants have been found when vegetal succession progresses to produce a dense scrubland.

**Keywords:** endangered species, life history, conservation biology, SE Spain.
A Contribution to the study of Threatened Flora species from the Valencian Community (West Mediterranean, Spain)

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Valencian Community (Western Mediterranean area, Spain) is a territorial area with a great value of plant Biodiversity. The need for its conservation has stimulated the publication of many studies (Bañares & al., 2004). During the last year a multidisciplinary team work constituted by staff from the “Jardí Botànic de la Universitat de València”, the “Banc de Dades Biodiversitat de la Comunitat Valenciana” and also by a lot of Valencian botanists, have been editing the Valencian Threatened Species Book, where, for the first time, it has been made a study of all the species included in the Valencian Threatened Plant Species Catalogue in an exhaustive way (Laguna & al. 1998). A fundamental element in this study has been the compilation of all the chorological information available for each species, basically coming from our data base (Idubeda), and the Banc de Dades de Biodiversitat de la Comunitat Valenciana. The study of the chorological maps enables us to know the main endemity zones of the territory. Also it has been valued the taxonomic and chorological distribution of the species in the studied context. The publication of the book is expected for 2009. This work has been subsizeded by the Conselleria de Medi Ambient, Aigua, Urbanisme i Habitatge, Generalitat Valenciana.

Keywords: Valencian Community, threatened flora species, chorological information, endemics.

References:
Distribution, ecology and conservation status of *Draba hispanica* subsp. *lebrunii* P. Monts

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*Draba hispanica* subsp. *lebrunii* P. Monts. is an endemic taxa quoted in several points of the south-west of the Natural Park of “Fuentes Carrionas y Fuente Cobre- Montaña Palentina” (Palencia, Castilla y León- Spain).

The objects of this study can be summarized in two points. Firstly, a demographic and corologic monitoring of *Draba hispanica* subsp. *lebrunii* and secondly dealing with conservational problems in the area of interest.

Data about the taxonomy of the species of interest and current vegetation communities are provided. Conservation status, threat factors and possible alternatives of management are analyzed in order to guarantee flora protection and survival in this Natural Space. Moreover, we describe the habitat characteristics where *Draba hispanica* subsp. *lebrunii* grows, by evaluating the biogeographical, bioclimatological and edaphical conditions.

**Keywords:** *Draba hispanica* subsp. *lebrunii*, distribution, ecology, conservation.

**References:**
Anónimo 2007. Decreto 63/2007, de 14 de junio, por el que se crean el Catálogo de Flora Protegida de Castilla y León y la figura de protección denominada Microreserva de la Flora.
Germination and seedling recruitment constraints in the endemic species *Corema album*

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*Corema album* (L.) D. Don (Fam. *Ericaceae*, subfam. *Ericoideae*, tribu *Empetrae*) is a dioecious shrub endemic to coastal areas of the Iberian Peninsula, from NW Spain to the Strait of Gibraltar. Fruits are fleshy berries dispersed by vertebrates, mostly rabbits in Southern areas of the geographical range (Clavijo et al. 2002). Seeds present dormancy and regeneration has been described to present low rates (Calviño-Cancela 2002, 2004). The species has been classified as vulnerable due to the fragility of its habitat, and a decrease of populations has been related to construction and reforestations with pine trees.

In this study we analysed germination and seedling recruitment constraints with the aim of gaining knowledge of factors that diminish regeneration of *C. album*, to establish a management protocol to foster decreasing population areas.

Germination experiments were conducted under laboratory conditions. Five treatments were carried out to determine factors breaking dormancy: cold stratification, smoke, heat shock, hydrochloric acid, and gibberellic acid exposure. Control seeds and seeds from rabbit excrements were also set to germinate. Until date, germination was only found in seeds from rabbits, confirming previous results on the effects of such unspecialised dispersers.

Seedlings were monitored under natural conditions, analyzing microsite effects on the survival rate. Results pointed out that seedling establishment was unrelated to distance to fruit-bearing plants. Higher densities of seedlings occurred in open areas during the wet season (autumn, winter, and early spring), with an aggregated pattern that could be related to rabbit dispersion. Seedling mortality showed higher rates during summer, reaching 99% during two consecutive seasons. Results showed negative effects of pine tree cover on seedling establishment, allowing to conclude that such reforestations have restrictive consequences for the regeneration of this endangered species.

**Keywords:** *Corema album*, germination, seedling recruitment.

**References:**
Calviño-Cancela M. 2004. Ingestion and dispersal: direct and indirect effects of frugivores on seed viability and germination of *Corema album* (*Empetraceae*). Acta Oecologica 26: 55-64.
The Iberian Peninsula endemic *Succisella carvalhoana* (Mariz) Baksay (*Dipsacaceae*): an evaluation of its conservation status in Portugal

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Every conservation program should start with a thorough evaluation of the current status of the species. Questions such as what is the distribution range, or how is population declining should be answered. Also, the knowledge of the ecological characteristics of an endangered species is essential to its conservation and management. A detailed analysis of distribution, population size, habitat, threat it faces and stand disturbance of an endangered plant *Succisella carvalhoana* (Mariz) Baksay in Portugal was carried out. This *Dipsacaceae* is a narrow endemic of the central and western Iberian Peninsula. The species is listed as threatened in several Spanish documents (AA.VV. 2000, Bañares et al. 2003, Moreno 2008), although it does not figure as such in any Portuguese document. The total number of individuals thought to exist is < 1000, distributed in only two highly isolated and fragmented patches in the central western of Portugal. The main threats for the survival of the species are the specific small populations and loss of habitat for anthropogenic destruction, and the two Portuguese populations can be considered threatened. To determine the Area of Occupancy and the Extent of Occurrence of *Succisella carvalhoana*, an exhaustive bibliographical survey was carried out, and herbarium specimens deposited in several institutions were revised. It is, therefore, classifiable as Critically Endangered in Portugal. Based on the results, some strategies were put forward for the conservation of *Succisella carvalhoana* populations.

**Keywords**: Area of distribution, conservation, *Dipsacaceae*, Portugal, *Succisella carvalhoana*, threatened species.

**References**:
Ecological characterisation of *Taxus baccata* occurrence in Elba island

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The aim of this work is to provide a first characterization of a previously undescribed *Taxus baccata* L stand on Elba Island, along the slopes of Mount Capanne massif. After a comparison with the historical bibliography that shows an ancient presence, and an overview of biological and ecological site characteristics, a general framework of this isolated yew population is given. The description of this *T. baccata* stand started with GPS localisation of each plant, with a special attention to its regeneration, followed by a further data processing through GIS. The sex ratio was also established. The analysis showed that the population as a whole appears healthy and vital, well adapted to severe environmental conditions such as strong wind and lack of soil, although growing with shrubby habitus. Also in terms of regeneration, the stand shows good adaptability, though it seems to prefer cooler exposures and small spots of light to survive. After those considerations, and especially under the indication of EU Directive 92/43/CEE – habitat code 9580 “*Taxus baccata* Mediterranean woods” - a series of conservation actions useful to manage the stand examined will be proposed. Due to the information collected it will also be possible to have access to Life program to promote specific conservation actions. It also appears necessary to provide greater knowledge and awareness about the delicate balance of this habitat.

**Keywords:** *Taxus baccata*, Elba Island, ecological characterisation.
Ex situ conservation of sicilian “threatened” Limonium and potentiality of the germplasm

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The genus Limonium (Plumbaginaceae) includes more than 400 species, mainly distributed in the Mediterranean basin (Greuter et al. 1989). They are almost exclusively halophile and peculiar to habitats with high salt concentrations present in the substratum (sea cliffs, sandy shores, salt marshes, salt flats, coastal lagoons). Altogether 43 species are present in Sicily (Giardina et al. 2007), most of which are endemic, while others belong to “red lists” proposed on a national (Conti et al. 1996) or regional level (Raimondo et al. 1994). The environment they live in reveals their extreme vulnerability as coasts today are at risk of great modification or even destruction, especially due to anthropic activities.

Within the framework of the research carried out during the last 10 years by the CRA-SFM, fields for the collection and exploitation of autochthon germplasms, among which Sicilian Limonium, have been created at the experimental farm of Bagheria (Palermo). The present work reports the results of a two year research on some species of Limonium genus considered “vulnerable” (L. calcarae, L. catanzaroi, L. flagellare, L. glomeratum, L. hyblaearum, L. ionicum, L. lilybaeum, L. lojaconoi, L. opulentum, L. cosyrense, L. pavoneanum, L. selinuntinum, L. tauromenitanum) or “endangered” (L. todaroanum).

The research has enabled to obtain a better knowledge of the bio-ecological characteristics of the same species, distant from their original habitat, by comparing natural populations with plants grown ex situ. The results of the activities carried out emphasize, besides the high ecological value of the examined germplasms, the possibility of species conservation and the potential applicableness of some of them. Certain Limonium, in fact, could be used to requalify environments, especially degraded halophytic habitats. Others, thanks to their aesthetical characteristics, could be used to create new ornamental products.

Keywords: vulnerable plants, Mediterranean species, halophile species, bio-ecology, exploitation.

References:
Seed germination studies of *Sarcopoterium spinosum* (L.) Spach (*Rosaceae*)

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The germination behaviour of three populations (Sardinia - It, Chios – Gr and Malta) of *Sarcopoterium spinosum* (L.) Spach (*Rosaceae*) was investigated under controlled laboratory conditions at the Sardinian Germplasm Bank (BG-SAR). Viability and germination of each population was checked and compared by testing at 10, 15, 20, 25°C with a photoperiod of 12 hours light / 12 hours darkness. In addition the effects on germination of two sowing mediums (germination paper and agar 1%) and a pre-treatment (chipping by scalpel) were analysed. Germination at 20°C of “fresh” collected seeds, after 80 days of storing under environmental conditions and after one year of storing at 5°C was also investigated to verify the presence of physiological dormancy, as previously reported by Vahl (1940) and Litav & Orshan (1971) on seeds belonging to the Middle East region. In this study a low viability was detected for the seeds belonging to Malta population, probably due to imbreeding phoenomena, whereas the results achieved for the other two populations allowed us to characterise their germination ecology.

**Keywords:** conservation, imbreeding, *Sarcopoterium spinosum*, seed dormancy, seed germination.

**References:**


Biology of the Sierra Nevada endemic *Moehringia fontqueri* Pau

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One of the major focuses in conservation must be endemic and threatened species from regions with high biodiversity, high degree of endemism and sensitive to possible environmental changes. Sierra Nevada (Granada and Almería provinces, Southeastern Spain) is the most important centre of plant diversity in the western Mediterranean region featuring more than 80 exclusive taxa (Blanca 1998). Out of the 2100 species catalogued in Sierra Nevada, 123 are threatened (8 are critically endangered, 20 endangered, 95 are vulnerable and 17 are data deficient) representing the 6.7 % of the total flora. *Moehringia fontqueri* Pau (Caryophyllaceae) is an endangered narrow endemic that inhabits crevices in siliceous shady cliffs in the eastern part of the Sierra Nevada mountain range. Species ecological traits can be considered as threat factors themselves that together with habitat loss may lead to a higher risk degree (Peñas & Lorite 2003).

The main aim of this study was to identify the potential occurrence area, estimating species population size and to carry out a preliminary study on the species reproductive biology to assess reproduction-related parameters to understand key autoecological features.

With this aim presence records, direct count censuses together with a dataset of environmental variables and a presence-based modelling algorithm were used to build a distribution model. Phenology was monitored in 30 individuals in three different plots along an altitudinal gradient during 3 months. Fitness was estimated as the ratio between the number of ovules counted and seeds produced per fruit. Results show there are reproductive differences between plots. Our study intends to provide useful information for species management and to point out the need to work towards its conservation.

**Keywords:** conservation, chorology, endemic, *Moehringia fontqueri* Pau, phenology, population size, reproductive biology.

**References:**
Conservation of a threatened plant in serpentine landscapes: *Antirrhinum ophioliticum* (*Scrophulariaceae*), a narrow Portuguese endemic

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Patchy habitats are intriguing to both ecologists and evolutionists. The distinctive flora of serpentine, with its anciently discontinuous distribution, would seem a prime candidate for such diversity-enhancing effects (Harrison et al. 2000). Soils developed from different types of ophiolitic bedrocks are known since long time to represent a strongly hostile environment for plant life due to severe anomalies in their chemical and physical properties (Selvi 2007).

Serpentine outcrops typically are discrete, highly variable in extent and isolation. These areas support a distinctive flora with numerous uncommon or rare endemic taxa. Such qualities make this landscape an excellent arena for studying of conservation topics (Wolf 2001, Stevanović et al. 2003, Selvi 2007). The aim of this study is to determine the conservation status of *Antirrhinum ophioliticum* nom. nudum (*Scrophulariaceae*), a threatened narrow endemism of the ultramafic crops of NE Portugal Lusitan Duriensean biogeographical sector, by using the IUCN (2001) IUCN Red List Categories and Criteria.

Here we report detailed studies of its distribution, and assess its current distribution status with respect to this, the sizes of its populations, and the threat it faces. Our estimation of the size of the Portuguese populations was based on our own census data from those sites at which we found the species. All censuses were performed by direct counting of all potentially reproductive individuals. Four populations were found, and the total members thought to exist are between 300 and 400, with highly fragmented distribution in the serpentine outcrops of NE Portugal. Based on our data, the species is classifiable as Critically Endangered. The risk of local population extinction is high due to its typically small local population sizes and suitable conservation strategies should be developed in order to preserve the species.

Results from this investigation illustrate the need to protect serpentine landscapes that contain full range of microhabitats that are inhabited by serpentine endemic plants.

**Keywords:** *Antirrhinum ophioliticum*, endangered species, habitat fragmentation, serpentine, *Scrophulariaceae*.

**References:**
"Lebanon flora online", the first step in the long conservation pathway

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The Mediterranean region is one of the 25 "hot spots" of biodiversity of our planet, with bio-geographic zones among the rarest in the world and a biodiversity of the first importance. Despite the affinities that the Lebanese vegetation had with the Mediterranean region, its diversity depends on several geomorphologic elements.

The geographical situation of Lebanon, its mountainous relief and the proximity of the sea are as many factors which seem to have supported the development of a very diverse, abundant and rich flora. The mountainous relief is characterized by deep valleys, a great number of rivers and snows which cover the mountain top all the year. It is precisely in these valleys, at the mountains and sometimes on the littoral sand that is found the greatest number of endemic plants. One hundred of species occur exclusively in Lebanon.

After 30 years of war, Lebanon plant biodiversity cries out for adequate evaluation and a more integrative and encompassing knowledge of it is a necessary prerogative for appropriate management and conservation strategies. Although the flora of Lebanon have been privileged place for many botanists for years, the war period of the past decades has hampered investigations and Lebanese taxa are excluded from regional and global studies because of the perceived difficulties of collecting plant material. The fastest way to promote the knowledge of our flora and make it accessible to the scientists but also to the amateurs remains the web.

Since three years our team undertook the construction of a web-based database describing the botanical, ecological and genetic richness of Lebanese flora, regrouping data as chromosome number, genome size, ecological requirements in terms of habitat, and potential and observed geographical distribution. This electronic data base is available on the following address: http://fs.usj.edu.lb/flore_du_liban/.

The database project is designed to bring together data collected by scientific researchers, students, local NGOs, as well amateur botanists. This project will hopefully enable the establishment of a "red list" for Lebanese plant species at risk as well as a "black list" of invasive species to enable an optimal management of fragile ecosystems in Lebanon.

This work enabled us to develop in situ and ex situ approaches on the preservation of threatened, rare and endemic Lebanese plants including population studies as well as seed preservation and germination ecology studies.

Keywords: Lebanon, conservation, biodiversity, online database, flora, endemic.

References:
Updating of threatened species of coastal sites of SE Sicily

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In the frame of floristic researches carried out in coastal sites of south-eastern Sicily, we present a contribution focused on assessing the category of threat according to the IUCN Red List Categories and Criteria (IUCN 2001, 2003). Our study concerns several species, some of which already included in the Italian Regional Red List (Conti et al. 1997), while other ones have to be included in a upcoming updating. All the examined species are found in coastal areas strongly affected by anthropic disturbance (mainly human settlements and intensive agro-pastoral land use), but still of great importance as conservation areas. Presently, most of these areas falls into SCI or SPA (EU directive 92/42). They are: SPA Torre Manfria, Biviere e Piana di Gela (ITA050012), SCI Punta Braccetto, Contrada Cammarana (ITA080004), SCI Cava Randello, Passo Marinaro (ITA080006), SCI Foce del Fiume Irmino (ITA080001), SCI Pantani della Sicilia Sud-Orientale (ITA000003), SCI Isola Correnti, Pantani di P. Pilieri, Chiusa dell’Alga (ITA090010), SCI Isola di Capo Passero (ITA090001), SCI Pantano Morghella (ITA090004), SCI Pantano di Marzamemi (ITA090005), SCI Vendicari (ITA090002), SCI Capo Murro di Porco, Penisola della Maddalena e Grotta Pellegrino (ITA090008), SPA Saline di Siracusa e Fiume Ciane (ITA090006). The following species are examined: *Asphodelus tenuifolius* Cav., Med.-Iran.-Tur., Torre Manfria (Gela), coastal cliffs; *Cichorium spinosum* L., Med., Capo Passero, coastal cliffs; *Crucianella rupestris* Guss., SE Med., Cammarana (Scoglitti), coastal cliffs; *Cyperus alopecuroides* Rottb., Paleotrop., Biviere di Gela, coastal lakes; *Desmazeria pignatti* Brullo & Pavone, Sicilian-Maltese endemic, Sampieri e Vendicari, coastal cliffs; *Halopeplis amplexicaulis* (Vahl) Cesati et al., SW Med., Pantano Ciaramiraro, salt marshes. *Helianthemum sicanorum* Brullo, Giusso & Sciandrello, Endemic, Torre Manfria (Gela), coastal cliffs; *Hormuzachia aggregata* (Lehm.) Gusul, S Med., Manfria, Macconi di Gela, Siculiana, sandy habitats; *Leopoldia gussonei* Parl., Endem., Poggio Arena, Macconi di Gela, Cammarana (Scoglitti), sandy habitats; *Limonium pachynense* Brullo, Endemic, Pantano Longarini, salt marshes; *Limonium pavonianum* Brullo, Endemic, Cava D’Aliga, coastal cliffs; *Linum maritimum* L., Med., Pantano Arezzi, salt marshes; *Reaumuria vermiculata* L., S Med., Torre Manfria (Gela), coastal cliffs; *Senecio pygmaeus* DC., Sicilian-Maltese endemic, Sampieri, Capo Passero rocky habitats; *Spergularia heldreichii* Fouc., Med., Isola di Capo Passero; *Trigonella maritima* Delile S, Med., Punta Braccetto, rocky habitats.

Literature data on distribution are checked and, basing on personal field investigations, updated. In addition, area of occupancy and size of populations are assessed in order to update the category of threat.

Keywords: threatened species, IUCN Red List Categories and Criteria, Sicily.

References:


Inferences on the ecological niche of *Quercus crenata* Lam. from a representative area in Central Italy

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This work aims at defining the accurate occurrence of *Quercus crenata* Lam. (*Fagaceae*) in the territories of Viterbo administrative province, by means of extensive sampling. As a result, the full inventory for the taxon reaches over 300 trees, thus enriching available knowledge based on the previously known 55 individuals. In addition, the main bi-ecological characteristics of the trees are collected and described, in order to provide a deeper insight on the species characterisation in the study area.

The methodologies involved include field surveys, GPS positioning and data elaboration through a report card with a full description of every single tree and collecting site. Environmental main parameters of the distribution sites have been elaborated with G.I.S. Resulting data have been used for ecological comparisons with similar studies on *Quercus crenata* across the Italian species’ range. Based on abundance and morphological data, the study area seem to be characterised by an ecological optimum for this taxon. The work has been completed with the sampling of leaves, fruits, pathogens, soil samples and pictures, to provide starting material (eg. DNAs, herbarium specimen, seedlings, etc.) to deepen studies on the species biology.

**Keywords:** *Quercus crenata*, taxonomy, ecology, distribution, conservation.
Conservation status of *Dianthus morisianus* (Caryophyllaceae), an exclusive endemic species of Sardinia (Italy)

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The evaluation of the conservation status, by monitoring population trends, of rare and endemic species is one of the main aims of plant biology conservation studies. In this study the only known population of *Dianthus morisianus* Vals., a paleoendemic species that occurred in the dune system of Portixeddu (Fluminimaggiore) in south-western Sardinia, was analyzed.

*D. morisianus*, togheter with *D. cyathophorus* Moris and *D. sardous* Bacch., Brullo, Casti & Giusso, belongs to the cycle of *D. sylvestris* Wulfen, one of the most complex and unstudied groups with numerous taxa whose real taxonomic value is doubtful.  

*D. morisianus* is a psammophylous species, characteristic of inner partially stabilized dunes, where it is found near the *Juniperus* sp. pl. shrubs. It flowers between May and June whereas ripe fruits can be found in June and July.

Because of its rarity, this species has been inserted on a National Red List of endangered species, on a Regional Red List of vulnerable species and recently it has been elevated to critically endangered.

Although the narrow area of occurrence, few researches on *D. morisianus* have been realized in the past. Since 2007 we have been monitoring its small population and analysing its reproductive biology, population structure and demography. In addiction the main threats affecting the population, due to agricultural activities (e.g. reforestation activities and grazing) and to recreational and touristic activities, where detected.

The obtained results allowed to characterize the distribution and population size, to collect and to store ex situ the germplasm in the Sardinian Germplasm Bank (BG-SAR) and to carry out studies about biology and ecology. It has also been possible to verify its conservation status, according to the IUCN criteria, mainly based on the narrow distribution and on the area of occupancy (AOO) and extent of occurrence (EOO).

**Keywords:** Caryophyllaceae, Dianthus, conservation, IUCN Red List, narrow endemic, population studies.
Contribution to the knowledge of the endemic vascular flora of Supramontes (CE-Sardinia), a priority plant conservation area

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The “Supramontes” region spreads for 21,000 ha from the limestone massif of the CE Sardinia to the Orosei gulf, in the municipalities of Baunei, Dorgali, Oliena, Orgosolo and Urzulei. The altitude varies from the sea level to 1463 m of the Mt. Corrasi (Oliena).

In this study 127 endemic taxa, belonging to 92 genera and 42 families, have been found, with 89 of which being species, 33 subspecies and 5 varieties. The analysis of biologic and chorologic data highlighted the peculiarities of this territory, given by the local evolution of a rich floristic contingent. The biologic spectrum of the endemic flora of Supramontes is dominated by the chamaephytes (32.3%), followed by the hemicryptophytes (29.9%), geophytes (24.4%), nanophanerophytes and phanerophytes (9.4%) and therophytes (2.4%). The great majority of the taxa are exclusive endemic to Sardinia (41.7%) that, with the 29.1% of endemic to Sardinia and Corsica. In particular 6.3 % are exclusives to these territories and highlighted the rank of this area as an autonomous biogeographic sector.

From the analysed taxa, 27 are included in the IUCN Red List and 4 in the DIR 92/43/CEE “Habitat”. The results of this work allowed the Oliena Municipality to enact in 2007 a resolution to protect 20 species including the very threatened Ribes sardoum Martelli, Centranthus amazonum Fridl. & A. Raynal and Aquilegia nugorensis Arrigoni & E. Nardi.

Keywords: biogeography, chorology, conservation, endemic flora, Sardinia, Supramontes.
Contribution to the floristic and vegetation knowledge of Garigliano estuary area (CE, Southern Italy)

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The northern part of the coastal area of Caserta district is mainly characterized by a sandy flat seashore, with a mosaic of sand dunes and halophytic habitats, as well as plantations of thermophilous pines. These habitats are often bordering on both urban and agricultural areas due to the increasing exploitation of the last decades. Due to its importance in terms of presence of European natural habitats, two Natura 2000 Sites were proposed for this area: “Fiume Garigliano” (Natura 2000 code: IT8010029), including the water course and the estuary of Garigliano river (Campania side), and “Pineta della foce del Garigliano” (Natura 2000 code: IT8010019), including a coastal area extending for about 185 ha; the two sites are actually included in the Regional Nature Park “Roccamonfina-foce del Garigliano”. In spite of the importance of these sites, the floristic knowledge of the area is still scarce (1) and no data are reported concerning the plant communities. In this context this research began gathering of both floristic and vegetational data in order to highlight the criticism and to suggest the best management practices to preserve and restore the natural habitats disturbed by increasing human activities.

Floristic research pointed out the presence of rare species such as Ophrys exaltata subsp. tyrhena (2) or Malcolmia ramosissima and Romulea rollii (3); the presence of Nuphar luteum in the Garigliano river (the only record for Campania region) and Daphne sericea in dune sclerophyllous scrubs has been assessed too. As regard on vegetation studies, the first results confirmed the presence of coastal sand dunes and halophytic habitats, but somewhere in very degraded conditions due to the high impact of human activities leading to a fragmented pattern of plant communities. A management strategy for the area is needed in order to preserve the existing habitats and to improve the overall environmental quality.

Keywords: Natura 2000, habitat, threatened species, conservation.

References:

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Conservation study of an endemic plant of the Balearic Islands endangered to become extinct: *Apium bermejoi* L. Llorens (*Apiaceae*)

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*Apium bermejoi* is an umbelliferae endemic of Minorca, which is endangered to become extinct according with the IUCN criteria. Recently, the Conselleria de Medi Ambient del Govern Balear has approved the conservation plan (May 2008). We show the most important performances of management done in collaboration with Consell Insular de Menorca and Conselleria de Medi Ambient del Govern Balear.

In situ conservation. This specie was introduced in three new localities, one in 2004 and the others in 2008, according with criteria of suitability of habitat, maximum representation of genetic variability, according to the property and easy accessibility (Rita & Cardona 2004).

Ex situ conservation. A seed bank of the species was created, it include seeds from all the fertile plants found in the wild in 2004, to be sure that we got all the genetic variability. It is kept in the Jardi Botaníc de Sóller. We did an ex situ population in the gardens of the University, which allows us to increase the seed bank (2007), too.

Demographic monitoring. We have done a demographic monitoring from 1999, which shows a high annual fluctuation of the population size. Since 2006 it has been realized a monthly monitoring of all the populations (Cursach 2008). Our information shows that the original population has a seasonal marked dynamics, with a maximum at the end of spring and a minimum at the beginning of autumn when the most of individuals die. *A. bermejoi* is very sensitive at meteorological events at the moment of germination and during the vegetative development (autumn and winter).

Study of biology reproductive. Floral phenology and the reproductive success on the all populations have been studied. Ants seem to be the main pollinator vector. Although the total number of effective is low, the production of fruits of each population is high, about thousands of seeds. Germination potential in controlled conditions is very high, too (>80%).

Predation like a threat factor. The waste material of anthill of close nest of *Messor bouvieri* Bondroit (*Myrminicinae*) was analyzed, we found seeds of the target specie, and then these ants probably play a role as predator/disseminator. The geoautochoria could be a protection mechanism to predation. Moreover, herbivory episodes by caterpillar of *Orthonama obstipata* Fabricius (*Geometridae*) were detected.

Threats to commit the survival of *A. bermejoi* are very diverse. The conservation status of the specie requires continuing monitoring demography of populations and studying the biology of the specie in order to improve in measures of management.

**Keywords:** *Apium bermejoi*, threatened specie, population dynamics, reproductive biology, management, Balearic Islands.

**References:**
Photochemical activity and leaf functional traits of *Petagnaea gussonei* and *Sanicula europaea* (*Apiaceae*) as affected by variable environmental conditions

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*Petagnaea gussonei* (Sprengel) Rauschert (=*Petagnia saniculifolia* Guss.) is a very rare species and is endemic to North Eastern Sicily (Italy). It is confined in a few area of Nebrodi Mountain. Its rarity as well as the general difficulty of sampling make it a very poorly known species up to little time ago (De Castro et al. 2008, 2009). Because no eco-physiological information is available on this rare species, the aim of this work was to assess the photochemical activity and some leaf functional traits as influenced by environmental conditions in order to investigate the strategies that allow plant to adapt successfully to its habitat. For this purpose, measurements of chlorophyll *a* fluorescence as well as determinations of leaf characteristics such as specific leaf area (SLA), leaf water content (WC), leaf relative water content (RWC) and chlorophylls were performed seasonally on leaves of *P. gussonei* grown in the field. The same experimental approach was carried out in a parallel fashion on *Sanicula europaea* L. The two species are morphologically similar but, since *S. europaea* is very abundant and widespread.

In spring and autumn, when no-limiting environmental conditions occur at measuring site, both species showed the highest (P<0.01) quantum yield of PSII electron transport (ΦPSII) and photochemical quenching (qP) as well as higher values (P<0.05) of SLA, WC, RWC and total chlorophyll content compared to summer and winter.

In winter both species exhibited the strongest decrease (P<0.001) of SLA, ΦPSII, qP and maximum photochemical efficiency (Fv/Fm) together with the highest non-photochemical quenching (qN) and the greatest amount of carotenoids. No difference was observed among spring, summer and autumn in Fv/Fm between the two species. Data indicate that for both *P. gussonei* and *S. europaea*, winter represent the more critical season for photosynthetic apparatus in terms of light harvesting and light conversion to reaction centres and for photoinhibitory damage risks (Huner et al. 1993). However the highest qN and the greatest amount of carotenoids suggest that thermal dissipation is very active in photoprotection at low temperature (Adams et al. 2001).

The success of *S. europaea* in colonizing wide areas seems to be not attributable to a better photochemical performance during the seasons compared to *P. gussonei*, but rather to other causes that require further investigations.

The authors are grateful to Nando Peretti Foundation for funding the study.

**Keywords:** endangered species, *P. gussonei*, photochemical activity, *S. europaea*, pigment content.

**References:**
Weed risk assessment of *Cortaderia selloana* in Sardinian wetlands through germination study

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Biological invasions are considered one of the most threatening factors to the loss of plant diversity all over the world. Invasive success depends, among other factors, on the biological attributes of the invaders and the biotic and abiotic characteristics of the ecosystems. *Cortaderia selloana* (Schult. & Schult. f.) Asch. & Graebn. (*Poaceae*) is a perennial grass introduced from South America which is considered invasive worldwide (Domènech & Vilà 2008). This species can tolerate a wide range of environmental conditions and it can invade a variety of habitats both ruderal and natural, although it is particularly enhanced by soil disturbances that provide safe sites for seedlings establishment. In the last decades it has become a serious problem in most of European countries. Its distribution in Sardinia has been increasing only in the last few years, threatening most of all natural habitats like wetlands (Bacchetta et al. 2008, 2009). The present work is focused on the study of abiotic factors that may favour seed germination. The main aim is to get more information regarding the potential invasiveness of *C. selloana*, with particular attention to wetlands. Germination tests were conducted at the Sardinian Germplasm Bank (BG-SAR), testing different temperatures and percentages of NaCl in order to determine the optimal germination protocol and the effect of salt on seeds germination, seedlings survivorship and vigour. Seeds completely germinated at every tested temperature, yet the higher germination rate was found at 25 degrees C. Salinity didn't prevent seeds to germinate, but it affected germination and seedlings parameters. Further researches are in progress in order to assess the real entity of the threatening power of *C. selloana* on the most sensitive habitats and ecosystems of Sardinia.

**Keywords:** *Cortaderia selloana*, germination, invasive alien plants, salinity, wetlands.

**References:**
Ecology of the portuguese endemic *Omphalodes kuzinskyanae* Willk.: contributions to community management and conservation

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*Omphalodes kuzinskyanae* is a Portuguese endemic taxon with very restrict distribution. Recent studies have shown that this vascular annual plant is severely threatened, mainly due to human action. According to the peculiar ecological needs, and a low seed bank available, the species is especially vulnerable to the impact of human induced climatic changes. For its preoccupant conservation status, the specie is included in Berne Convention, and its populations included in the Nature 2000 network. However, the ecology of *O. kuzinskyanae* is yet poorly understood. The few populations known, are distributed between Cabo Raso (Cascais) and Ericeira, in the coastal centre of Mainland Portugal. The taxa exist only on sandy soils, situated in the top of rocky littoral platforms, annexes to coastal cliffs under intense wind and salt spray. We have studied the ecological requests of *O. kuzinskyanae*, by comparison with the two other taxa from the same clade, *O. gallaecica* (from Galicia) and *O. littoralis* (from west of France). The germination rates, and several habitat conditions, like the soil chemical characteristic, grain size, and light and shadow plant response, have been investigated. In order to fulfil the needs of integrated management and conservation policies, and maintain the availability of the populations, it is vital to know its specific ecological requests. This particular study was made in the context of the definition of alternative locations, to reintroduce this specie, threatened of extinction. The syntaxonomic scheme of the species communities is discuss.

**Keywords:** *Omphalodes*, psamophytic vegetation, threat, ecology, conservation.
The Germplasm Bank of the Botanic Garden and Museum of the University of Bari: ex situ conservation of the spontaneous spermatophytic Apulian flora

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The Germplasm Bank of the Botanic Garden and Museum of the University of Bari (BG-MOBB), designed as a seed bank, was established in 2005 within the framework of the LIFE03 NAT/IT/000134 project, which was aimed at the conservation and restoration of the priority habitat ‘Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea’ (Annex I, Habitats Directive 92/43/CEE) in the area between the gravine of Palagianello and Castellaneta (Ta - Apulia) (Forte et al. 2009).

The purpose of the BG-MOBB is to preserve autochthonous species with orthodox seeds from Apulian flora ex situ and to contribute to their conservation in situ as well. The BG-MOBB aims not only at conserving entities at risk of extinction in the region, rare and endemic species and important entities for phytogeographical reasons, but also at preserving the germplasm from local populations of more common species representing the diversity of Apulian natural environments. The seed conservation process at BG-MOBB is carried out in several steps (Bacchetta et al. 2006): 1) seed collection by skilled collectors according to scientific criteria (Brown & Marshall 1995) and filling the field data form; 2) seed cleaning and sorting according to the species and often through the binocular stereomicroscope; 3) characterization of each seed accession (wet weight, weight per 1000 seeds, etc.), germination and viability tests; 4) drying (dehumidifier with chemical absorption, T 15 °C and R.H. 15%); 5) packaging into airtight HDPET/nylon envelopes with self-indicating silica gel inside after slightly reducing the air content; 6) long-term storage (12 m³ cold room, T -20 °C) after a test period (refrigerated cabinet, T between 0 and -5 °C). All the available data on the entire process are registered in a special database. To date, about 100 entities have been stored in the BG-MOBB. Some of them are species of conservation interest, as the ones included in the National and Regional Red Lists (Conti et al. 1997) (f.e. Acinos suaveolens (Sm.) Loudon, Triticum biunciale (Vis.) K. Richter) or important species for phytogeographical reasons (f.e. Aurinia saxatilis (L.) Desv. subsp. megalocarpa (Hausskn) T.R. Dudley, Phlomis fruticosa L., Scrophularia lucida L., Asyneuma limonifolium (L.) Janchen) or endemic and sub-endemic species (f.e. Cytisus spinescens C. Presl, Thymus spinulosus Ten., Helianthemum jonium Lacaita, Iris pseudopumila Tineo, Crocus thomasi Ten.).

Keywords: ex situ conservation, seed bank, Apulian flora.

References:
Conservation of *Cistus clusii* Dunal from ‘Bosco Isola’ (Lesina-Apulia): current status and new experimental evidence

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*Cistus clusii* Dunal, a xerophilous species with a West Mediterranean distribution, is very rare in Italy, where it may be found only in Sicily (Giardina 1988) and Apulia. In this last region, i.e. on the oriental limit of its distribution, this species is known only from Lesina, in the Gargano National Park, on the ‘Bosco Isola’ dune cordon (Forte et al. 2002a). Several years ago specific actions were carried out at this site for the conservation of *C. clusii*, as it is a critically endangered species in Apulia (Conti et al. 1997). In particular, in situ reinforcement of the Lesina spontaneous population was conducted in 2001 in an ecologically suitable area between Acquarotta and Pennacchio by planting individuals obtained through cross-breeding within the spontaneous population (Forte et al. 2002b). A large fire occurred in Lesina in the summer of 2007, reducing the reintroduced population to 10 individuals. In 2008 the last two surviving individuals of the spontaneous population withered. According to previous studies the spontaneous ‘Bosco Isola’ population belonged to a particular biotype which was likely to derive from genetic drift phenomena and geographic isolation. This biotype was characterized by a greater susceptibility to water stress than other populations of the species (Forte & Pastore 2005) and by the exclusive production of soft seeds (Cavallaro et al. 2005). This last characteristic did not allow building up a large and persistent soil seed bank contrary to what is known about all other species of the *Cistaceae* family (Thanos et al. 1992). These studies identified such peculiarities as the cause of low competitiveness of this spontaneous population.

This contribution presents the results of germination tests on the seeds collected from the fire-surviving individuals among the reintroduced ones. Tests were conducted at constant temperatures (15, 20 °C) and after different dry-heat pretreatments in various time/temperature combinations (1, 5, 7.5, 10, 15 min/80, 100, 120, 140 °C). For each test 4 replications of 25 seeds were performed, placing the seeds in Petri dishes on cotton-wool and filter paper in darkness. Our results show that the seeds have physical dormancy broken by dry heat. Therefore, this experimental evidence may suggest a greater competitiveness of the reintroduced population.

Keywords: in situ conservation, *Cistus clusii*, seed ecology, Bosco Isola Lesina, Apulia.

References:
Role of Mediterranean temporary ponds in the conservation of threatened plant species in Minorca (Balearic Islands, Spain)

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Mediterranean temporary ponds are well known for their biodiversity richness. Among the different groups of living organisms, vascular plants are the most representative one and clearly define this habitat. Recent works have shown that the island of Minorca (Balearic Islands) has a high representation of temporary ponds, both in quantity and also in types. This situation means that temporary ponds are even more important sites for conservation of the island’s vascular flora. Within the LIFE BASSES project (LIFE05/NAT/ES/000058) particular studies on the inventory of the vascular flora have shown that up to 27% of the taxa are related to this habitat in a broad sense (Fraga 2008). This includes plant species in different levels of conservation status, and among them some of the most endangered species at a local or regional framework. Some of these threatened taxa grow exclusively in temporary ponds, thus conservation of this habitat is mandatory for the preservation of these populations.

Polygonum romanum subsp. balearicum Raffaelli & L. Villar, is considered to be a Gymnesian endemism. In Minorca it is a plant clearly related to temporary ponds on sandy or clayish calcareous soils. The development of the LIFE BASSES project has revealed that this plant has a wider distribution than presumed before. Isoetes velata A. Braun s.l., in the Balearic Island grows only in temporary ponds on siliceous soils of Minorca. So far only five populations are known today. Although they grow in the same habitat, there are significant differences concerning aspects like population size, plant density or the surrounding vegetation.

Pilularia minuta Durieu ex A. Braun in the Balearic Islands as a whole is only known from three temporary ponds of Minorca. But these ponds differ in geology, in geomorphology and also in the plant communities that they hold. Galium debile Desv. grows in two temporary ponds, both on sandstone rocks. Despite being the same type of pond, they are quite different in size and in geomorphological configuration. These seem to be the main reasons to explain the great differences in size and density of individuals between the two populations. Corrigiola litoralis L., for more than 100 years was known only from one record (Rodríguez 1904) and this couldn’t be confirmed in the last 80 year. Within the LIFE BASSES project several new populations have been found, all of them in the same type of temporary ponds. Verbena supina L. grows only in temporary ponds on sandy calcareous soils in the western part of the island. It is a typical species of the dry stage of this type of ponds.

Keywords: temporary ponds, vascular flora, endemism, endangered plants, conservation, management.

References:
Genetic variability in the endemic species from the north of Portugal, *Antirrhinum ophioliticum* (Scrophulariaceae): implications for the conservation

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The serpentine areas of Trás-os-Montes, in the north of Portugal, are rich in endemism restricted to this kind of substracts (e.g., *Alyssum serpyllifolium* subsp. *lusitanicum*, *Anthyllis vulneraria* subsp. *sampaioana*). The low range of these areas and the high distance between the different outcrops generate a very fragmented environment and several serpentine species have scattered distributions and rare populations. For that reason, these areas are vulnerable and the species living there need a special attention with regard to conservation.

Morphological data (García-Barriuso et al. unpub.) suggest that the serpentine populations from the north of Portugal described as *Antirrhinum braun-blanquetii* Rothm. (Pinto da Silva 1970, Franco 1984) probably belong to a new taxa (*A. ophioliticum* nom. nudum), endemic and restricted to the north of the Iberian Peninsula.

Between 15 and 18 individuals from all the known populations of *A. ophioliticum*, present in Portugal and from two Spanish populations of *A. braun-blanquetii* were analyzed to study the genetic variability and population structure of this new taxon and genetic differentiation between both species. Eleven primers specially designed for ISSR (Inter-Simple Sequence Repeats) analyses were tested.

We discuss the implication of the genetic data for the conservation strategies of the serpentine areas and this endangered taxon.

Keywords: *Antirrhinum*, Serpentine, genetic variability, ISSR.

References:
Conservation degree of habitat and threatened species of Canary Islands

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Canary Islands, together with Salvage Island and Madeira Archipelago constitute the Canario-Madeirense Subregion of the Biogeographical Mediterranean Region. This subregion forms an important generator nucleus of endemisms within the Mediterranean Basin Hotspot or even with a proper identity, as a hotspot among the 10 considered by Médail & Quézel (1997) in that basin. A good proportion of the Canary endemisms are restricted to a single island, including several monotypic genera. Some of them present a limited distribution sometimes restricted to a few local populations with scarce individuals.

In the present communication we try to assign the different taxa included in the current Top 100 lists for the Canaries (Marrero et al. 2007) and Red data book of threatened vascular flora of Spain (Bañares et al. 2004) to the communities where they are growing, by using different GIS techniques, and elaborating several graphs. To compare with vegetation we use the digital Map of the Vegetation of the Canary Islands (Del Arco et al. 2006) and a later quantitative approach. In the graphs we try to correlate the threatened species with the regression of the area of the communities with which they are linked trying to establish some possible relations.

Keywords: hotspots, plant communities, Canary Islands, threatened species.

References:
Ex situ conservation measures of a threatened *Limonium avei* (De Not.) Brullo & Erben population

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*Limonium avei* (De Not.) Brullo & Erben (*Plumbaginaceae*), basionym *Statice avei* (De Notaris 1846), is a triploid (2n=27), annual species with apomictic reproduction (Brullo 1988). It is endemic to the central Mediterranean coast and in Liguria (NW Italy) it is present in only one population, with almost 1500 individuals. The natural site is located on a rocky cliff, consisting of clayey marls, thin sands and siltstones, that falls sheer to the sea, in Punta Rocca, Ventimiglia (Imperia). *L. avei* is included in the Red List of Endangered Species by the IUCN (Conti et al. 1997). The increasing urbanization of its natural habitat has prompted the adoption of measures for its conservation. As part of this effort *ex situ* seed conservation and tissue culture techniques were developed for the species. Collected seeds were put aside in the Seed Bank of Hanbury Botanic Garden. Fast *in vitro* propagation was achieved from sterilized immature inflorescence-node explants, which were grown in a growth chamber, on MS medium (Murashige & Skoog 1962) consisting of MS salts and vitamins, sucrose (30 g/l), pH 5.7, agar 0.8%, kinetin (KIN 2 mg/l); moreover, plant regeneration from *in vitro* leaves was obtained on MS medium supplemented with indole-3-acetic acid (IAA 2 mg/l) and N\(^6\)-benzyladenine (BAP 1 mg/l). *L. avei* plantlets were rooted on MS medium without growth regulators and then they were successfully acclimatized in the greenhouse. The cultivated *ex vitro* plants flowered and produced fertile seeds. The use of neutral DNA-based molecular markers allows the study of the genetic material of plant species, avoiding environmental influence on gene expression. Genetic relationships in *Limonium* wild species and cultivated varieties have been previously investigated using random amplified polymorphic DNA markers (RAPDs) by Bruna et al. (2005). In this work, a first approach for the assessment of genetic variation in *L. avei* population through RAPD markers was made. Random decamers were screened using total genomic DNA extracted from immature inflorescences of few samples, collected in Punta Rocca, at a minimum distance of 100 m. between individuals. The primers that produced the most robust and clear amplification profiles were utilized for subsequent experiments. The understanding of the genetic pool of natural populations is an essential requirement in order to establish efficient conservation measures for endangered species.

**Keywords:** biodiversity, endangered species, genetic variation, micropropagation, molecular markers, seed bank.

**References:**


Plant communities and species diversity in Molise coastal dunes: a multitemporal approach

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Coastal dune systems are characterized by strong environmental gradients which determine the coexistence of different plant communities in a relatively small area. One of the most outstanding features of coastal dunes is a high ecological diversity in terms of environmental heterogeneity and variability of species composition. However, all over the world and, particularly in the Mediterranean region, coastal ecosystems are considered to be highly endangered. Land-use change, coastal erosion and the increase of alien species are considered major threats to sandy coasts. Either if the importance of monitoring plant species and plant communities patterns of coastal ecosystems is evident, few studies have performed a multitemporal analysis of its flora and vegetation. One of the major threat to Molise’s sandy ecosystems, as in many other Adriatic areas, is represented by coastal erosion.

In this work, we propose an integrated monitoring approach able to relate vascular flora and plant communities temporal trends with coastal dynamics (changes of the shoreline). We assume that the typical dune vegetation zonation is closely related to the geomorphological and sedimentological features of dune systems. Due to this interdependence between community types and the environment, the analyses of vegetation zonation growing in dune ecosystems can only be properly understood if it is treated as a whole. We analyzed data derived from permanent plots (belt transects) distributed along the sandy coasts where vascular flora, vegetation and geomorphological features are periodically measured. Integrating these data, we propose to elaborate ecological models aiming to predict the consequences of shoreline changes on spatial distribution of native/threatened species and Habitats of Community Interest (Directive 92/43/CEE).

The application and expansion of the proposed monitoring approach could be particularly useful to promote an efficient coastal preservation and planning.

Keywords: sandy coastal ecosystems, plant communities, coastal erosion, changes of shoreline

References:
Threatened and rare species in Mediterranean (Lazio region, Italy) and Atlantic (Aquitaine region, France) coastal dunes

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Coastal dune habitats are unique and ecologically remarkable ecosystems with a high diversity and an extremely specialized flora. On the other hand, sandy coasts are fragile ecosystems, and several threats and human related disturbances affect them. In fact, in most parts of the world, and in particular in Mediterranean areas, land-use change, coastal erosion and the increase of alien species are considered major threats to sandy coasts biodiversity. These vulnerable environments, therefore, host many seriously threatened plant species. Moreover, the fragility of coastal dunes and their plant communities has been recognized by the European Community including, among Community Habitats (Directive 92/43/EEC), almost all coastal habitats. In this study we analyses the threatened flora of two different European dune systems: one in the Atlantic (Aquitaine region, France) and the other in the Mediterranean (Lazio region, Italy). We compare the floristic composition of both coastal ecosystems, focusing on major differences and similarities regarding rare and threatened species. In particular, we consider the following issues: 1) Conservation status; 2) Biological and chorological characteristics; 3) Position along the Mediterranean and Atlantic coastal zonation (sea-inland gradient) and inclusion in habitat of Directive (92/43/CEE).

Comparing Mediterranean and Atlantic coastal dune communities a higher species richness is found in the Mediterranean. The Aquitaine littoral, instead, is rich of endemic species (often developing in endemic plant associations) probably because of its geological history and particular environmental characteristics. Moreover, endemic species are protected at national or regional level and also four of them are included in French Red List. For the Mediterranean study area instead endemic species were not observed nor included in Red Lists either at both national and regional level; only five species are reported by the Lazio Regional law (LR. N.61, 19/9/1974) as species to preserve. Five threatened species are in common between Mediterranean and Atlantic coastal systems, but only Otanthus maritimus and Pancratium maritimum are protected in both areas. The Mediterranean study area is strongly affected by human impact and subjected to a higher level of urbanisation respect to the French one. For this reason, in this case we propose that species typical of coastal dunes should be also included in the Red Lists even though they are relatively widespread. In order to conservation aims, floristic studies represent a useful tool for more objective compiling of Red Lists and for the individuation of new dune species that deserve protection. On the European level the Habitat Directive 92/43/CEE represents a good example of how it is possible to realize lists of threatened species on the basis of the biotope, taking into account complex interactions among species growing in the same environment.

Keywords: sandy coastal ecosystems, coastal vegetation, endangered species, Red Lists.
Genetic structure of *Limonium album* (Coincy) Sennen, a narrow endemic plant of south-eastern Spain

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*Limonium album* (Coincy) Sennen is an endemic endangered species inhabiting in bushes on marls and schistous soils in the biogeographic Murcian-Almeriensian Province. It is restricted to two mountains of the Autonomous Community of Murcia (Spain). Recently, it has been listed as a threatened species in the Catalogue of protected wild flora of Murcia, therefore it should have a Conservation program adopted to assure its survival.

In this work, intersimple sequence repeats (ISSRs) analysis was conducted on fifteen natural populations of *L. album*, which cover quite its area of distribution. The aim of this study is to evaluate the levels of genetic variation present within and among the populations and how they are partitioned to improve the conservation guidelines. Our results suggest that, in spite of the disappearance of some populations after the construction of a highway, *L. album* is not genetically impoverished. In addition, the strategies for conservation of the species are discussed.

Keywords: conservation of biodiversity, genetic structure, ISSR markers, *Limonium*.

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A new Red Data Book for the flora of Greece

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The creation of a new Red Data Book for the flora of Greece, which is being under preparation initially in Greek, is expected to offer a wealth of new information on the endemic, rare and threatened taxa of the Greek flora. It will significantly revise and amend the existing book, entitled “The Red Data Book of the Rare and Threatened Plants of Greece” by Phitos et al., published in English in 1995.

Until today, ca. 200 taxa (species and subspecies) have been prepared for the new book mostly by Greek, as well as by foreign botanists. The total number of taxa that will be included in the new book is estimated between 250 and 300. Even though this number is not exhaustive with regard to the total amount of rare and threatened taxa of the Greek flora, it is nevertheless deemed satisfactory and concordant with the time availability for the completion of the project.

For each taxon, detailed information is being provided, with regard to the morphology, distribution, as well as the habitat, population status, threats and conservation measures. Moreover, information is being given on taxonomy, typification and chromosome number for each taxon, whereas the taxa assignment to threat categories closely follows the IUCN criteria (2001, 2003, 2006).

Colour photographs of taxa and habitats, as well as a distribution map, complement the provided data for each treated species or subspecies.

The book will be freely distributed to University libraries, the Ministry of Environment and the Ministry of Agricultural Development and Food, as well as to Management Agencies of Protected Areas, regular members of the Hellenic Botanical Society and other parties, the goals of which support Environmental Protection.

Keywords: conservation, endemics, monitoring, threatened plants.

References:
Responses to different water stress regimes of *Laurus nobilis* trees

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The noble laurel (*Laurus nobilis* L.) is a very widespread species on the Mediterranean circumference. It has a great interest for its multiple uses (medicinal, decorative and aromatic). In Tunisia, this species was at the edges of the wadis and the sources of water, in mountain and on wet rocks. For this, it is subjected to strong pressures which made it threatened of disappearance in its natural surface. Overexploitation of the foliar biomass is the essential cause of regression of this species whose regeneration is failing.

The noble laurel is classified among the species which knows little about the autoecology and in particular its tolerances opposite environmental conditions, particularly drought. Knowledge of its tolerance and analysis of adaptive mechanisms involved should, as a practical help in the choice of planting sites and to provide rational criteria for selection. This plant species is frequently encountered under semiarid conditions and thus has to cope with long periods of water shortage, although it is also well adapted to coastal humid environments and requires high amounts of water during the first year of plant establishment (Rhizopoulou & Mitrakos 1990).

Plants from two populations of *L. nobilis* (Tunisia - semi-arid inland site - and Algeria - coastal sub-humid area) were exposed to two stress intensities of permanent stress (60% (S1) and 20% (S2) of field capacity). Algeria exhibited a higher decrease in osmotic potential in relation to stress-induced proline accumulation. Both populations had similar net photosynthesis but Algeria exhibited higher water use efficiency than Tunisia. A drought-induced increase in the apoplastic water content was noticed in response to mild stress intensities (S1) in Tunisia and in response to higher stress intensities (S2) in Algeria.

However, bulk modulus of elasticity increased only in Tunisia. Water stress tolerance could be achieved by both osmotic and elastic adjustment in the coastal population. Differences between populations are strongly influenced by the kinetics of water stress application.

**Keywords:** apoplastic water content, bulk modulus of elasticity, drought, glycinebetaine, laurel, osmoregulation, proline.

**References:**

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*Dryopteris tyrrhena* is a West Mediterranean endemism with a few populations in Spain (Sierra Nevada, Mallorca), France (Vallée de la Roja, Cévennes, Corsica), and Italy (Liguria, Tuscan Archipelago and Sardinia). Its fragmented distribution and the distances between the populations, often in caves or deep crevices in silicate rocks, suggests that it is a tertiary relict species of the ancient flora of the Mediterranean mountains (Fraser-Jenkins et al. 1975). This study was undertaken to learn more about the biological factors determining the distribution of this threatened species. The spores were collected from 2 Italian population from Liguria (Riomaggiore, SP) and Tuscany (Capraia Island, LI). In vitro reproduction started in the summer of 2008: the spores were sown in sterile Petri dishes with MS medium, 0.7% of agar and a Nystatin fungicide solution (100 U/ml⁻¹). The cultures were incubated at T=20±1°C with a 12-h photoperiod (Menendez et al. 2006, Magrini & Scoppola 2008).

The results show a significant difference in the time and percentage of germination between the 2 populations. Spores collected from the Riomaggiore population (DTR) showed a very low germination rate (5%) after 36 days from sowing, while all spores taken from the Capraia population (DTC) have germinated within 7 d. All gametophytes (DTR and DTC) were filamentous at inception, but significant differences in the transition to laminar-cordate phase were observed. In DTR it followed a normal trend of development, with the first oblique division of the terminal cell of the germ filament starting after the fourth longitudinal division; laminar gametophytes (about 100%) were observed after 15 d from germination and they all produced apogamous sporophytes after 74 d f.g., in absence of gametangia. Instead, in DTC we observed a filamentous growth for about 3 months, and the prothallia reached the laminar phase after 88 d f.g., with the development of gametangia (in about 30%) after 141 d f.g. and the first sporophyte after 162 d f.g.

The Capraia population is reduced to a single nucleus of a few plants in an area of about 1m², a mesophilic niche between the rocks in Vado del Capo, in the NE coast. If it follows the same trend showed in vitro, these results can help us to explain its extremely small size. Since the spores showed high germination capacity, the long time of the sensitive gametophytic phase and the need for water for fertilization during the summer, when the little stream is totally dry, could restrict the colonization capacity of this species in the island. Instead, Riomaggiore population results potentially better adapted to dry habitats, because the possibility to form embryos apogamously and the much faster speed of formation of sporophyte make it able to persist and reproduce even in absence of water. More observations and tests will be made to define if its apogamy is obligate or facultative.

**Keywords:** *D. tyrrhena*, in vitro reproduction, apogamy, Mediterranean endemism.

**References:**
Contribution of managed public areas to the regional biodiversity in Sardinia

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Our work proposes a first analysis of regional environment patrimony of which the “Ente Foreste della Sardegna” is in charge. We will focus on protected areas, on habitats interesting for their conservative characteristics, endemic and rare species interesting mainly for their phytogeographical distinctiveness. Our aim is to study the areas for which management is a strategic issue for the conservation of regional biodiversity and for which it will be needed to study specific management activities, within the existing management plans.

Concerning methodology we are working on a geodatabase built on the basis of both bibliographical and field research. It concerns the distribution of protected areas, species and habitat that are under a protect regime in the territories under the administration of Ente Foreste.

The research proposes a first balance of the contribution of these managed areas to the whole regional biodiversity, and suggests the need of reinforce and implement conservation activities in situ and ex situ in some strategic areas.

Keywords: Ente Foreste, public areas, biodiversity, management, in situ conservation, ex situ conservation.
Biology, ecology and conservation status of *Lavatera triloba* subsp. *pallescens* L. in Sardinia

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*Lavatera triloba* s.l. is a nanophanerophyte of *Malvaceae* family with W-Mediterranean distribution. Traditionally, the taxon is recorded with the nominal subspecies in Spain Peninsula and Sardinia, and with the subsp. *pallescens* in Minorca island (var. *minoricensis*) and Sardinia (limited to S. Pietro island). Two other very close entities *L. flava* Desf. (N-Africa) and *L. agrigentina* Tineo (W-Sicily) are only recently elevated to specific level. In Sardinia, the taxon was discovered by Moris (1832) and its presence confirmed till the firsts decades of the XXth century, even with few bibliographic records and herbarium material. Recently, Bacchetta (2006) recorded the presence of *L. triloba* subsp. *pallescens* var. *minoricensis* in the island. During the period 2007-09, field researches are carried out to clarify the biology, ecology and conservation status of *L. triloba* s.l. in Sardinia. In particular the reproductive biology, the autoecology and synecology have been examined. The germplasm of all populations has been collected and stored in the Sardinian Germplasm Bank (BG-SAR). The research carried out confirmed the presence of *L. triloba* subsp. *pallescens* in the southern sector of Sardinia with 11 stations spread in 7 municipality territories. Sardinian populations include less than 400 mature individuals, with only 1 composed by more than 100. The species is related to marginal subhalophilous habitats of coastal or inland wetlands with brackish water, and in particular to humid and weakly brackish alluvial soils, in variable pH conditions, always in termomediterranean bioclimatic belt. The taxon participates to the communities with prevalence of therophytic taxa of the *Echio-Galactition* alliance, often contacting with *Juncetea maritimi*, *Arthrocnemetea* and *Nerio-Tamaricetea* classes. More than 50% of populations are located in protected areas. Nevertheless, these sites are not controlled or correctly managed. According to the IUCN hierarchic classification, human activities (wetlands fills, farmland and urban areas expansion, industrial and commercial activities, fires) are the most important threats, and probably the principal causes of demographic reduction and fragmentation. In Italy, *L. minoricensis* is considered Critically Endangered (CR) (Conti et al. 1997). With the present study we confirmed that in Sardinia this entity is not present, while *L. triloba* subsp. *pallescens* must considered (CR), according to the IUCN criteria B, E.

**Keywords:** chorology, conservation, IUCN, *Lavatera triloba* group, *Malvaceae*.

**References:**

Evaluation of the threat status of dolomitophilous plant species endemic to the Baetic Ranges (Southern Spain)

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The Baetic Ranges (south Spain) are one of the main Mediterranean hot-spots. Its biodiversity is due to some factors such as the geographical situation (near the Atlantic Ocean and Africa), the consequences of the glaciations periods and the human activities from the Neolithic period. This richness is increased by the occurrence of several special substrates like serpentines, gypsum or dolomites where numerous plant edaphisms live. The dolomite soils are an extremely particular fragmented habitat that contains a peculiar flora with high endemicity rates. Due to their physical-chemical features, these areas are especially stressful for the plants.

This work evaluates, for the first time, the threat categories of the Baetic dolomiticolous flora according to the IUCN criteria and applying several variables such as the presence of protected areas, legal status of the taxa, land use, mining activities, etc. To evaluate the extinction risk of every taxon, we used the software RAMAS Redlist 3.0 Pro following the guidelines for using the IUCN categories and criteria, version 7.0. According to the checklist made by Mota et al. in 2008 on the Baetic dolomiticolous flora, we evaluated 31 strict dolomitophytes i.e. those taxa whose index is higher than 2.75. Moreover, the results obtained are compared with those of the new Spanish Red List of 2008.

As a result, the 31 taxa are ascribed in this way: 1 taxon is considered CR, 5 EN, 17 VU, 3 NT and 5 LC. If the taxa that were not evaluated in the Spanish Red List are assimilated to the IUCN categories that do not involve direct threat (LC and NT), we obtain 18 taxa whose categories have not changed. For the rest of the taxa (13), our evaluation is different: 5 taxa obtain a higher threat category and other 3 have been included, for the first time, in a threat category (CR, EN or VU) or LC. So, Chaenorhinum rubrifolium subsp. raveyi, Helianthemum viscidulum subsp. viscidulum and Linaria salzmannii were not included in the Spanish red list but have been evaluated as VU in our study. This work implies a significant advance in the knowledge of the threat status of this peculiar flora of the Baetic Ranges.

This investigation has been sponsored by the Spanish Ministry of Science and Innovation through the project “Caracterización edáfica y nutricional de la vegetación y flora de dolomías en las Cordilleras Béticas y su relación con otros ambientes ricos en magnesio (hábitats prioritarios de la UE)” CGL2007-63563/BOS.

Keywords: dolomite, extinction risk, threatened species, edaphism, Mediterranean hot-spot.
The role of presowing treatments on seed germination of three *Helianthemum* species (*Cistaceae*)

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Seed coat hardness and impermeability to water are the most important cause of the dormancy present in several species of *Cistaceae* (Thanos et al. 1992, Pérez-García & Gonzáles-Benito 2005, 2006). The aim of this study was to investigate and to compare the germination behaviour of three *Helianthemum* chamaephytic species: *H. aegyptiacum* (L.) Mill. and *H. croceum* (Desf.) Pers. are Mediterranean species that occur in Sardinia in the calcareous areas of the central-eastern part; *H. caput-felis* Boiss has a smaller distribution area, corresponding to the SW-Mediterranean Region and occurs in Sardinia only in the Sinis Peninsula (central-western part).

Germination tests were conducted at the Sardinian Germplasm Bank (BG-SAR). In the first phase, tests were conducted under two different incubation temperatures (15 and 20° C), without any pretreatment and after manual scarification (chipping), in order to find the best germination conditions. In the second phase various pretreatments were applied after choosing the best temperature for each species. Presowing treatments applied were boiling water (100° C for 10 seconds), hot water (95° C for 5 minutes) and dry heat (100° C for 5 minutes, 100° C for 15 minutes). Germination values recorded were final germination percentage and germination rate expressed as days to reach 50% of the final germination percentage (T₅₀). In all three species studied, the highest germination percentages were reached after manual scarification of seeds.

Keywords: *Cistaceae*, *Helianthemum*, Sardinia, seed dormancy, seed germination.

References:
Climate change effects on germination of Mediterranean mountain plants: the case of two Sardinian endemic taxa

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Global warming represents the most pervasive threat to the planet’s biodiversity, due to its influence even in areas far from human activities, and its effects are expected greatly to affect plant diversity in the Mediterranean basin (Malcolm et al. 2006). Effects of climate change are expected in several aspects: changes in phenology, lower seed production, delay or complete inhibition of germination (for example caused by chilling insufficient to satisfy pre-germination vernalization requirements), seedling emergence under not suitable climatic conditions, shortening of the period of optimal meteorological conditions for germination.

Moreover, if the habitats of a lot of species move poleward or upward from their locations, the risk of extinction will increase for vulnerable species, like endemisms restricted to mountainous areas.

There is great demand for realistic modelling approaches that can foresee the future distribution of species given different climate scenarios (Hawkins et al. 2008). This study aims to assess the effects of expected climate changes on seed germination of two endemic species from Supramonte of Oliena (Sardinia, Italy): Nepeta foliosa Moris and Cerastium supramontanum Arrigoni. Theoretical effects under different climatic scenarios have been devised. Germination tests have been performed under different laboratory conditions (varying temperature, photoperiod and pre-chilling period) at the Sardinian Germplasm Bank (BG-SAR).

Ecological and physiological observations are supported by the analysis of climatic data proceeding from the near thermopluiometric station of Montes (operative since 1986) and from a temperature sensor (TidbiT v2 Temp logger HOBO Onset) positioned in 2008 in the study area under the top layer of soil (2-3 cm), where germination occurs.

Further researches are in progress in order to assess the real entity of the threatening power of the climate change on Sardinian mountain habitats and ecosystems.

Keywords: climate change, Nepeta foliosa, Cerastium supramontanum, germination, vascular flora.

References:
Monitoring rare, endemic and threatened flora of Valencian Community (Spain)

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Since a few years the CIEF (Centre d’Investigació i Experimentació Forestal, Generalitat Valenciana) study and monitor the rare, endemic and threatened flora of the Valencian Community. Its vascular flora is compound by ca. 3150 species, 350 of them being Spanish endemic plant; 60 of these species are exclusive endemics of the Valencian region. Part of this conservation tasks consists of census and seed collection for a long list of target species. The data obtained are included in a Geographic Information System (GIS), which becomes both a helpful tool and a basic resource to develop plant conservation projects. In this poster we summarize by means of maps the state of knowledge.

Keywords: Valencian Community, vascular flora, spanish endemic species, geographic information system.
The role of post-pollination isolation limiting hybridization between two snapdragon species (*Antirrhinum*): the rare *A. valentinum* Font Quer and the common *A. controversum* Pau (*Scrophulariaceae*)

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Hybridization of a rare species with a more common congener may lead to the extinction of the rare species through genetic assimilation or reduction in fitness and population size due to gamete wastage in the formation of unfit hybrid individuals. However, the impact of hybridization on the rare species will depend on the degree of reproductive isolation from the more common congener.

Recent anthropogenic habitat disturbance has broken down ecological isolation between the rare endemic *Antirrhinum valentinum* and the common *A. controversum*. Individuals of these two species separated for less than one meter of distance have been observed in three of the seven known localities of *A. valentinum*. The two species have overlapping flowering periods and share pollinators (bumblebees and bees), and interfertility between them has been previously suggested through artificial hybridizations.

Post-pollination reproductive isolation (pollen tube growth, fruit set, germination rate and germination speed of hybrid seeds, hybrid pollen viability) between *A. valentinum* and *A. controversum* were investigated in order to evaluate their role limiting hybridization.

Keywords: *Antirrhinum*, conservation, habitat disturbance, hybridization, narrow endemic.

References:
The Life Providune project for the conservation and restoration of dune habitats among the sites of Cagliari, Matera, Taranto, Caserta provinces

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The Providune project, financed by LIFE+ ‘Nature and Biodiversity’ program for the years 2009-2012, has as the main purpose the study and conservation of the priority habitat 2250 (*Coastal Juniper dunes) of Council Directive 92/43/EEC, and of the other habitats characterizing mediterranean sandy coasts (*2270, 2230, 2240, 2210, 2120, 2210). These habitats, distinguished by high cenotic biodiversity and elevated number of endemic entities, are among all the most threatened due to the high anthropic impact, in particular the tourist pressure.

The project is coordinated by the OCEANS of the Dipartimento di Scienze della Terra and by the CCB of the Dipartimento di Scienze Botaniche of the Università degli studi di Cagliari, in collaboration with the Provinces of Cagliari (coordinating beneficiary), Caserta, Matera and Taranto. The selected Sites of Communitarian Importance (SIC) of the project are 5.

The project includes preliminary actions such as geobotanical studies about the status of the dune habitats and detailed habitat mapping, sedimentology and marine-coastal dynamics studies making also used of telecontrol system, analysis of the tourist pressure impacts on the habitats and preliminary plan of action. The concrete conservation actions concern the restoration and recovery of the degraded dunes habitats through protection systems for stabilized dunes, systems of sand capture and trapping, systems of vegetation of the degraded dunes fields, uprooting of alien species, in-situ and ex-situ conservation of plant species, realisation of pedestrian accesses, low impact delimitation and rest areas, and finally the creation of a floristic-vegetational and abiotic data base. Particular attention will be reserved to the spreading of the obtained results (realization of a website and informative material, organization of conferences) and to increase visitor and local population awareness of the value of these habitats through educational activities in the schools and realisation of informative panels.

Besides the actions of geobotanical characterization and mapping of the Sardinian sites, the CCB will take care of the collection and conservation of seeds which will be preserved in the Banca del Germoplasma della Sardegna (BG-SAR), and in-situ conservation of vegetal species throught two pilot plans which forsee the creation of a micro-reserve of the flora and the reinforcement of the structural species populations from collected, conserved and multiplied seeds.

Keywords: Sardinia, Habitats Directive, coastal juniper dune.
Weed risk assessment of *Acacia saligna* in Sardinian coastland habitats trough ex situ germination study and in situ monitoring

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Invasions by alien species are widely recognized as a significant component of global environmental changes caused by human action, often resulting in a relevant loss in the economic value, biological diversity and functions of invaded ecosystems (Mooney & Hobbs 2000). *Acacia saligna* (Labill.) Wendl. (*Fabaceae*) is a phanerophyte native to the southwestern corner of Australia, it was introduced in Sardinia for afforestation, mainly in coastal areas, and at present it is considered naturalized becoming invasive in sand dune habitats. A monitoring of this species has been carried out in order to verify its distribution in Sardinia and phytosociological behaviour. Since the invasiveness and expansion of the species has been detected and recognized as threatening the habitat “*Coastal dunes with Juniperus* spp” (number 2250 of the Habitat Directive), a study plot (75 m²) was placed in a retrodunal zone inside a SIC area. Phytosociological relevés highlighted the dominance of *A. saligna* over *Juniperus oxycedrus* subsp. *macrocarpa*, but not over the other characteristic species of this habitat.

More information regarding the potential invasiveness of *A. saligna*, with particular attention to dunes and coastland habitats are also investigated through the study of germination. Germination tests were conducted at the Sardinian Germplasm Bank (BG-SAR), testing different temperatures and percentages of NaCl in order to determine the optimal germination protocol and the effect of salt. Further research are in progress in order to assess the real entity of the threatening power of *A. saligna* on the most sensitive habitats and ecosystems of Sardinia.

**Keywords:** afforestation, *Acacia saligna*, germination, invasive plants, monitoring, salinity, sand dune areas.

**References:**
Characterization of *Juniperus oxycedrus* subsp. *macrocarpa* (Sm.) Ball in the Valencia region

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*Juniperus oxycedrus* subsp. *macrocarpa* occurs along the coastal strip of the Mediterranean and Irano-Turanian regions. In the Iberian Peninsula, this taxon has been classed as Vulnerable and is protected in all the administrative regions in which it is found except for the Balearic Islands (Bañares et al. 2004). Its situation in the Valencia region is particularly alarming, as the latest data show only 243 specimens, mature and young, in the wild (Mayoral & Gomez 2001, 2003), located at scattered spots along the coast. These populations suffer from strong anthropic pressure, essentially from building and leisure uses, and low population sizes (below the minimum for population viability). Another factor is competition from allochthonous species.

This paper gives a preview of studies that have been conducted to characterize the Valencian populations of *J. oxycedrus* subsp. *macrocarpa*. They are part of a plan to conserve the genetic resources of this taxon as a means to promote its future adaptability. During the first stage, the intention is to reach an assessment of the existing genetic resources by locating populations, describing them demographically and genetically, estimating their dynamics and identifying the risks to which they may be exposed. The results of the first stage will make it possible to design specific conservation programmes for each population, applying both in situ and ex situ measures. These studies are also fundamental in order to draw up guidelines for using the genetic resources of the taxon in accordance with biogeographical and evolutionary criteria, not only in reinforcement programmes but also when undertaking actions that entail creating new populations for protection or landscaping purposes.

**Keywords:** genetic resources, conservation, population dynamics.

**References:**


The seed orchards of Sa Corona Arrubia (Sardinia)

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Biodiversity represents a very important role both for the natural ecosystems and for the anthropogenic ones such as the sour-ecosystems. Therefore, the man should have every interest to maintain and preserve their functional efficiency, because after all, the life on the earth is possible thanks to the services furnished by the ecosystems themselves. The debate on the global safeguard of the biodiversity, but also on the necessity of a particular protection in the circumediterranean area, characterized by a high concentration of endemic species (4.3% all of the world) and at the same time subject to erosion and to strong alteration of the environment, are very actual problems. On this consideration, since 1999, the Consortium “Sa Corona Arrubia” identified, in collaboration with other organisations (National Research Council, University of the Studies of Florence, Sardinia Forest Agency), politics and actions concretely finalized to the safeguard of the difference of some of the Sardinian forest species more threatened by erosion or extinction. In this context, conservative orchards have been realized through which it has been possible to undertake an action for the ex situ and in situ conservation (Gregorius 1989, Ziehe et al. 1989) both of the germplasm of some relict populations of Taxus baccata L. and Quercus pubescens Willd. of the Gennargentu Mountains, and of those of Quercus coccifera L. of South-western Sardinia. These populations are characterized by a high value for their ancestrality, for the history of the vegetation dynamism and for the documentation that they can furnish in composite analysis among use of the territory and anthropic activity. Thanks to the realization of seed orchards, it has been possible to undertake, at first, studies on the germinability of the seeds (reproductive ability), and successively to deepen the knowledge on the adaptive ability of these populations. In addition, studies on the inter and intra-population genetic variability are in progress and conducted by molecular biology methods using nuclear microsatellites (nSSR) markers. The genotype characterization of the relict populations as well as the use of bioinformatic approaches represent the starting point for a correct conservation strategy, that will allow to discriminate between the effects due to the evolutionary factors and the anthropic activities in Sardinia.

Keywords: biodiversity, ex situ and in situ conservation, genetic variability, relict populations.

References:
Seed germination of endemic species from Sicily

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Sicily is one of the biodiversity hotspots in the Mediterranean region. Sicilian flora counts about 3500 taxa at specific and infraspecific level. The amount of endemic flora is around 10% and a big part of this contingent are taxa only growing in Sicily and its islets (Brullo et al. 1995, Giardina et al. 2007, Raimondo et al. 1994). Sicilian biodiversity depends on the central place in the Mediterranean area, the paleogeographic history and the marked diversity of landscapes and habitats. An high number of endemic species in Sicily grows in special ecological niches, as crevices, rocky and gravel places, gypsum, badlands, saltmarshes and freshwater habitats. Most of these natural environments are threatened and highly degraded being subjected to anthropic pressure and unchecked exploitation. It is worldwide assessed that to know the reproductive requirements of those species at risk is an essential part of any management strategy for conservation. Germination, particularly, is a crucial step in the plant life, strongly affecting the status of natural populations.

As a part of the conservation actions of the endemic Sicilian flora, the Seed Bank at the Botanical Garden of Catania University is working to study the seed germination behaviour and requirements of endemic plants (Guglielmo & Salmeri 2008, Salmeri et al. 2005, Salmeri et al. 2008), above all those ones adapted to very specialized habitats. The aim is to define efficient protocols for seed germination and production of viable seedlings and adult plants to use in reintroduction and restoration projects.

Seed samples from Centaurea tauromenitana, Retama raetam subsp. gussonei, Senecio candidus, Ptilostemon niveus, Silene hicesiae and the taxa of Dianthus rupicola group were tested under different controlled conditions of substrate, light and temperature. Pre-treatments, such as disinfection, manual or chemical scarification, and/or water imbibition, were applied with relation to seed types and coats hardness. The results of germination tests gave the best protocols combining both germination percentage and time and the production of normal viable seedlings. The proportion of viable seeds produced from wild populations and the seed response to low temperature storage in the seed bank were also checked. The seedlings obtained from germinations in laboratory were transplanted to their typical micro-habitats at the Sicilian Botanical Garden, improving local ex situ conservation for these endemic plants. These studies were done with the support of different national and international projects (GENMEDOC, SEMCLIMED, PRIN 2007).

Keywords: Conservation, seed germination, endemic species, Sicilian flora.

References:
Ex situ conservation of Sicilian endemic species in the Botanical Garden of Catania University

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Ex situ conservation of wild plants, endemic, rare or threatened, is today one of the main goals in the Botanical Gardens activities. The objective is the maintenance of genetic resources from natural populations more or less endangered in their typical habitats. On the other side, public awareness and knowledge of regional plant biodiversity can be better achieved in the Botanical Gardens planting living specimens in suitable areas where natural habitats are built up.

Since 1858, the Sicilian Garden (Hortus Siculus) is specially devoted to the cultivation of the wild flora of the island. Actually, this section of the Botanical Garden of Catania University let people see the most representative environments of Sicilian landscape arranged on a surface of 3,000 sq m with active financial support of Sicilian Region (P.O.R. Sicilia 2000-2006 - Measure 1). There, plants belonging to more than 300 taxa from natural populations of protected areas or very endangered habitats are housed as they would be found in nature, from sandy dunes to ponds and marshes, from maquis and garigue to termophilous woods. Along with commonly found plants, also rare species only growing in Sicily can be found.

The most relevant aspects are the volcanic and calcareous rocks where small perennials, chamaephytes and geophytes are arranged following the altitudinal belts of vegetation, from the sea coast to highest mountains. Living collections of all endemic species of Limonium, Brassica, Centaurea, Helichrysum, Genista and many others are maintained here and well acclimated. Samples of the endemic flora from Mt. Etna, Madonie and Hyblean mountains, and from the Sicilian archipelagos testify the great plant biodiversity in Sicily.

Rumex aetnensis, Senecio aetnensis, Armeria nebrodensis, Jurinea bocconei, Cenchrus ciliaris, Bothriochloa panormitana, Asperula rupestris, Cytisus aecolicus, Silene hicesiae are only some examples of the plant richness in this garden. Other interesting areas reproduce gypsum soils and badlands where only a very specialized flora can take place.

Explanatory boards, specific leaflets and an interactive electronic system of explanation by hand palms (TGuide) support and facilitate the visit and public interests. The cultivated plants come out of seeds collected in field, stored and propagated in the Seed Bank of the Botanical Garden of Catania University with the support of national and international projects (GENMEDOC, SEMCLIMED, PRIN 2007).

Keywords: ex situ conservation, botanical gardens, plant biodiversity, wild flora, endemic plants.
*Helianthemum motae* Sánchez-Gómez & al. (*Cistaceae*) a new threatened species from southeastern Spain

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*Helianthemum motae* Sánchez-Gómez et al. a new species recently discovered, is presented and illustrated. It is an endemism of the Southeartern of the Iberian Peninsula restricted to only one population, that occupies less than one hectare. It grows in thermophilous garigues on subsaline soils near to the sea.

Macromorphological studies suggest that *H. motae* is related to other species with Mediterranean or North-African distribution, such as *H. syriacum*, *H. kahiricum* and *H. sicanorum*. However, a preliminary ITS survey point out that *H. motae* is taxonomically different from these species.

Finally, based in the criteria adopted by IUCN, taking into account the area of occupancy of *H. motae*, the number of individuals of the only known population and the analysis of threats, it is proposed its inclusion in the category “Endangered (EN)”.

**Keywords:** *Cistaceae*, *Helianthemum*, Iberian flora, new species.
Criteria of prioritization of protected plant species in the natural park “Calares del Mundo y de la Sima” (southeastern Spain)

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The Natural Park “Calares del Mundo y de la Sima” was created in 2005. It is located in the Autonomous Community of Castilla-La Mancha (Spain). This park spreads over an area of 19,000 hectares. Therefore, it is very interesting karst formations and many different well-conserved habitats, resulting in an excellent area to conservation of endemic and/or rare plants.

As recommended in the text of the regulations for the protection in the Natural Park (PORN, PRUG), we listed the endangered, threatened and rare flora present in this Park. We have tried to evaluate which plant species are in more risk of extinction or need an urgent conservation program. To understand that taxa should be prioritized for conservation, we ranked the species on the basis of assessed values for four criteria: 1) Protection status in Castilla-La Mancha, 2) Abundance of populations in the Natural Park, 3) Importance of populations in the Natural Park with regard to the populations present in Castilla-La Mancha, and 4) Importance of populations in the Natural Park with regard to the total distribution of the species.

In general, rare and endemic species with low number of populations were ranked in the highest priority group, while highly distributed species were ranked in the lower priority group.

Keywords: biodiversity, conservation of rare plants, endemism, prioritization scheme.
Plant communities and soil parameters on sandy shores of Lazio

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Abiotic factors and plant communities on sandy coastal systems are particularly interrelated. Factors related to the substrate vary along the sea-inland ecotone giving rise to an environmental gradient and their intensity strongly affects coastal communities, giving in turn rise to a marked vegetation zonation. On the other hand plants on sandy shores are able to stabilize the mobile substrate and influence transitions from the coast to the hinterland. Since plant communities on sandy coastal systems are particularly endangered in the entire Mediterranean basin, understanding how factors related to the substrate influence the vegetation becomes crucial. The relationship between communities and abiotic factors has been mainly studied in oceanic environments and only few researchers have concentrated on the Mediterranean. For this reason, the aim of this study is to explore how soil parameters and sand burial are correlated with plant communities along the sea-inland gradient in sandy shores on the Tyrrhenian coast. We used a database of 409 georeferenced 2x2m vegetation plots available for the Lazio coast (Central Italy). In each random plot, all plants were registered using cover as abundance measure. The final plot by species matrix was analyzed through multivariate techniques to identify the main communities. We then selected a proportional random number of plots in each community (for a total of 63 plots), in which we measured soil parameters and sand burial. Soil samples were collected in the center of each plot, drawing about 1000g of soil from the profile between 5 and 15 cm. The following parameters were measured: granulometry, content in organic matter, pH, and salinity. Granulometry was measured using standard sieves and a laser-granulometer for the fraction below 1.7 mm. Salinity and pH were instrumentally measured after dilution of soil samples. Content of organic matter was measured as chemical oxidation. Sand burial (deposition or erosion) was measured as covering level of 2m bamboo fixed poles after one month of exposure (at time 0 = 1 m above sand surface and 1 m below sand surface). Main results showed a gradient along the zonation. Granulometry showed a gradient along the zonation, but it also exhibited differences between sites. Content of organic matter showed a gradient from beaches to fixed dunes. Values of pH became less alkaline moving along the gradient. This result was in agreement with the pattern of organic matter, as an increase in organic matter causes acidification. Salinity showed a less pronounced gradient. Sand burial was variable in the foredune communities, while it was negligible in the backdune communities.

Measured values were related to vegetation zonation, through multivariate and conventional analytic techniques, trying to highlight parameters related to distribution and structure of communities along zonation. Results could improve our knowledge about ecological processes in coastal systems. Evidencing the relationship between soil parameters and coastal vegetation could be a significant step to promote an efficient coastal planning and it could be also important for restoration ecology.

Keywords: vegetation, dunal habitats, C-Italy.
Seed mass variation and in vitro embryos culture of *Abies nebrodensis* (Lojac.) Mattei

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*Abies nebrodensis* (Lojac.) Mattei is an endemic and relict species of 30 individuals scattered in a small area of the Madonie Natural Park in Sicily (Italy); it is listed as a “critically endangered” species (Conti et al. 1997). The germination rate is poor and the presence of seeds lacking in embryos (Scialabba et al. 2007) makes it difficult to evaluate the population genetic variability and to preserve it into a genebank collection. The purposes of this study were to establish: i) the relationship between embryo presence and seed mass to identify those seeds which are suitable for the conservation in a genebank; ii) the best in vitro culture conditions for growing embryos that will be used for the in vitro germplasm conservation. The seeds, collected in 2006 from reintroduced plants, were weighted individually, the major and minor axis and the height were measured. On the basis of their mass, seeds were grouped into five classes corresponding to the following fractions: class I, < 30 mg; class II, 31-40 mg; class III, 41-50 mg; class IV, 51-60 mg; class V, 61-70 mg. Seeds were sterilized and imbibed for 48 hours and their embryos were extracted and counted. The isolated embryos were cultured on solidified medium containing salt and vitamins MS (Murashige & Skoog 1962) and 50 g l⁻¹ sucrose as basal medium hormone free (control) Three treatments were used for the isolated embryo growth: basal medium supplemented with indole-3-butyric acid (IBA) in two concentration (5 or 10 μM) or with IBA (2.5 μM) and 6-benzylaminopurine (BAP) (4.4 μM). All explants were incubated for 40 days at 10±1°C under a 16/8 hours photoperiod of light/dark. The embryo growth response was evaluated (in percentage) considering the embryos with roots 2 mm long.

The results showed that seeds had similar sizes but different mass. The seeds belonged to the classes I, II, III, IV and V respectively in percentage of 27.5%, 32.5%, 24.5%, 11.5% and 4% and contained embryos in percentages of 0%, 16.9%, 61.2%, 100% and 100%. The total percentage of seeds containing green embryos was 24%, while albino embryos were present in 6.5%. In vitro roots emerged only in the green embryos, but not in the albino ones, and the best culture medium both for the root emergence (75 ± 5%) and for the root elongation was the hormone free one. This preliminary study permitted to observe that the embryo presence in seeds increases as the mass seed increases. In a genebank the conservation of *A. nebrodensis* germlasm may be carried out collecting seeds with a mass between 40 and 70 mg, preferring the fractions superior to 50 mg in which the embryos are always present. Besides, in vitro embryos cultures may be used for ex situ germplasm conservation of this endangered species.

Keywords: *Abies nebrodensis*, endangered species, ex situ conservation, embryos in vitro culture, seed mass.

References:
Divinity in incompatibility groups and conservation in *Sonchus pustulatus* Willk.

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Diversity in incompatibility groups is a main factor affecting fruit set and reproductive success in small populations and/or endangered species, since a low number of groups may be determinant of reduced success conducting to extinction (Demauro 1993). Very few reports on this subject are available in the literature, so no founded hypothesis can be suggested on the incidence in plant extinction risk. Within the *Asteraceae*, a family where homomorphic self-incompatibility seems to be the rule, present situation is particularly outstanding because of a wide ignorance of the incompatibility biology in natural populations, in spite of its high incidence in world vegetation.

At present, we are conducting a research program with the main objective of estimating the diversity in incompatibility groups and reproductive success of the critically endangered species *Sonchus pustulatus*. This plant is limited to some coastal and low altitude rocky walls enclaves, and distributed in two areas at both sides of the western Mediterranean basin; on Morocco it occupies some river valleys of the occidental Rif, whiles in the Iberian Peninsula there are three isolated populations in the southeast, Almeria province (Mejias 1988). From these, we have chosen the population from Barranco de San Antonio because it is a stable, well-delimited population in a conserved area comprising 500 individuals about, the highest number among Iberian populations. A program of diallel crosses with cuttings of geo-referenced individuals have been performed, and completed with fruit set and population dynamics observations.

Results show a general incidence of self-incompatibility in the population and suggest the existence of a considerable high number of alleles and incompatibility groups, which allow an adequate fruit set level in spite of a reduced flower production. This situation contrasts with previous indications for *Senecio squalidus* (Brenan 2006), where estimations indicate a maximum of 11 alleles in all its Britain distribution. Differences in population origins and their characteristics may be responsible of the detected contrast, but these results allow discussing about evolution of self-sterility alleles diversity in natural populations and its interest in plant conservation. Contrarily to our expectations, population persistence ability in *S. pustulatus* seems to be depending on safe sites scarcity and deficient long distance dispersal.

**Keywords:** endangered species, Western Mediterranean Basin, *Sonchus*, incompatibility groups, diallel crosses.

**References:**  
Molecular phylogeny, systematics and conservation of the western Mediterranean Vella pseudocytisus – Boleum asperum (Brassicaceae) taxa

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The Vella pseudocytisus L. - Boleum asperum (Pers.) Desv. complex consists of a set of four suffruticose steppe shrubs endemic to the western Mediterranean. In V. pseudocytisus three subspecies, V. pseudocytisus L. subsp. pseudocytisus, restricted to C (tetraploid) and S (diploid) Iberian areas, V. pseudocytisus subsp. paui Gómez-Campo (tetraploid), restricted to NE Iberian areas, and V. pseudocytisus subsp. glabrata Greuter (diploid), restricted to Middle Atlas and NW Morocco, have been recognized. B. asperum is a narrow NE Iberian hexaploid species. The boundaries between Vella and Boleum have been controversial since their morphology suggests a close relationship between the two genera (Gómez-Campo 1981, Crespo et al. 2000, Pérez-Collazos 2004).

The aim of this study was to recover the evolutionary relationships between individuals of different populations of the V. pseudocytisus - B. asperum complex based on analysis of nuclear ribosomal ITS and plastid trnTL and trnLF sequence data. Sampling included 3 individuals per population from 21 populations of the four taxa that covered their entire geographical distribution. The samples were analyzed through phylogenetic analysis using parsimony and Bayesian inference methods.

B. asperum was resolved as sister species of V. pseudocytisus s.l. favoring its inclusion within the paraphyletic genus Vella. Our analysis detected the divergence of two independent lineages within V. pseudocytisus subsp. pseudocytisus, one corresponding to the C Iberian populations, which included the locality of the type specimen, and a second one corresponding to S Iberian populations. The second group also differed from the first one on morphological characters and on ploidy level supporting its treatment as a separate taxon, V. pseudocytisus subsp. orcensis. V. pseudocytisus subsp. paui was split into two diverging lineages, which corresponded to the narrow Alfambra and Turia valley population ranges, however their uncertain evolutionary relationships and the lack of morphological differentiation precluded any further taxonomic division. The evolutionary placement of V. pseudocytisus subsp. glabrata remains unclear as its relationships were unresolved in most topologies. The evolutionary differentiation of five and three geographic groups, respectively, within V. pseudocytisus s. l. and B. asperum, supports the classification of all five V. pseudocytisus s.l population lineages within the IUCN category of 'Critically Endangered', based on their genetic singularity and scarce number of individuals per population, and of all three B. asperum population lineages within the category of 'Vulnerable' based on their lower level of menace. This would involve the establishment of specific in situ and ex situ conservation plans for these genetic units.

Keywords: Vella pseudocytisus, Boleum asperum, molecular phylogeny, ITS, trnTL, trnLF sequences, Mediterranean steppe.

References:
Vulnerability to climatic change: effect of increased CO₂ concentration in the European palm tree *Chamaerops humilis*

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Although climate is subjected to constant change throughout Earth’s History, there is no doubt about the acceleration of this process in current times because of human activities. The current climatic change is the result of both natural processes and the emission of greenhouse effect gases such as CO₂, NOₓ, CH₄, volatile substances, etc. The effect of global warming starts to be evident on certain ecosystems, in which species living in the limits of their distribution area are the most vulnerable to climatic change, since the environmental conditions are in many cases already close to their physiological limits (Körner 1999).

The main purpose of this study was to reveal the vulnerability degree of the European palm tree (*Chamaerops humilis*) to one of the factors responsible for climatic change, CO₂ increase, in order to establish adaptation and mitigation measures. Thirty *C. humilis* palms were grown in greenhouse with CO₂ controlled conditions (15 in normal conditions – 370 ppm- and 15 in double concentration – 740 ppm). The following variables were measured every four months: height, number of leaves, carbon assimilation, number of stomata and mycorrhizic association degree.

The first differences between treatments appeared as an increase in the number of stomata in the abaxial surface of leaves after a three-month period in doubled CO₂ concentration. After 7 months of treatment, in summer, significant differences were recorded in photosynthetic activity, in water use efficiency, in height, in the increase in number of leaves and in stomatal density, though not in mycorhizic activity. However, in the autumn (after 11 months of treatment) sampling campaign, differences between treatments could be observed only in photosynthetic activity and not in the increase in the number of leaves (neither living nor death), nor in the number of stomata. Although palm trees in high CO₂ produced a greater number of new leaves, they also showed greater leaf mortality. Our results showed that the increase in CO₂ stimulated the species’ photosynthetic activity and growth (Rathgeber et al. 2000), though the species’ phenologic patterns persisted (Kramer 1995).

**Keywords:** growth, mycorhize, photosynthetic rate, stomatal density.

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