

**RELIC MIRES IN PENINSULAR ITALY AND NATURA 2000**LAURA CASELLA<sup>1</sup>, FRANCESCO SPADA<sup>1</sup>, EMILIANO AGRILLO<sup>2</sup><sup>1</sup>*Dipartimento di Biologia vegetale, Università "La Sapienza", Rome -Italy*<sup>2</sup>*Dipartimento Ambiente e Foreste, Università "La Tuscia", Viterbo - Italy*

ABSTRACT - The study aims to detect patterns of distribution of mires along a geographical gradient. In order to do this, data from Natura 2000 inventories and distributional data for a selection of mire species have been compared. All data are referred to the 20 Regions (Administrative Districts) since distributional records of mire habitats and mire species are not yet available in literature sources. The inventory and mapping are in progress.

KEY WORDS - Natura 2000, peninsular mires, relictuality.

## INTRODUCTION

An attempt to survey the diversity in the floristic structure of the peninsular mires is presented.

Italy south of the 44° degree of latitude encompasses territories where Mediterranean and submediterranean climate is ruling throughout most of the topographical gradient (Rivas Martinez, 1996).

A large number of mires in the Italian peninsula are isolates, embedded in areas potentially covered by temperate or submediterranean deciduous forests, with close floristic affinities with analogous communities in the Balkan peninsula.

## MATERIAL AND METHODS

This study aims to detect patterns of mire species distribution along the geographical gradient in the Italian peninsula in order to reconstruct their colonization history in this area.

For this purpose, data from site-locations of Natura 2000 Network national inventories and distribution data for a selection of mire species (Conti *et al*, 2005; Cortini Pedrotti, 1992; Pignatti, 1982) have been compared.

A set of 93 species of vascular plants and *Bryophyta* recorded in the Italian mires

has been selected on the basis of the indicator values of these species according to literature sources (Pott, 1995; Ellenberg, 1978; Gore, 1996).

The species ranges are mapped according to their presence/absence in the 20 Regions (Administrative Districts) being more detailed ranges for each species of this database not yet available in literature.

The patterns of distribution are investigated using surface isometric graphs, in which the binary data are recorded on the nodes of the grid. Their validation has been achieved performing a randomization of the records of the same set. The patterns of distribution of a set of 93 species of vascular plants, randomly chosen among the 7464 species recorded in the Italian flora has been used as additional test.

Changes in species richness per Region in Italy have been investigated using a Geostatistical approach (“kriging”). This interpolation technique quantifies the spatial structure of the data creating surfaces for points with the same values. Here the pattern of the distribution of mire plants has been represented using lines that connect points with the same number of species.

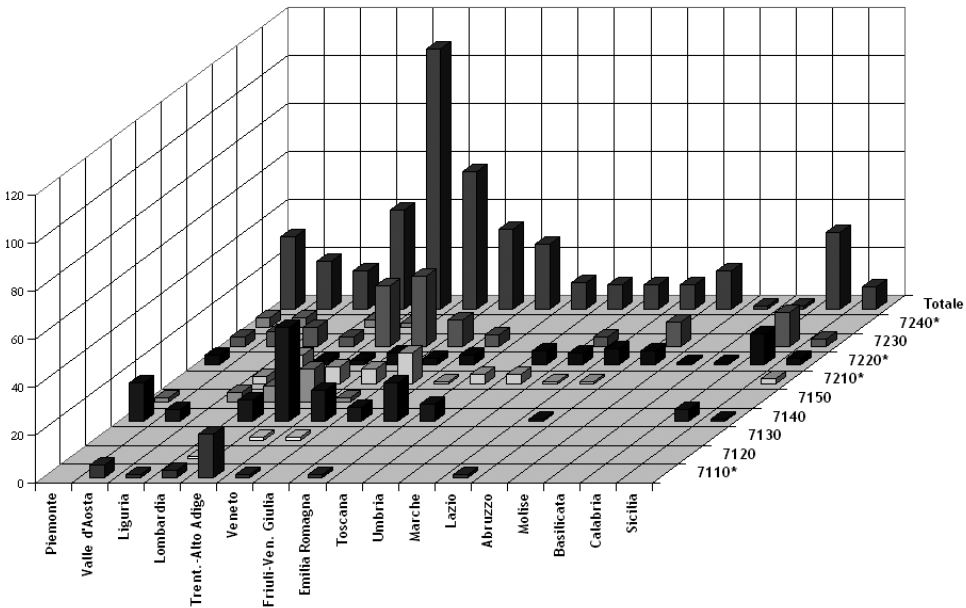


FIGURE 1 - Number of sites recorded for each Habitat (type of mire) in Nature 2000 Inventory per Region in Italy

## RESULTS

The distribution of Natura 2000 mire Habitats (European Commission DG Environment, 2003) in Italy (Italian Ministry for the Environment, Land and Sea, 2007), is represented in Fig. 1. In this graph, a northern and a southern district are detected, on the basis of the Habitat setting: the northern district encompasses bogs (7110 \*Active raised bogs, 7130 Blanket bog, 7140 Transitional mires and quaking bogs, 7150 Depressions on peat substrates -*Rhynchosporion*, 7240 \*Alpine pioneer formations of *Caricion bicoloris-atrofuscae*), while the southern one encompasses fens and springs (7210 \*Calcareous fens with *Cladium mariscus* and *Carex davalliana*, 7220 \*Petrifying springs with tufa formation -*Cratoneurion*, 7230 Alkaline fens).

In Fig. 2, the diversity in each region of Natura 2000 mire Habitats is represented. Regions with a lower number of sites may be characterized by a large number of mire types (Sicily, Latium). This suggests in these regions a higher degree of Habitat differentiation due to higher site-heterogeneity than elsewhere.

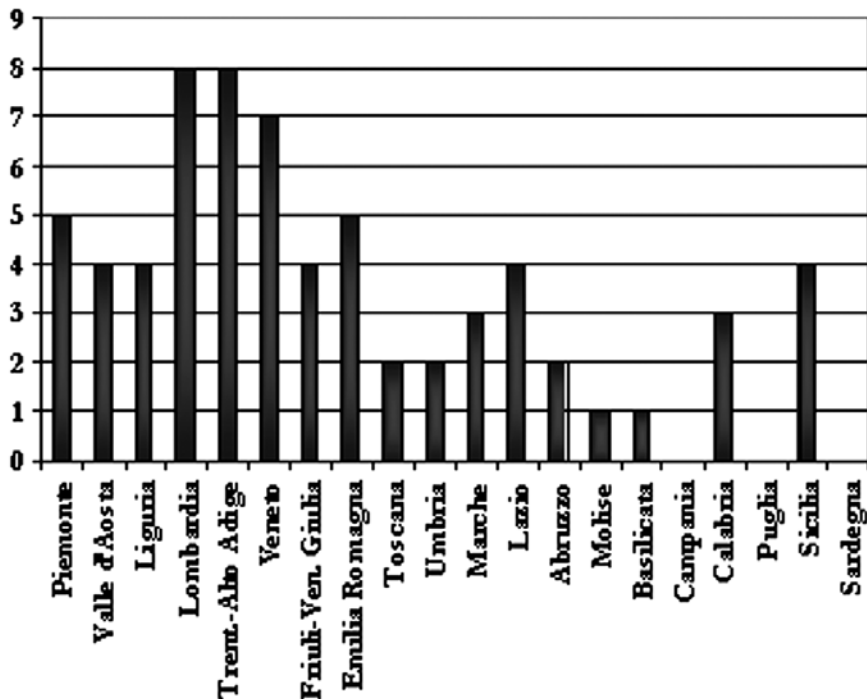


FIGURE 2 - Natura 2000 mire-Habitats diversity (number of mire Habitats per Region).

A similar geographical pattern is obtained when the ranges of the selected Italian mire species are compared. The spatial design in the surface isometric graph (Fig. 3-A), stresses significant floristic changes in the structure of the mires along the geographical gradient in the peninsula. The borderline between a northern and a southern eco-geographical district runs across the territory of Tuscany. The floristic changes along this N-S gradient show that, south of the territory of Tuscany, typical bog (*Hochmoor*) species (Pott, 1995) disappear (*Swertia perennis*, *Rhynchospora fusca*, *Eriophorum vaginatum*), while some species of *Sphagnum*, *Drosera*, *Utricularia* reappear in the records as disjunct populations in the south. This suggests the partial control by environmental factors related to lower elevation in central Apennines acting as dispersal barriers under the present macroclimatic conditions.

An overall N-S floristic gradient is evident also in the decrease of the total number of species towards the south (Fig. 4).

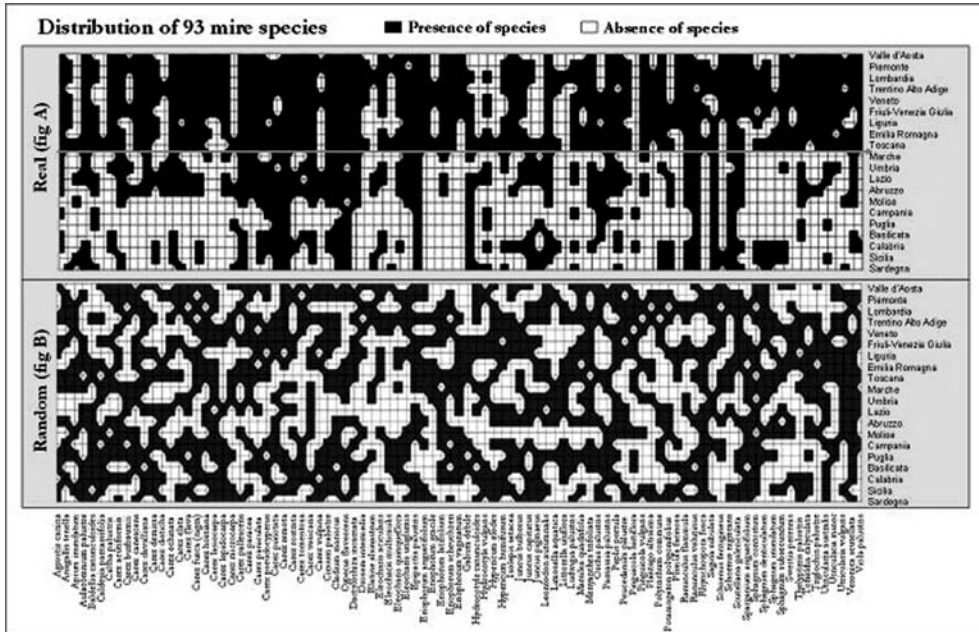


FIGURE 3 - Distribution of mire species along the geographical (Fig. A) from northern regions (Valle d’Aosta, Piemonte, Lombardia, Trentino Alto Adige, Veneto, Friuli-Venezia Giulia, Liguria, Emilia Romagna e Toscana) to central-southern ones (Marche, Umbria, Lazio, Abruzzo, Molise, Campania, Puglia, Basilicata, Calabria, Sicilia and Sardegna). In Fig. B the results of randomization of records of the same set.

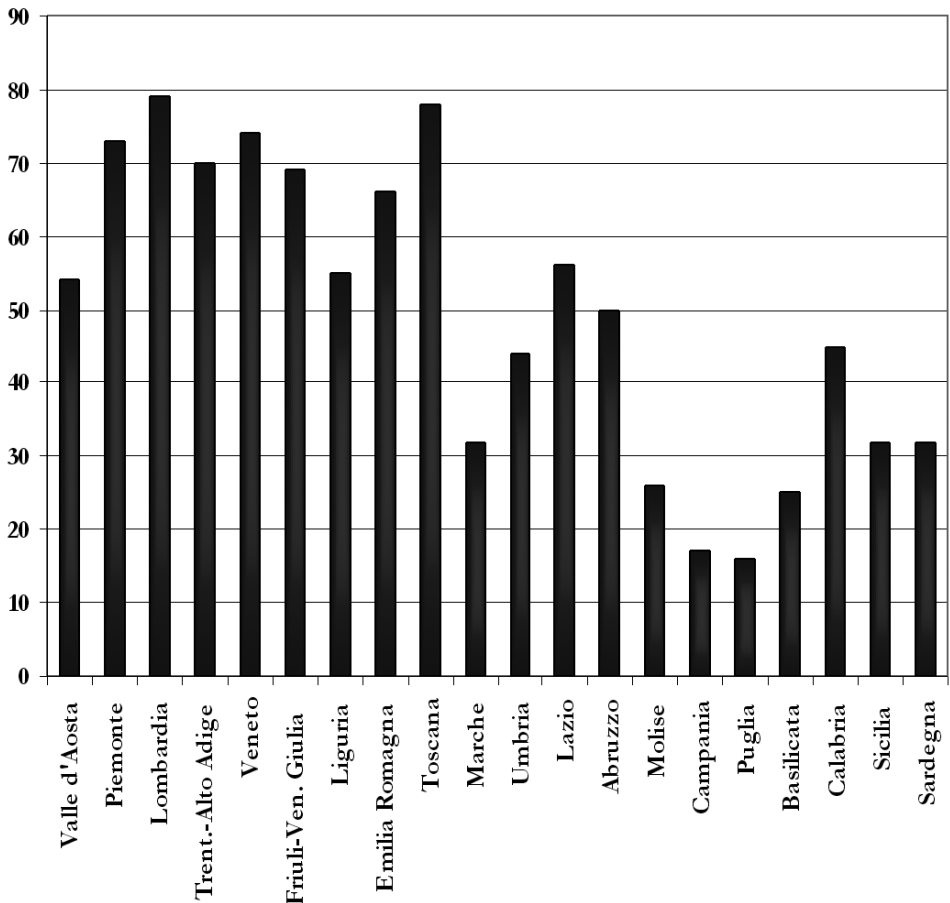


FIGURE 4 - Total number of mire species per Region

The occurrence of two distinct eco-geographical districts and of a steep gradient of species richness along the altitudinal gradient in Italy is stressed by the distribution of the species of *Sphagnum* within the same geographic framework (Fig. 5). This makes the disjunctions along the latitudinal gradient and the borderline running across the territory of Tuscany much more evident.

An additional test has been performed using the distribution along the same gradient of a set of 93 species of vascular plants, randomly chosen among the 7464 species recorded in the Italian flora (Fig. 6). This distribution exhibits no peninsular effect.

The spatial pattern of the variation as species richness in mire is shown (Fig. 7) using a Geostatistical approach (“kriging”). Here the pattern of the distribution of mire plants is represented using lines that connect points with the same number of species. They delimit higher values isocores (darker colour) to lower values isocores (lighter colour).



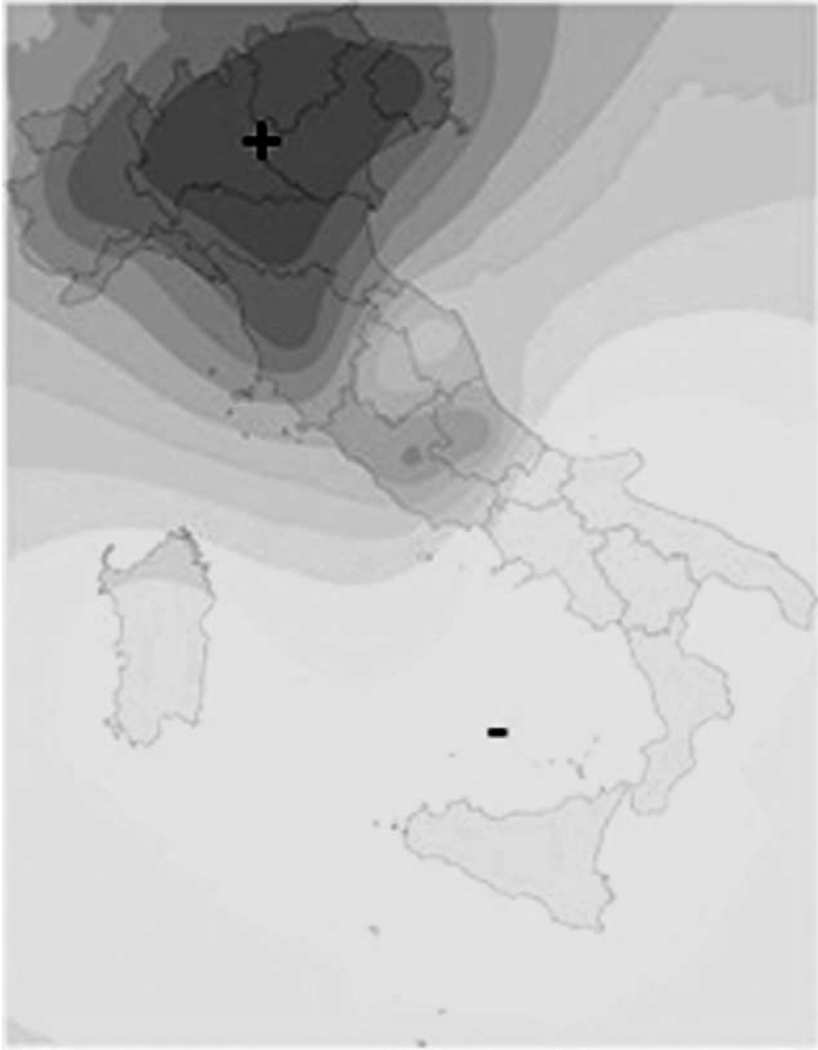


FIGURE 7 - Interpolation of mire-species richness per Region in Italy. A gradient of impoverishment is outlined from north (+) to south (-).

Many of them are residual fragments of formerly larger patches, surviving in refugial sites in lowlands not yet completely changed by agricultural practices.

Comparison between the patterns emerged from the Natura 2000 inventory and the results of the quantitative analyses of the distribution of the selected species, stresses the importance of the Tuscanian border zone in separating, from the point of view of mire species, two main, floristically distinct, districts. Nevertheless, some species which are clustered in the northern district occur also further south as disjunct populations. While it suggests relictuality due to locally favorable environmental conditions, might also be result of residuality, the heritage of different histories of natural and human fragmentation.

## REFERENCES

- CONTI F., ABBATE G., ALESSANDRINI A. & BLASI C. (EDS.), 2005 - An annotated checklist of the Italian Vascular Flora. Ministero dell' Ambiente e della Tutela del Territorio – Dip. Biol. Vegetale - Università di Roma “La Sapienza”, Palumbo Ed.
- CORTINI PEDROTTI C., 1992 - *Check list of the mosses of Italy*. Flora Mediterranea **2**: 119-221.
- ELLENBERG H., 1978. Vegetation Mitteleuropas mit den Alpen. 2 Voll. Stuttgart.
- EUROPEAN COMMISSION DG ENVIRONMENT, 2003 - Interpretation Manual of European Union Habitats - EUR25.
- GORE A.J.P., 1996 - Mires: swamp, bog, fen and moor. Voll. 4A & 4B. Elsevier, Amsterdam.
- Italian Ministry for the Environment, land and sea, 2007. Banche dati Natura 2000. Website: [www2.minambiente.it/sito/settori\\_azione/scn/rete\\_natura2000/banche\\_dati](http://www2.minambiente.it/sito/settori_azione/scn/rete_natura2000/banche_dati)
- PIGNATTI S., 1982 - Flora d'Italia. 3 Voll. EdAgricole, Bologna.
- POTT R., 1995 - Die Pflanzengesellschaften Deutschlands. 2 Voll. E. Ulmer, Stuttgart.
- RIVAS MARTINEZ S., 1996 - *Clasificación bioclimática de la tierra*. Folia Bot. Madritensis, **16**: 1-32.