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THE FLOATING ISLAND OF POSTA FIBRENO: AN EXAMPLE OF A RELIC MIRE IN CENTRAL ITALY

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ABSTRACT - The lake of Posta Fibreno (S Latium, C. Italy), is a biotope where some outstanding anomalies in the flora and vegetation of the wetlands of peninsular Italy are concentrated. Here the southernmost Italian populations of *Sphagnum palustre* occur on the small surface of a floating island, a cup-formed core of *Sphagnum* peat and rhizomes of Helophytes, erratically floating on the water-body of a submerged *doline*, annexed to the easternmost edge of the lake, characterised by the extension of a large reed bed. A strong correlation between characteristics of the physical environment and the structure of the vegetation on the island, points out the descriptive ability of the communities recorded in the site to reconstruc the genesis of the biotope.

KEY WORDS - FLOATING ISLAND, RELIC MIRES, GLACIAL REFUGIA, *SPHAGNUM PALUSTRE*

INTRODUCTION

Some outstanding floristic anomalies stress the relevance of the lacustrine environment of Posta Fibreno as a refugial site for boreal species in Central-South Italy (Fig. 1).

Here some of the southernmost Italian populations of *Sphagnum palustre* occur (Cortini Pedrotti, 1992), along with the southernmost largest lacustrine stands of *Carex paniculata* in Italy (Casella, 2008). The former are restricted on the small surface of a floating island, a cup-formed core of *Sphagnum* peat and rhizomes of helophytes, erratically floating on the water-body of a submerged *doline*, annexed to the easternmost edge of the lake. The latter, forms impressive palisades of 1-1,5 m high tussocks fringing the island and the S and SE shores of the lake.

The crucial element in this scenario is the presence of the floating island, as a portion of mire floating in a 10 meters deep pool located at the southern shore of the lake of Posta Fibreno surrounded .by one of the largest reed bed in peninsular Italy (Fig. 2).

Here a diachronic approach is used to test the magnitude of changes in the vegetation of the island exploring the trends in the present vegetation dynamics in natural conditions and under different land-use regimes with the support of biogeographic evidence.

STUDY AREA

Lake Fibreno (300 m a.s.l.) is a spring lake located in Central Italy, in Lazio district, at the foothill of the Marsica Mountain Range (western portion of the National Park of Abruzzo, Lazio and Molise), finding its recharge area in the karstic environment of

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Fig. 1 – Map of Italy with the localization of the study area (red dot). The image is realized by the use of a Digital Terrain Model to emphasize topography and the position of the study area in respect of Apennine Range: dark brown =high elevation a.s.l., light brown= low elevation a.s.l.

carbonate Apennines (Boni *et al.* 1988).

The macroclimate in the area is sub-Mediterranean with two months summer drought (July and August) (Lupia Palmieri, 1969). Deciduous species-rich oak forests dominate the slopes of the catchment, Mediterranean evergreen woody species are scattered on topographical discontinuities (Casella *et al.* 2008).

The comparison between the time series of local precipitation and the discharge data related to the Fibreno river points out a succession of dry and wet periods in respect of the mean yearly value of precipitation. According to precipitation, the last dry period started in 1980 and it's not over yet (Casella, 2003). As a consequence of this, the precipitation variability in the time series draws an evidence of availability constraints of the renewable water resources in the ecosystems.

Fig. 2 – Lake of Posta Fibreno: the main water body is fringed by a large reed bed. On the left is visible the island floating in its lake, detached by the main one.

The lake takes its origin from a complex of submerged and surface karstic springs of mineral-rich water, with a mean annual discharge of 10 $m^3 \cdot s^{-1}$(Casella et al., 2008). The lake has only one outlet: the homonymous river. Water temperature at the spring is around 10 °C, without significant seasonal variations. The average depth of the lake is around 2 meters, except in the submerged natural depressions (*dolines*) "Le Codigliane" (15 m) and "La Rota" (10 m, where the floating island is located). In Fibreno catchment, sinkhole formation is a common phenomenon because of the presence of thick carbonate deposits that are susceptible to dissolution due to circulating ground water (Casella *et al.*, 2008).

Fig. 3 – Schematic representation of the cover of some relevant species on the floating island along the belt transect surveyed. Abundance values according Braun-Blanquet scale are reported as follows: narrow line= + , 1; medium size line= 2, 3; wide line= 4, 5.

Despite of the name, the constant flowing and the low temperature during all the year produce in Lake Fibreno characteristics more similar to a river habitat than to a lacustrine one (Casella, 2003).

Geological evidence point out the existence in the area of a large lacustrine basin since Late Pleistocene. The progressive filling of the lake caused by changing in climatic conditions and neotectonic events, brought about the formation of peat deposits in the area, following different depositional cycles in a swampy environment (Parotto, 1969).

To these deposits has to be referred the formation of the floating island: a round-shaped portion of fen, originated around lake margins in waterlogged areas, that was somehow isolated from the bank and started to float.

The floating island has a diameter of about 35 meters and it extends on an area of 650 sq m. The diameter of submerged portion is 28 m and the submerged thickness is about 3 m (Casella, 2003). The vegetation is organized in concentric belts, from the *Carex paniculata* palisade to the *Sphagnum* core (Fig. 3).

Meterial and Methods

Data collection

Vegetation sampling was carried out in different surveys. In summer 2002 the plant cover was recorded in 1x2 m quadrats along a 16 m transect belt across the island, approximatively along its ray (numbers 1-16 in Table 1). In this transect 48 species were recorded. In 2007, four plots were sampled on physionomically homogeneous stands in the island (numbers 19-22 in Table 1). A total of 38 species were recorded in these stands. To assess the structure of the local source of the species, two sample plots were taken on the edge of the lake in two different environments: along shoreline (number 17 in

Species	Life Form	Chorotype	Seed dispersal	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Acer campestre	P scap	E	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Alisma plantago-aquatica	I rad	E	H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Anthoxanthum odoratum	H caesp	E	M	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Asparagus acutifolius	G rhiz	M	O	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Berula erecta	G rhiz	B	H	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
Bidens cernua	T scap	E	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Callitriche stagnalis	I rad	E	H	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Caltha palustris	H ros	B	H	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0
Calystegia sepium	H scand	E	H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Carex cfr. microcarpa	H caesp	E	H, M	0	0	1	0	0	1	1	1	1	1	1	0	0	0	0	1	0	1	0	1	0	0	0	0
Carex elata	He/G rhiz	E	H, M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Carex paniculata	H caesp	E	H, M	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	1	0	0	1	1
Carex pseudocyperus	He/H caesp	E	H, M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	1
Celtis australis	P scap	M	O	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Cirsium creticum subsp. *triumfetti*	H bien	M	A	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Cirsium palustre	H bien	E	A	0	0	1	0	1	1	0	1	0	0	0	1	1	1	1	0	1	0	1	0	1	0	0	0
Cornus sanguinea	P caesp	E	O	0	0	0	0	0	0	1	0	0	0	0	1	1	1	0	1	0	0	0	0	1	1	0	0
Cyperus longus	He/G rhiz	E	H, M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Dactylorhiza maculata	G rhiz	E	A	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eleocharis palustris	G rhiz	E	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Epilobium hirsutum	H scap	E	A	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	1	1	1	0
Epipactis palustris	G rhiz	B	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Equisetum palustre	G rhiz	B	A	0	0	0	0	1	0	0	0	1	0	1	1	1	1	1	1	1	0	0	1	1	1	1	1
Euonimus europaeus	P caesp	E	O	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Eupatorium cannabinum	H scap	E	A	0	1	1	1	1	1	1	1	0	0	0	1	1	0	1	1	1	0	1	1	1	1	0	1
Galega officinalis	H scap	M	H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
Galium palustre	H scap	E	H, M	1	0	0	1	0	1	0	0	0	1	1	0	0	0	0	0	1	1	0	0	1	0	1	0
Groenlandia densa	I rad	B	H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Hedera helix	P lian	M	O	0	0	0	1	1	1	1	1	0	0	0	1	1	1	0	0	0	0	0	1	1	0	0	0
Hieracium umbellatum	H scap	B	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hippuris vulgaris	I rad	E	H	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Holcus lanatus	H caesp	B	M	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	1	1	0	1
Hypericum tetrapterum	H scap	E	M	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1
Iris pseudacorus	G rhiz	E	H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0
Juncus articulatus	G rhiz	B	H, M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Juncus fontanesii	G rhiz	E	H, M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Juncus subnodulosus	G rhiz	M	H, M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Juniperus communis	P caesp	E	O	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Laurus nobilis	P caesp	B	O	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Lycopus europaeus	H scap	M	H, M	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	1
Lysimachia vulgaris	H scap	E	H	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	1
Lythrum salicaria	H scap	E	H, M	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
Mentha aquatica	H scap	E	H, M	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	1	0
Myosotis scorpioides	H scap	E	H	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
Myriophyllum spicatum	I rad	E	H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Nasturtium officinale	H scap	E	H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Peucedanum palustre	H scap	E	H	0	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	1	1	1	1	1	0	1	1
Phalaris arundinacea	He	B	H, M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Phragmites australis	G rhiz	B	H, M	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0	1	1	0	1
Platanthera bifolia	G rhiz	E	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Platanthera chlorantha	G rhiz	E	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Poa cfr. palustris	H caesp	B	M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Polygonum hydropiper	T scap	B	H, M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Polygonum mite	T scap	E	H, M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Populus tremula	P scap	B	A	0	0	0	1	0	1	1	1	1	0	1	1	1	1	1	1	0	0	0	0	1	1	0	1
Potamogeton polygonifolius	I rad	E	H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Potentilla reptans	H ros	E	M	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Prunella vulgaris	H scap	B	M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Prunus avium	P scap	M	O	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
Ranunculus repens	H rept	E	H, M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Rubus ulmifolius	NP	M	O	0	0	0	0	1	1	1	1	1	1	0	1	1	1	1	0	0	0	0	0	1	1	0	1
Salix x cinerea	P caesp	E	A	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	0	1
Scrophularia umbrosa	H scap	E	H	0	0	0	0	0	1	0	0	1	1	0	0	1	0	0	1	1	0	0	0	0	0	0	0
Scutellaria galericulata	G rhiz	B	M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1
Serapias cfr. *vomeracea*	G bulb	M	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Sphagnum palustre	M	B	A	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0	0	1	0	1
Tamus communis	G rad	M	O	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Thelypteris palustris	G rhiz	E	A	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	0
Urtica dioica	H scap	E	M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0
Veronica beccabunga	H rept	E	H	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
Vitis sylvestris	P lian	M	O	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0

Table 1 - Floristic table and functional traits of the recorded plant cover. Seed dispersal: hydrochory (H), anemochory (A), myrmechory (M), ornithochory (O). Chorotype: eurasiatic wide distribution (E), mediterranean (M), boreal (B). Life form classes according Pignatti (1982)

Table 1) and inside the reed bed (number 18 in Table 1).

Diachronic analysis was performed by comparing these data with presence-absence data from two sample plots taken on the island in 1954 (Montelucci, 1979): the first on the edge of the island (number 23 in Table 1), the second in the *Sphagnum* core stand (number 24 in Table 1). Here a total amount of 44 species were recorded. A table of presence-absence data has been obtained.

On this basis a floristic data matrix of 71 species (the table is obtained from all the inventories: 2002, 2007, 1954) and 24 samples (plots) was constructed (Table 1). Based on the relative presence in the different inventories the species were then classified as "persisting" (if recorded in 2002-2007 and 1954), "new" (if recorded in 2002-2007 but not in 1954), "extinct" (if recorded in 1954 but not in 2002-2007).

Furthermore, in this matrix each species was characterized by selected functional attributes. Since the island, because of its buoyancy, is characterized by physical conditions which are stable in time, it is here assumed that plant traits might play an overall crucial role in assessing mechanisms and processes of the vegetation dynamics on the island, determining the competitive abilities of the species and their capacity of persistence in time. The plant traits used here are: chorotype (geoelement), life form (Raunkiaer, 1934) and dispersal (based from fruit and seed characteristics reported in Pignatti (1982) for each species; classes based on agents of dispersal are ornithochory, myrmechory, anemochory, hydrochory).

The chorotypes according to Pignatti 1982 have been renamed in order to point out the range bulk of the species. The geoelements used are Eurasiatic, Boreal, Mediterranean.

A new binary matrix (species x plant trait) of 20 attributes and 71 species was obtained.

Data analysis

Multivariate numerical methods were used to process the floristic matrix and the matrix of the plant traits.

Classification of the matrix data was carried out using the Multivariate Statistical Package SYNTAX 2000 (Podani, 2001) by performing cluster analysis using Jaccard coefficient as distance measure with complete link method.

Results and discussion

The classification of the floristic matrix (Fig. 4) produced the following groups of plots:

The Quadrats of the 2002 transect and the1954 releve taken on the peripheral helophytic-hydrophytic belt of the Island. This affinity suggests a remarkable overlapping of the data taken within the time-span of half a century. To the same group is connected the sample plots taken in 2007 outside the island along the shoreline;

The Quadrat on the *Carex paniculata* palisade is isolated from all the other ones;

The Quadrat of the 2002 transect and the 2007 sample plots both taken in the *Salix cinerea* belt with *Thelypteris* and *Phragmites*;

The Quadrats of the 2002 transect, the 1954 and the 2007 sample plots taken on the central part of the island, including the *Sphagnum* core.

The classification of the matrix of plant traits points out the existence of 4 groups of species (Fig. 5):

Wide distributed species, with subgroups:

Hemycryptophyte and phanerophyte, wind dispersal;

Hemycryptophyte, water and ants dispersal;

Boreal and eurasiatic geophyte and hemycryptophyte, ants dispersal;

Group including only *Sphagnum palustre* and *Equisetum palustre*, with no traits in common;

Mediterranean phanerophyte, bird dispersal.

Comparing the results of the floristic matrix and the

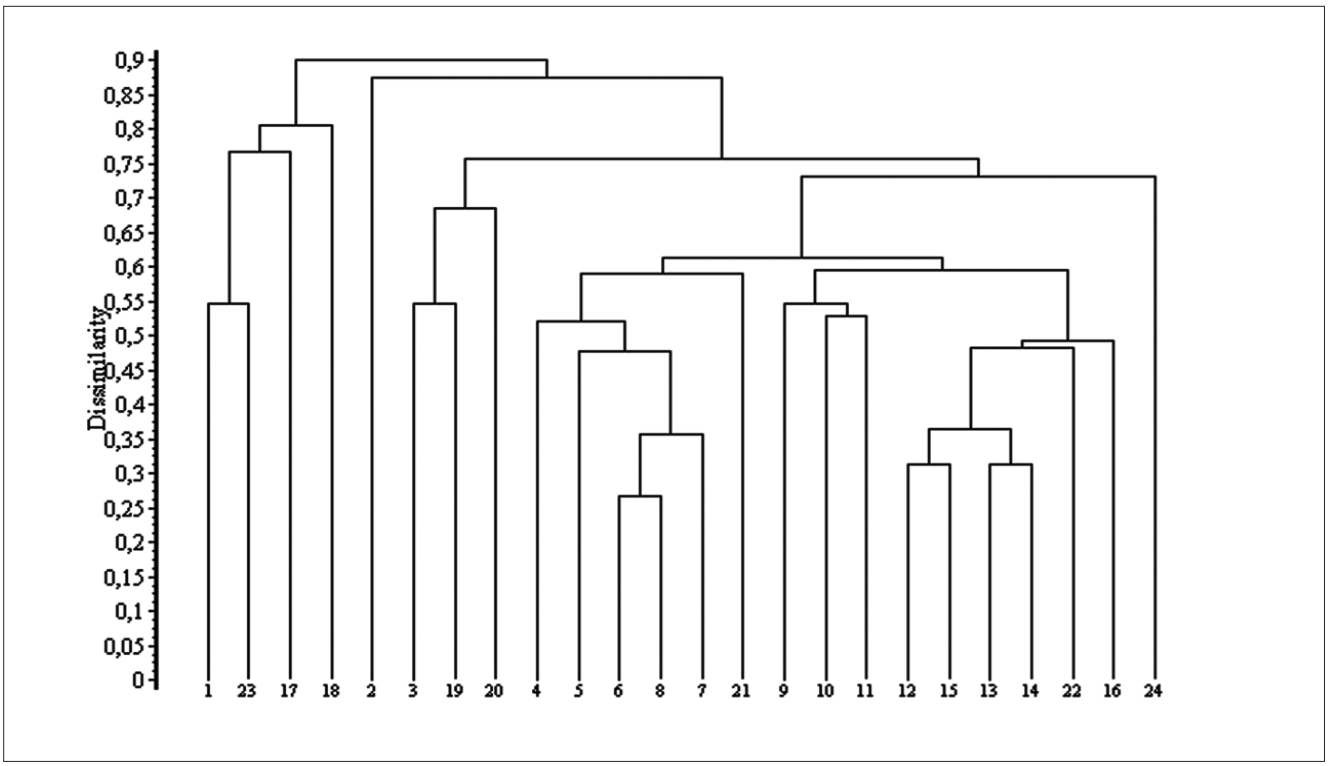

Fig. 4 - Numerical classification of the presence-absence data from the datasets of 1954 and 2002-2007. Legend of the plots as in Chapter Material and methods.

plant traits groups, considering their *status* of "persisting", "new" or "extinct", we obtained the following:

"persisting" species are overall eurasiatic with wide distribution;

"new" species are Mediterranean phanerophyte bird dispersed;

"extinct" species are prevalently (6 on 8) boreal.

The successional trend shows therefore that during the last decades bird-dispersed Mediterranean phanerophyta are increasing (since *Salix* and *Populus* attract resting birds) while boreal water dispersed Hemicryptophyta and Geophyta decrease.

Juncus subnodulosus, J. articulatus, Eleocharis palustris, Anthoxanthum odoratum still occurred on the island in the '50, but are not to be found on it today. As species of fen-meadows in temperate Europe *(cfr: J. subnodulosus - Cirsium palustre aggr.*, Rodwell 1991), they represent indicators early successional, disturbance (grazing) controlled stages of the development of aggregations of metastable reed –marshe*s (Peucedano -Phragmitetum, cfr. Thelypterido – Phragmitetum p.p.,* Rodwell 1991) which develop later in the succession. This community is today recorded on the floating island where it dominates. It represents as well a community where *Sphagnum palustre* in W Europe finds favourable conditions for growth (Schaminee *et al.,* 1995).

The local extinction of *Juncus sp.pl.* populations suggests primarily the sudden end of grazing (Pott, 1995). But a local event of desiccation documented by a dramatic decrease of precipitation during the last 30 years can also be accounted for (Casella, 2003)

These circumstantial evidence suggest an ongoing process of reconstruction of the natural potential zonation along the topographical gradient of the area (Ellenberg, 1963) along with a general process of succession from a Cyperograminoid-dominated

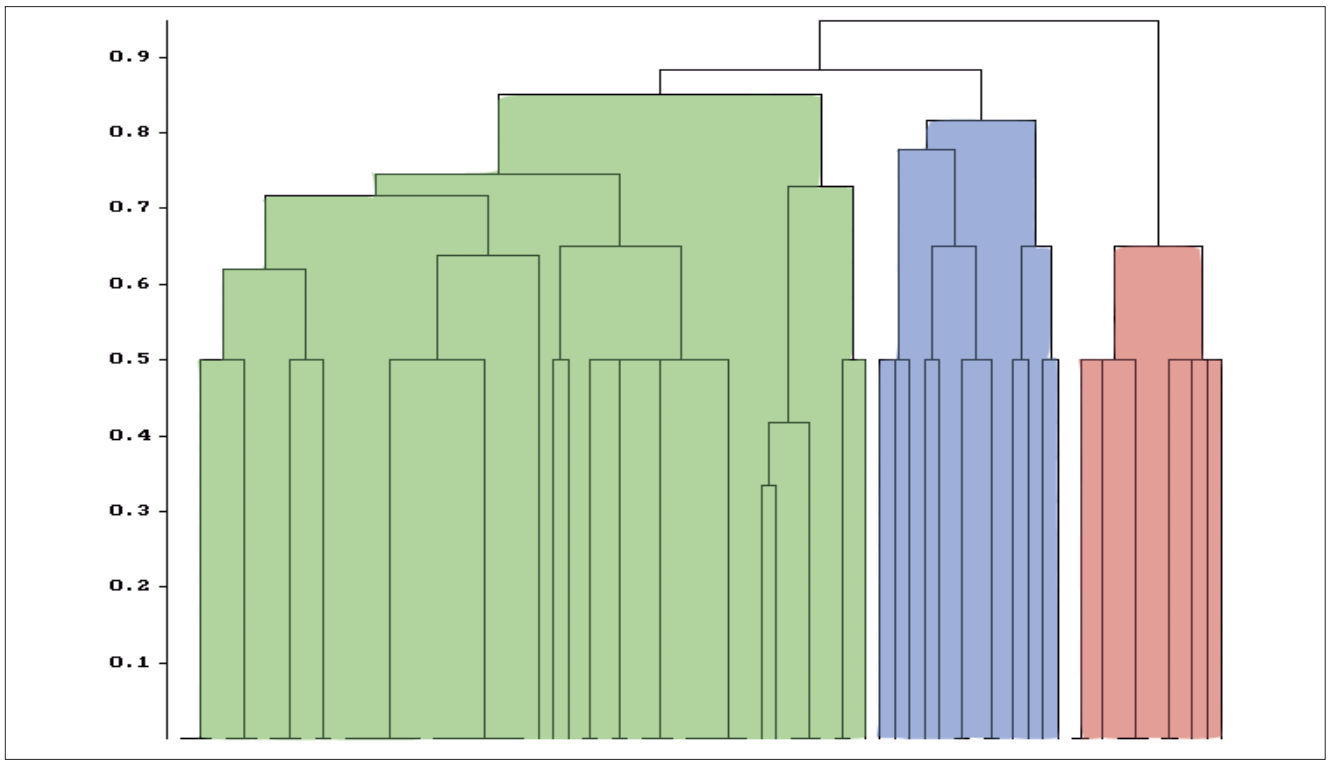

Fig. 5 - Result of the Classification of functional guilds (on the basis of Chorotype, Dispersal, Life Form) for the flora of the island recorded in all inventories. Species are grouped in relation to the dominant chorotype: Eurasiatic (green), Boreal (blue), Mediterranean (red).

swamp to tall-herb fen (*Thelypterido-Phragmitetum*) to woodland.

The patterns of floristic changes show the (re)construction of the *Carex paniculata* palisades at the edge of the island and a thicket of *Salix cinerea* in the intermediate area along with *Phragmites,* bordering the fringe of a *Sphagnum* mire developed in the central area of the island, where a clonal population of *Populus tremula* grows.

The trend towards a fulfilled terrestrialization seems to find its natural limits in the nature of submerged sink-hole displayed by the pool, preventing the anchorage of the peat. This floating prevents the waterlogging of the *Sphagnum* core providing stable ombrotrophic conditions and therefore the persistence of *Sphagnum* it self for unpredictably long timespan.

This study supports, by the mean of floristic and physical evidence, a new hypothesis for the formation process for the genesis of the island. Three are the main hypothesis addressed in literature for the formation of a floating island (Clark, 2000):

a piece of unvegetated organic substrate that delaminates from the deeper organic horizon colonized by vegetation, forming dense stands of vegetative floating mat (this is the actually accepted theory of explanation for the *genesis* of the floating island in Posta Fibreno, as reported in literature, Carbone 1965);

a lake fringing floating mire that for natural evolution has been cut off the bank to which was connected, typically occurring in boreal peatlands systems (Clark, 2000);

free floating vegetation mats characterised by intrinsic buoyancy that grow for horizontal expansion and secondary thickening, typically occurring in tropical systems (Clark, 2000).

The results of this investigation based on recent vegetation dynamics, which is extended to a longer time-span by the biogeographic evidence, suggest ,a new additional hypothesis for the formation of the floating islands. In this case the inner portion of a fen could have been isolated from the surrounding mire for the sudden collapse of a karstic cave. Lacustrine sediment were dragged down while the peat, because of intrinsic buoyancy, started to float.

Conclusion

Major sources of evidence for the relationships between dynamics of the physical environment and community succession are the outstanding occurrence of *Sphagnum palustre*. The species is restricted to the central part of the floating island, where it forms up to 70 cm high hummocks on an area of about 300 sqm, giving it the character of transitional mire.

The remote reason of its occurrence in Lake Fibreno is to be related to its minerotrophic requirements (Sjoers, 1983).

Nevertheless fragmentary populations of the species are scattered all along the Apenninic chain, revealing a long-lasting process of range fragmentation and reduction due to:

1) desiccation since Middle Holocene (Taylor, 1983)

2) human destruction of wetland habitats.

These processes have affected the lacustrine environment at Posta Fibreno, reducing the habitat favourable to *Sphagnum* to few sites in the swamps and fens along the W banks of the lake. With the agrarian colonisation of the area, most of the marshes have been transformed into arable land or pastures reducing much more the number of potential sites, There is circumstantial evidence for the occurrence of (viable?) populations on sites around the lake up to the years just before World War II, when the locally reported "mosses" (Carbone, 1965) were used as material for filling clay walls in rural traditional dwellings).

At a particular time during the development of the sedge-dominated transitional topogenous mire, starting approximately after 8000 BP (Tallis, 1983) during these processes, a sudden collapse in the bedrock under the water body, produced a submerged sink-hole.

The collapse of the limestone pavement dragged down the lacustrine sediment. The peat started to float in the water body of this "hole", becoming independent from the environmental constraints ruling in the marshes. This sequence of events, supported by the geological and hydrogeological evidence (Parotto, 1969) for the area, fits into the framework of long-term successional events related to the occurrence of *Sphagnum* on the floating island. If the initial fragment of peat supported a plant cover where populations of *Sphagnum* grew, this was the very moment when *S. palustre* started to develop under ombrotrophic conditions which since then characterise the environment in the central part of the island.

Present-day vegetation patterns on the floating island and the surrounding environment suggest that the biotope might have originated by the disruption of a former system of floating mire, due to the sudden collapse of the submerged karstic cave.

This mire is and has been affected by attempts of colonization by shrubs and trees, whose persisting ability seems to be limited in time. These fluctuations in the processes of turn-over of the flora of the biotope, provide future favourable conditions for the survivorship of *Sphagnum*, and explain its refugial status on the floating island mire.

The assessment of a conservation plan is extremely urgent, owing to the vulnerability of these isolated outposts of boreal plants. A consistent descriptive model for the floristic changes along the physical gradients is crucial for the correct management of its vegetation cover, which is expected to be addressed to the preservation of *Sphagnum*.

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