Geobotany Studies
Basics, Methods and Case Studies

Pauline Delbosc
Frédéric Bioret
Christophe Panaïotis *Editors*

Plant Landscape of Corsica

Typology and Mapping Plant Landscape of Cap Corse Region and Biguglia Pond

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Note: the taxonomic referential used is Flora Corsica (Jeanmonod and Gamisans 2007, reprinted in 2012, Editions Édisud). The syntaxonomic referential follows the nomenclature used in Corsican Vegetation Prodrome (Reymann et al. 2016). The author names for the species and syntaxa are not indicated in the text; those for the syntaxa are listed in the Appendix. The sigmataxonomic referential follows the nomenclature used in Bioret et al. 2019.

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Contents

Abbreviations and Acronyms

A.G.E.N.C.	Agence pour la Gestion des Espaces Naturels de la Corse
B.P.	Before Present (référence: 1950)
B.R.G.M.	Bureau de Recherches Géologiques et Minières
Car. H.A.B.	(programme) Cartographie des HABitats
C.B.N.C.	Conservatoire Botanique National de Corse
C.D.L.	Conservatoire Du Littoral
C.L.C.	CORINE Land Cover
C.T.C.	Collectivité Territoriale de Corse
D.F.C.I.	Défense de la Forêt Contre les Incendies
D.H.F.F.	Directive Habitats Faune Flore
I.S.T.H.M.E.	Image Société Territoire Homme Mémoire Environnement
H.C.I.	Habitat of Community interest
I.F.N.	Institut Forestier National
I.G.N.	Institut Géographique National
M.E.D.D.E.	Ministère de l'Écologie, du Développement Durable et de l'Énergie
O.E.C.	Office de l'Environnement de la Corse
P.A.D.D.U.C.	Plan d'Aménagement et de Développement Durable de la Corse
P.P.F.N.I	Plan de Protection des Forêts et des Espaces Naturels contre les Incendies en Corse
P.R.M.F.	Protection Rapprochée des Massifs Forestiers
R.N.N.	Réserve naturelle nationale
S.I.G.	Système d'Information Géographique
U.B.O.	Université de Bretagne Occidentale

General Introduction

Pauline Delbosc, Frédéric Bioret, and Christophe Panaïotis

Numerous vegetation and habitat mapping studies have been developed since the twentieth century (Rey 2009; Pedrotti 2013). Vegetation mapping of France, carried out in 1945 by Gaussen et al., by Paul Ozenda in the Alps (Ozenda 1963, 1985, 1986 Ozenda and Wagner 1975) and plant mapping in Montpellier under the direction of Louis Emberger (1961; Emberger and Gounot 1963), demonstrate amply the interest in mapping work for vegetation monitoring and conservation, land-use planning and nature protection.

In order to complete the response to national conservation policies, Habitat European directive obligations (assessment of the state of conservation of habitats of Community interest) and spatial planning needs (green and blue corridors, protected areas creation strategies…), the French Ministry of Ecology launched a national vegetation mapping program (CarHAB) in 2011. The aim of this program is to produce a map of the natural and semi-natural vegetation of France at the scale 1:25,000 by 2025. The methodology adopted follows the dynamico-catenal approach and allows apprehension, on the one hand, of vegetation dynamics for typological purposes of the vegetation series, and on the other hand, of the diversity and phytocoenotic originality of the plant landscape (Géhu 1986, 1988; Rivas-Martínez 2005b).

Corsica has been chosen as a pilot region due to the peculiarities of its mediterranean and mountain vegetation. For this region, a research project planned over 4 years is directed by the EA 2219 of the University of Western Brittany (UBO) and the National Botanical Conservatory of Corsica (CBNC). The main objective of this

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project is to set up a methodology to inventory and map vegetation series and geoseries of Corsica. More precisely, the aim is to develop and validate a methodology for the map of vegetation and to produce a catalog of the series and geoseries of Corsica. This program is also positioned within the knowledge-based framework for land-use planning and management, as well as medium and long-term vegetation monitoring and assessment of natural and semi-natural habitats within the framework of Natura 2000.

Since 2012, several symphytosociological projects have been carried out in the valleys of Asco (Delbosc 2015; Delbosc et al. 2015a, b), Niolu (Lefort 2013), Haut-Vénacais (Tanné 2014) and Balagne (CBNC 2015).

The aim of this paper is to characterize the vegetation series and geoseries (ecology, structure, dynamic trajectories, role of anthropogenic factors on vegetation dynamics, catenal positioning in landscape) of two sectors: Cap Corse and the pond Biguglia. These two study sites were selected according to two methods:

- for Cap Corse, typology and mapping are based on an inductive approach, the principle of which is to understand the dynamics of vegetation through the mature, substitutional, pioneering and anthropogenic associations likely to exist within a tessellar envelope. These various dynamic stages characterize "the vegetation series" (sigmetum or synassociation), the fundamental unit of symphytosociology (Géhu 2006; Biondi 2011). The aim of symphytosociology is, therefore, to define the vegetation series; in other words, it aims to identify the repetitive combinations of syntaxa under homogeneous ecological conditions.
- for the Biguglia pond, the typology and mapping are based on a deductive approach, the principle of which consists of crossing (under SIG) the ecological descriptor maps with the vegetation mapping to reveal the *tesselas* and the natural potential vegetation that underlies them. This approach, which has become widespread since the 2000s with the improvement of GIS techniques, is particularly interesting for characterizing plant landscapes from vegetation to vegetation geoseries, for the purpose of conservation management of natural and semi-natural environments.

Vegetation and Vegetation Series of Cap Corse (With Mapping at 1:25,000)

Pauline Delbosc, Frédéric Bioret, and Christophe Panaïotis

1 Study Area

Cap Corse is a micro-region encompassing three watersheds: Luri stream, Poggiolo stream and western Cap Corse (Fig. 1). Located in northern Corsica, Cap Corse extends over 33,730 ha, from Mucchiete in the east to the Campu Maggiore stream in the west, to Barcaggio in the north. Cap Corse extends over 23 communes and culminates at 1307 m (Monte Stello). The altitudinal range and the geomorphological complex (Castelnau 1920; Palmieri 2004) of its coastal features induce ecological and phytocoenotic diversity. Beyond its floristic-phytosociological originality, the plant landscape of Cap Corse integrates the ancient and recent history of the Corsican pastoral society (Ravel 1911; Simi 1964; Ravis-Giordani 1983).

1.1 Geomorphology, Geology and Soil

The physical features, the distribution of the materials and the morphogenic system induce heterogeneity in the shapes in the landscape of Cap Corse, where three geosystems can be distinguished (Palmieri 2004):

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Fig. 1 Location of Cap Corse

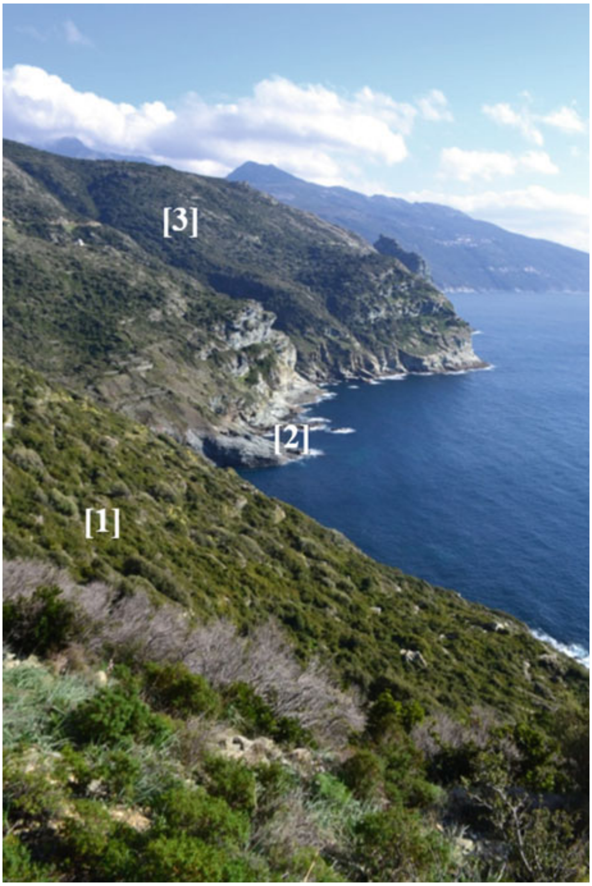

Fig. 2 Plant landscape of the coastal and thermo-mediterranean levels of the west coast; [1] *Pistacia lentiscus* and *Juniperus phoenicea* subsp. *turbinata* thermo-mediterranean thicket; [2] Geopermaseries of rocky coasts; [3] Meso-mediteranean series with *Galium scabrum* and *Quercus ilex*

- a coastal geosystem (Fig. 2);
- a low-plain geosystem (Fig.3);
- a semi-montane geosystem (Fig. 4).

At the bottom of the valley, the underground interstitial environment is heterogeneous, creating an original alluvial complex formed by juxtaposition or even imbrication of:

- secondary arms whose shallowness and narrowness differentiate them from the main stream;
- hygrophilous forests (*Alnus glutinosa* forests) established on peaty soils with water and flooding during a large part of the year;
- hardwood forests established on well-drained silt deposits on the upper banks;
- banks of gravel and pebbles without vegetation.

On the lower ground there are qualitatively and quantitatively different biological communities resulting from the combination of alluvial materials (pebbles, gravel, sand, silt...) and origin of the groundwater.

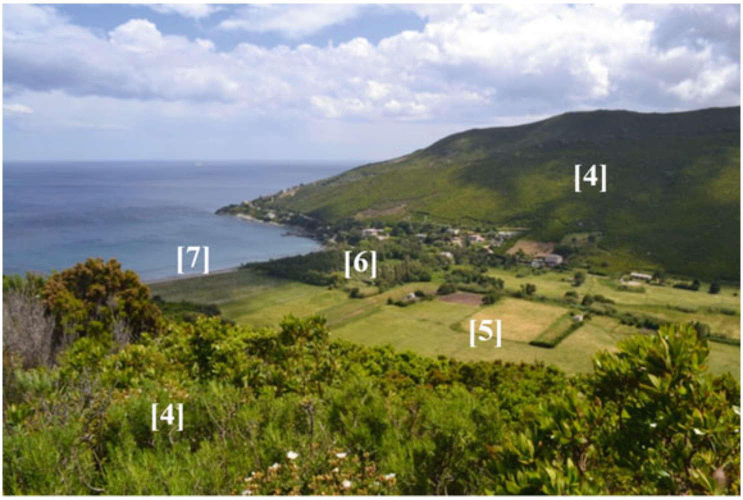

Fig. 3 Meso-mediterranean plant landscape of the Pietracorbara valley. [4] Thickets with *Erica arborea* and *Arbutus unedo* [5] Cultivated alluvial plain; [6] Swampy alder forest with *Scrophularia auriculata* and *Alnus glutinosa*; [7] Geopermaseries of sandy beaches

Fig. 4 Supra-mediterranean plant landscape (view from Monte Stello). [8] Heath with *Anthyllis hermanniae;* [9] Hygrophilous valley bottom with *Buxus sempervirens* and *Taxus baccata*; [10] Supra-mediterranean geopermaseries on steep rocks

Morphological and morphodynamic diversity induces five major systems:

- alluvial systems (alluvial systems not stabilized, alluvial systems clogged);
- collinean systems;

- colluvial systems;
- scree systems;
- rock-bed systems.

The relief of Cap Corse is mainly the result of a recent geologic eruption with an anticlinal north-south axis (Fig. 5). The allochtonous sedimentary units of Macinaggio in the north-east and St Florent in the south-west have a common origin and are currently separated by the reliefs of Cap Corse: between the two sectors, the more or less flat surface characterizes the basis of these elements carried on schist has thus been elevated to more than 1 km of altitude (Durand Delga et al. 1978; Gauthier 1983; Gauthier et al. 1984; Gauthier and Quilici 1997; Gauthier 2006).

To the west, the Miocene massif of St Florent is affected by a synclinal fold complementary to the anticlinal fold of Cap Corse (Fig. 6). These foldings are relatively recent (late Miocene to Quaternary). The anticlinal axis does not correspond to the mountain axis of the present peninsula. It is near the eastern coast, following a Bastia-Erbalunga-Sisco-Pietracorbara-Tomino line. Moreover, this fold is dyssimetric (Durand-Delga et al. 1978; Gauthier 1983, 2006).

The reliefs of Cap Corse are formed by several varieties of ophiolites (Gabbros, Serpentinites) (Fig. 7a and b). The schists are easily fragmented and altered to great thicknesses. They give rise to deep soils rich in mineral substrata (Favreau 2002; Demartini and Favreau 2011a, 2011b). Cap Corse is an illustration of Alpine Corsica characterized by magmatic rocks (Ophiolites, Pillow-lavas, Gabbros) and

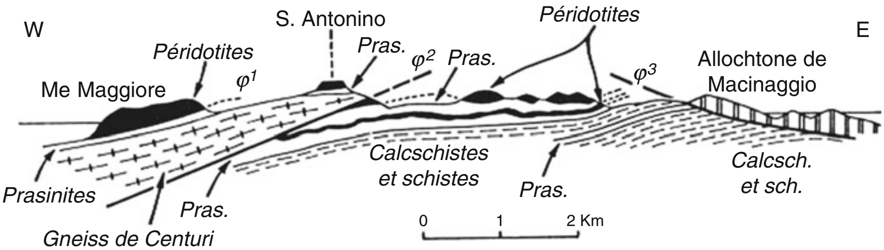

Fig. 5 Schematic cross-section of northern Cape Corsica, from Macinaggio to Centuri. The supposed order of formation of the main abnormal contacts is indicated by the numbers 1–3 (From Durand-Delga et al. 1978)

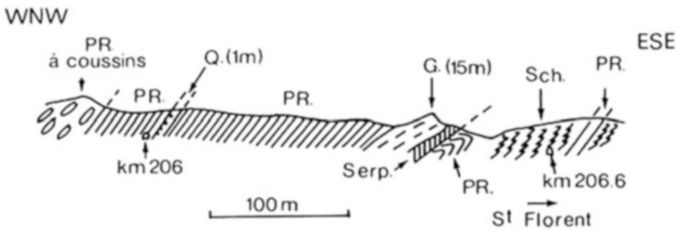

Fig. 6 Schematic cross-section along the road between Centuri and Pino, near Punta di Aliso (From Durand-Delga et al. 1978)

metamorphic rocks (Schistes, Micaschistes, Calschistes, Cipolins, Prasinites (Vellutini 1977; Durand-Delga et al. 1978; Gauthier 1983; Arrighi and Giorgetti 1985). The tormented relief of its western part comes from the presence of a gneiss enclave of the Tollari valley and a green rock, the Peridotite, which constitutes the center of Monte Maggiore.The eastern slope of Cap Corse presents three dominant types of rocks: shale, prasinite and serpentinite.

The soil description of Cap Corse is based on various studies and maps at 1:25,000, mainly those of Roche and Roux (1976), and of Demartini and Favreau (2004, 2011a, b). Different soil units can be distinguished:

- alluvial soils: these deposits are characterized by "raw fluviosoils" formed from sandy deposits, very recent, stratified and unaltered, poorly stabilized, of the minor beds of the rivers. These hydromorphic soils, with few reductisols with saturated pore horizons, present a small amount of organic matter but without pedological horizon.
- soils of the old terraces. This is a "brunisol" type of which it is possible to distinguish two categories:
  - neoluvisol with luvic eutric brunisol, neoluvisoils (by erosion) with average leaching index (IL = 1.6) are meso-saturated. They present a drainage generally deficient in depth and a high pierrosity.
  - haplic to pachic eutric brunisoil has a good drainage, sometimes deficient in depth, with stony horizons with peyrosols.
- soil units of the old terraces. The old terraces are characterized by soils of the "typical to degraded luvisoils" type: very clayey leached horizons with drainage often deficient, very often with stony horizons and sometimes stony peyrosol, meso-saturated to saturated.
- soils of colluvium. This is soil type "sandy colluviosoils": meso-saturated to saturated, on granite.

The Coastline of Cap Corse: An Original Geomorphological Complex

The coastline of Cap Corse shows great floristic and phytocoenologic diversity (Gamisans 1991; A.G.E.N.C. 1994; Paradis 2004; Palmieri 2004; Gauthier 2005; Paradis 2010):

- beaches [Fig. 8a] correspond to shores where sediments are deposited (fine to coarse sands, granules, gravels, pebbles). The ranges have a more or less concave transverse profile. Their slope varies according to the diameter of sediments and the hydrodynamic characteristics of breaking waves.
- dunes (Fig. 8b) (Barcaggio): rising more than 20 m above sea level, a dune cordon is behind two ponds flooded during the year.
- lagoon (Cala Francese) is limited behind by a flooded wetland. Posidonia deposits are important throughout the cord.
- coastline of medium sands (Cala Genovese, Tamarone). Posidonia deposits are important throughout the cord.
- coastline of coarse sands (Chapel of Santa Maria, Meria, Santa Severa south).

Fig. 7 (**a**) Geology of Cap Corse (From Rossi and Rouire 1980a, b). (**b**) Geology of Cap Corse (From Rossi and Rouire 1980a, b)

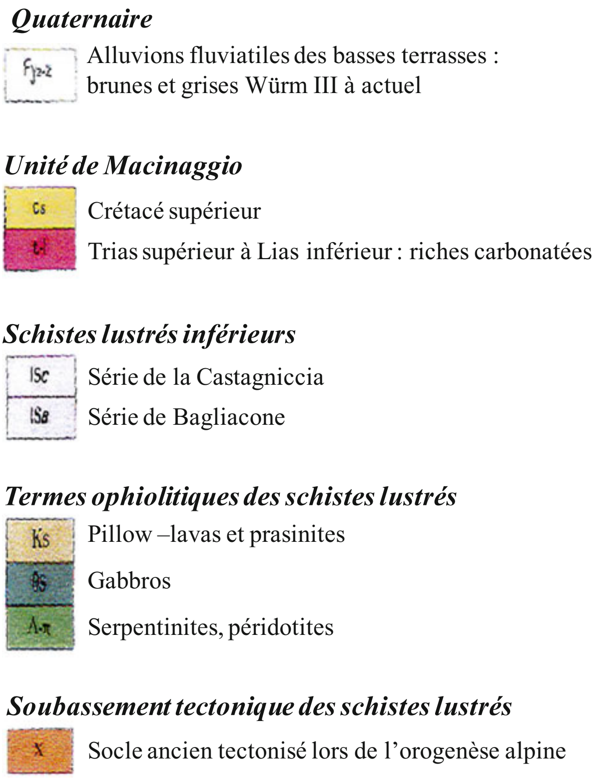

Fig. 7 (continued)

- coastline of fine sand (Porticciolo, Farinole marine, Gulf of Alisu).
- heterometric sand cord mixed with pebbles (Pietracorbara, Sisco, Miomo, Campu Maggiore, Farinole).
- pebble beach (Finocchiarole Beach, Macinaggio Beach, Morteda Beach, Santa Severa North, Brando, Grigione, Farinole, Campu Maggiore, Farinole, Negru Tower, Nonzo. Before the exploitation of asbestos in Canari, the beaches were reduced to the bottom of modest coves located at the outlet of small rivers.
- marine of the Campu Maggiore stream in the south, Farinole.
- rocky coasts (Fig. 8c) occupy much of the Corsican coastline. Depending on the morphology and degree of compaction of the substrate, there are distinct cliffs with steep slopes, cliffs with variable slopes and more or less wide platforms.
- dune depressions (Fig. 8d) are present in the north of Cap Corse, between Macinaggio and Barcaggio.

Cap Corse includes several satellite islets: Capense, Giraglia and Finocchiarola (Fig. 8e) (AGENC 1989; Delaugerre and Guyot 1995; AGENC 1998; CBNC 2009;

Fig. 8 (**a**) Sandy beach of Maccinaggio; (**b**) Dune of Barcaggio; (**c**) Rocky coast of Agnello; (**d**) coastal backwater pond of Barcaggio; (**e**) Islet of Giraglia

Moneglia et al. 2012). Despite a slightly diversified coastal landscape and a homogeneous appearance, the coastal landscapes of Cap Corse reveal a great diversity of vegetation and habitats whose general organization responds to a salinity gradient from the sea to the inlands Salt-spray deposits vary according to the regime and strength of the prevailing winds (Tramontane, Mistral, Grécale, Libeccio and Sirocco) and the relief and morphology of the coastline (Paradis 2004).

1.2 Biogeography

The Mediterranean biogeographical context has been studied by several authors. Giacomini in 1958 defined a Liguro-Thyrenean Province which includes a Sardo-Corsica district divided into two sectors: a Sardinian sector and a Corsican sector. More recently, Rivas-Martínez (1987) highlighted a biogeographic typology of the Mediterranean up to the provincial level.

Dupias and Rey in 1985, delimit the phytoecological regions of France to 1:1,000,000 based on the distribution of vegetation series, topography and degree of artificialization.

In Corsica, this division represents a delimitation of three geographical areas: the great plains sector, the Corsican schist sector and the Corsican crystalline sector/ Western basins. The Cap Corse is integrated in the Corsican schist sector. The last level of biogeographic integration is the district. In reality, the district corresponds to the sub-watershed scale as it constitutes the hydro-geomorphological base for understanding the rhythms of evolution of the river system and for a better understanding of the natural factors (geological structure, climate) but also anthropogenic factors (land use in particular).

Kingdom: Holarctic

- **Region:** Mediterranean
  - **Subregion:** Western mediterranean
    - **Superprovince:** Italo-Thyrenian
      - **Province:** Corso-Sardinia
        - **Sous province:** Corsica
          - **Sector:** Corsican schist
            - **District 1:** Occidental Cap Corse
            - **District 2:** Luri stream
            - **District 3:** Poggiolo stream

1.3 Bioclimatology

Cap Corse, like the rest of Corsica, is part of the "Mediterranean isoclimatic area", because the climate is characterized by the combination of drought period and a warm period, imposing to the vegetation a water stress of variable period (Daget 1977a, b; Quézel and Médail 2003; Meddour 2010). According to the xeric and rainfall parameters, many ecologists and bioclimatologists have carried out several tests on the bioclimatic terminology of Mediterranean basin. These include Emberger (1955) and Bagnouls and Gaussen (1957), Sauvage (1963), le Houérou

(1971), Quézel (1971), Rivas-Martínez (1981), Quézel and Barbero (1982) and Le Houérou (1989, 1995).

Bioclimatical analysis requires a long chronological series of observations in order to integrate the interannual variations (Guyot 1997; Richard 1997). According to Choisnel (1989) and the World Meteorological Organization (2015), a period of 30 consecutive years allows to define the climatic fluctuations. Averaged climate data are essential to characterize regional climate and recognize altitudinal gradients induced by climatic regimes. The bioclimatic characterization of a territory (Richard 1997) is possible on the basis of average ombric and thermic data.

The available data, from Météo-France and derived data from the analysis of Bruno et al. (2001) do not permit a rigorous characterization of the bioclimate of Cap Corse (Fig. 8, Table 1), often considered "an island in the island". Its relief and longitudinal position related to Corsica make it a particular climatic area. Although the climate have mediterranean characteristics, an average of 1 day of frost and 1 day of snow per year and 60–90 days of rain per year are observed, in particular due to windy episodes of sometimes strong and long western areas (Simi 1964; Bruno et al. 2001; Rome and Giorgetti 2007). The strong rainfall of Cap Corse can be explained by the long, narrow schists blade rising up to 1305 m in its central part: to the north and south, with decreasing altitude, the rain fades and the end of the Peninsula receives only 500–600 mm.

The climate is also characterized by a summer drought, with minimal precipitation values in July generally less than 10 mm (Palanqui and Giorgetti 2004). On the coastline, the average annual temperatures of months are 15–16 °C. The thermal and altitudinal amplitudes of Cap Corse allow to distinguish three climates (Gamisans 1991):

- a maritime mediterranean climate dominated by a strong summer drought and important sunshine, and by abundant rains in autumn. On the coast, average annual temperatures are close to 15 °C, with average winter temperatures between 5 and 8 °C and average summer temperatures between 25 and 26 °C. Temperatures are milder on the east coast due to a foehn effect.
- a mediterranean climate with an average annual temperature ranging from 6 to 15 °C, heavy but irregular rains (400–800 mm), characterized by a long dry

Table 1 Bioclimatic typology of meteorological stations of Cap Corse and Sisco

	Cap Corse	Sisco
Thermicity index	366.9 Lower thermocollinean	523.5 Infracollinean
Continentality index	14.5 Euoceanic	14.7 Euoceanic
Ombrothermic index	2.8 Dry	3.6 Lower subhumid
Period of plant activity	12	12
Average annual rainfall	550.7	732.6
Average annual temperature	16.5	16.7

summer season. The frequent low temperatures in winter and the high thermal amplitudes during the summer are ecologically significant.

- an altitudinal mediterranean climate (600–1200 m) with annual average temperatures between 13 and 10 °C, between 800 and 1500 mm of rainfall and a summer dry season shorter than for the previous climate. Mists and frosts are frequent, as is the persistence of snow until the end of summer in some massifs. Hot summers and cold winters generate high annual thermal amplitudes.

These climatic types, combined with landscape relief, involve ecological altitudinal zonation within Cap Corse (Figs. 9, 10 and 11; Table 1). Different ecosystems take their place from the coast to the supra-mediterranean level. The vegetation reflects the topographical (altitude, exposition) and climatic conditions (Gamisans 1975, 1979a, b; Gamisans and Grüber 1979; Allier and Lacoste 1980, 1981; Gamisans et al. 1981; Boyer et al. 1983; Gamisans 1986, 1991, 2010, 2012):

- the coastal area is located at the thermal level corresponding either to the limit of the lower meso-mediterranean level or to certain sectors at the limit of the thermo-mediterranean level. The dominant and very limiting factor is the presence of salt in spray or in some coastal marshes.
- the thermo-mediterranean level corresponds, from a thermal point of view, to average annual temperatures of 16 °C or more. In the Cap Corse, this level covers small areas
- the meso-mediterranean level extends from 200 m up to 600 m or even 700 m on the sunniest areas. Average annual temperatures are between 16 and 12 °C and an average of the minimum of the coldest month (m) between 5 °C and 0 °C

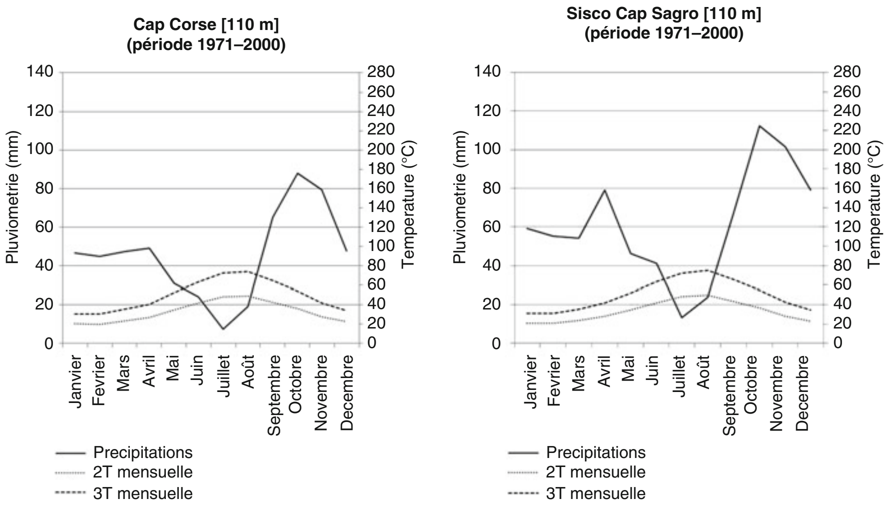

Fig. 9 Ombrothermic diagrams of meteorological stations of Cap Corse and Sisco (From Bruno et al. 2001)

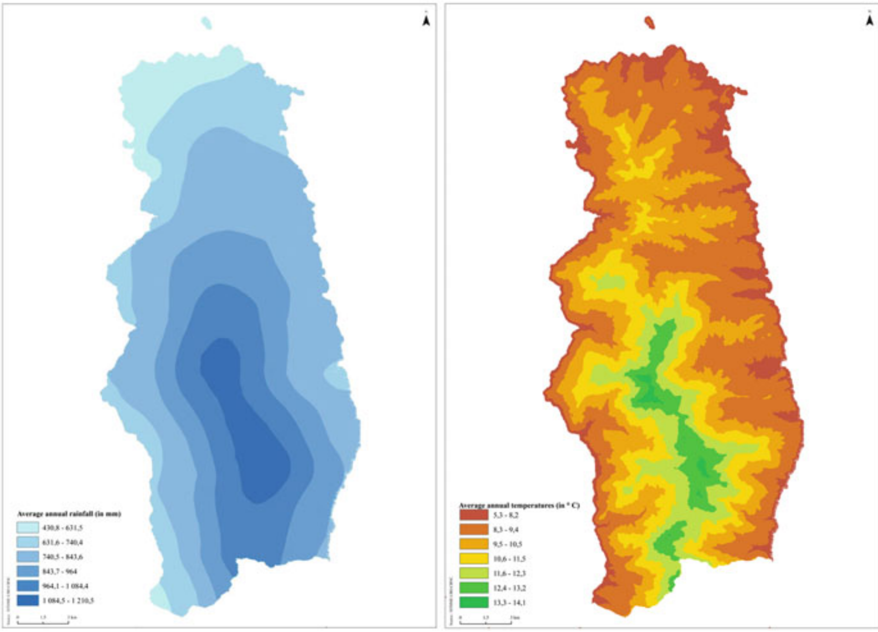

Fig. 10 Average annual rainfall and temperatures of Cap Corse and Sisco (ISTHME, UBO-CBNC)

(possible frosts for several months). The vegetation is characterized by sclerophyllous *Quercus ilex* formations.

- the supra-mediterranean level characterized by an average annual temperature of 12 °C to 8 °C and a m between 0 °C and − 3 °C, extends from 700 to 1200 m altitude. Its landscape is marked by *Genista salzmannii* var. *lobelioides* et *Alyssum robertianum* sub-scrubland.

1.4 Pollenanalytic and Pedoanthracological Knowledge

Palynoecological analyzes based on systematic research, identification and dating of pollens make it possible to better understand the vegetal history of a territory. The palynoecological studies carried out in Corsica (mainly by Maurice Reille) have highlighted the main features of island plant evolution:

- *Quercus ilex* does not appear to have played a role at medium altitude before the Suboreal. Throughout Atlantic, *Erica arborea* represents the climax of medium mountains. During Suboreal, *Quercus ilex* replaces *Erica arborea*, (Reille et al. 1980; Reille 1988a, 1992). The first signs of clearing by fire appear on the diagrams at the beginning of Subatlantic, around 2500 B.P. Throughout Subatlantic, man's action (fire, breeding) leads to the destruction of deciduous

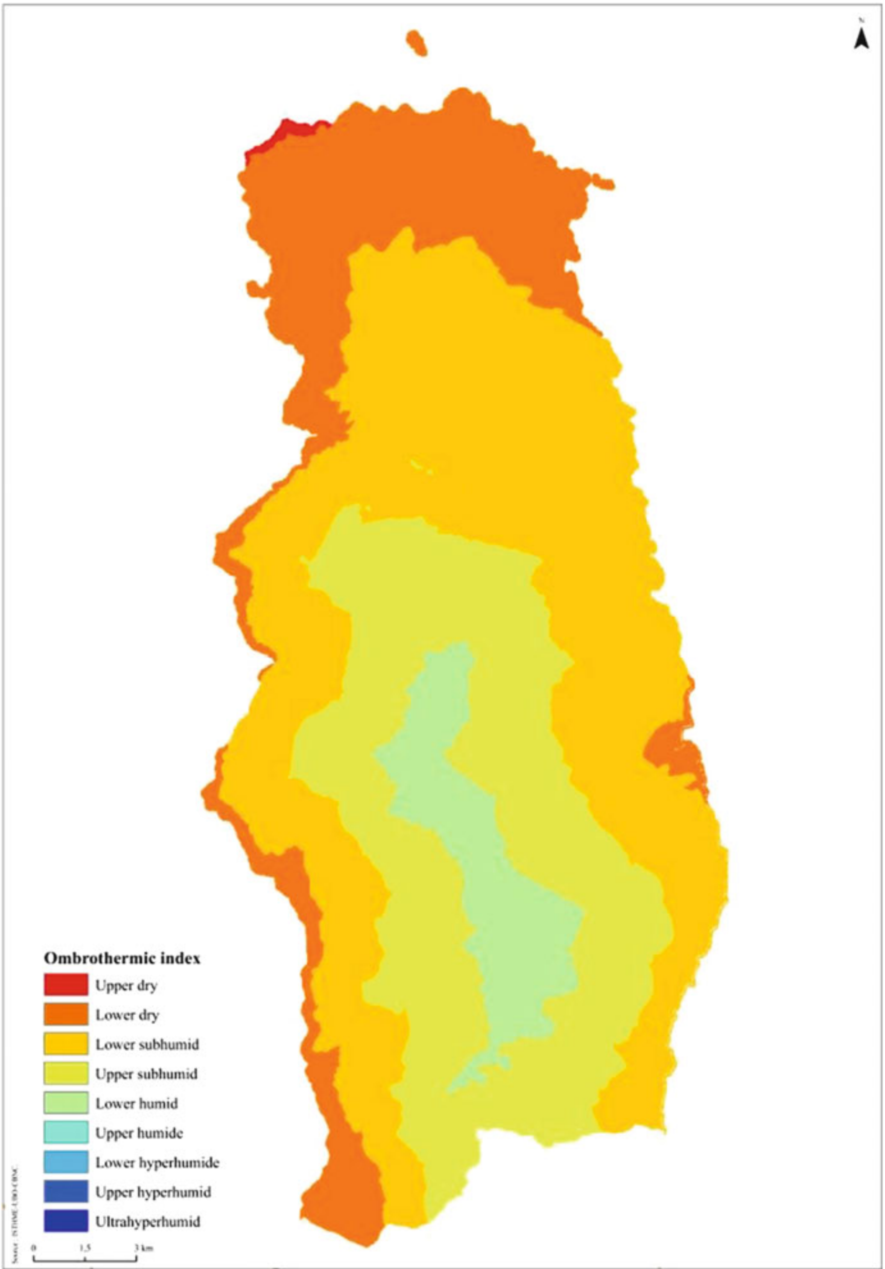

Fig. 11 Omrbothermic index of Cap Corse and Sisco (ISTHME, UBO-CBNC)

oak (and the beech forest) or even the disappearance of these vegetations on certain sectors in the fourteenth century. Since this period, the ecological conditions created by the disappearance of these forests is colonized by substitute vegetation: the *Quercus ilex* forests. The plant relics of the deciduous oak trees (*Querco roboris-Fagetea sylvaticae* Braun-Blanq and Vlieger in Vlieger 1937) are represented by undergrowth of the laricio pine forests (Reille and Pons 1992; Reille et al. 1980)

- Thinon (1998), in its study of the potential area of the pine laricio in Corsica, analysed charcoals for highlighting the limit of the *Pinus nigra* subsp. *laricio* area. He shows that the area of Pine was more high amounting up to 2090 m (cryo-oromediterranean and alpine level), 300 m above the current limit. At the altitude of 1250 m, the author demonstrates the presence of Pine but also its association with deciduous oaks.
- the palynoecological analyzes carried out in 1980 by Reille et al. show that the clustering of *Pinus pinaster*, which is widespread in the upper meso-mediterranean, is a paraclimactic vegetation.

To rely entirely upon the current "pollen-climate spectrum" implies that today pollen-producing vegetation accurately reflects the climate (Pons and Quézel 1998). However, many studies show that humans have shaped vegetation (Leveau et al. 1999). The aim of pedoanthracology is to realize models of reconstitution of woody vegetation burned from wood charcoal stored in the soil. It makes it possible to refine the knowledge on the evolution and the dynamics of the vegetation since 6000 years, in connection with human action (Thinon 1992, 1998). The charcoals observed in the soils rarely belong to the plant that are now dominant but those have been eliminated by fire which is almost never natural in Mediterranean (Quézel and Médail 2003). Human impacts over the last millennium in Mediterranean region has induced a vegetation which does'nt accurately reflect the real potential of climate and substrates (Pons and Quézel 1998).

Use changes of sclerophyllous vegetation has led a different evolution since the beginning of the twentieth century. The context of pastoral society, agricultural abandonment, abandonment of domestic wood heating and human pressure are decreasing, leading an increase in biomass and ecosystem diversity (Blondel 1986). Since Holocene (10,000 BP), the floristic composition of vegetation of Corsica has little changed, although it has undergone altitudinal oscillations due to climatic variations (Reille 1975). The major upheavals of the plant landscape during the last millennium result from anthropogenic action (Gamisans 1991). Since one century, wooded areas have increased, as a direct consequence of the desertification of the countryside and the reduction of agricultural land (impact of the two world wars). In absence of major fires and wood exploitation, it is likely that the differences observed are related to the difficulty of evaluating large areas of wooded scrubland (IFN 1988, 2006). Despite the fires, afforestation rate of Corsica continues to increase, particularly in Cap Corse, Eastern Plain and Balagne (IFN 1988, 2006).

1.5 Fires: A Regression Factor of Vegetation Cover

If forest fires have remained until Holocene, natural phenomena linked to lightning, human action played a major role in rejuvenation and dynamics of Mediterranean vegetation for a millennia (Carcaillet et al. 1997; Quézel and Médail 2003; Carcaillet and Leys 2012). The fires regime, recurrent and increasingly intense, has profoundly altered the structure of the substratum and the density and coverby vegetation, formerly forested (Reille et al. 1980; Pons and Quézel 1985). The shorter and more intense fires helped to eliminate these vegetations and promoted the installation of *Quercus ilex* (Gamisans 1986).

Mesléard (1988) highlighted the role of *Arbutus unedo* in soil preparation and in the dynamics of vegetation. The important accumulated litter, rich in organic matter, allows the development of mycorrhizae, essential for the colonization of thickets species such as *Quercus ilex*. *Quercus ilex* individuals recover a soil rich in humus with a good water retention for surviving during the dry season. When the soils are dry, as it is the case in heaths, the phenomenon of pedogenesis is difficult to realize. Vegetation dynamics become slower, sometimes blocked, when soils are too thin (Richard 1998, 2004).

Fires are undoubtedly the most regressive degradation factor in the Cap Corse (Fig. 12). These fires are the result of a combination of natural and socio-economic factors.

1.6 Socio-economic and Historical Context of Cap Corse

As everywhere in Corsica, the villages of Cap Corse remain until the middle of the twentieth century on a quasi-autarchic working prinniple. This mountain farming (terraces, plateau, crest), practiced in a context of self-sufficiency, was based on a system of crop-pasture-fallow rotation (Ravis-Giordani 1983). The vast area of Agriates that was cultivated provided the resources needed to feed the population and provided opportunities for bartering with other regions (CTC 2014a, b).

From the second world war, the harsh living conditions and the transition to a market economy favored the rural exodus and led to a very strong economical decline (Simi 1981; Arrighi and Giorgetti 1985; Lorenzi 2002). In Cap Corse, economic activity was and is still directed towards the sea. Centuri is the first French harbour for lobster fishery, with up to 20 fishermen in 1950, practicing inshore fishing with noble fish (red mullets, pageots, morays, dentists). Today, while the lobster fishery remains the main activity of the sector, some professionals are moving towards the tuna fishing (Ravis-Giordani 1988).

The first vines grown on the current areas of Cap Corse since the seventeenth century were devastated by the phylloxera in 1873. These farms experienced since the 1950s, like the Gioielli farm which was bought in 1952 by Ange-Louis Angeli to an old Genoese family. Two decades later, Capcorsin winemakers initiated a quality

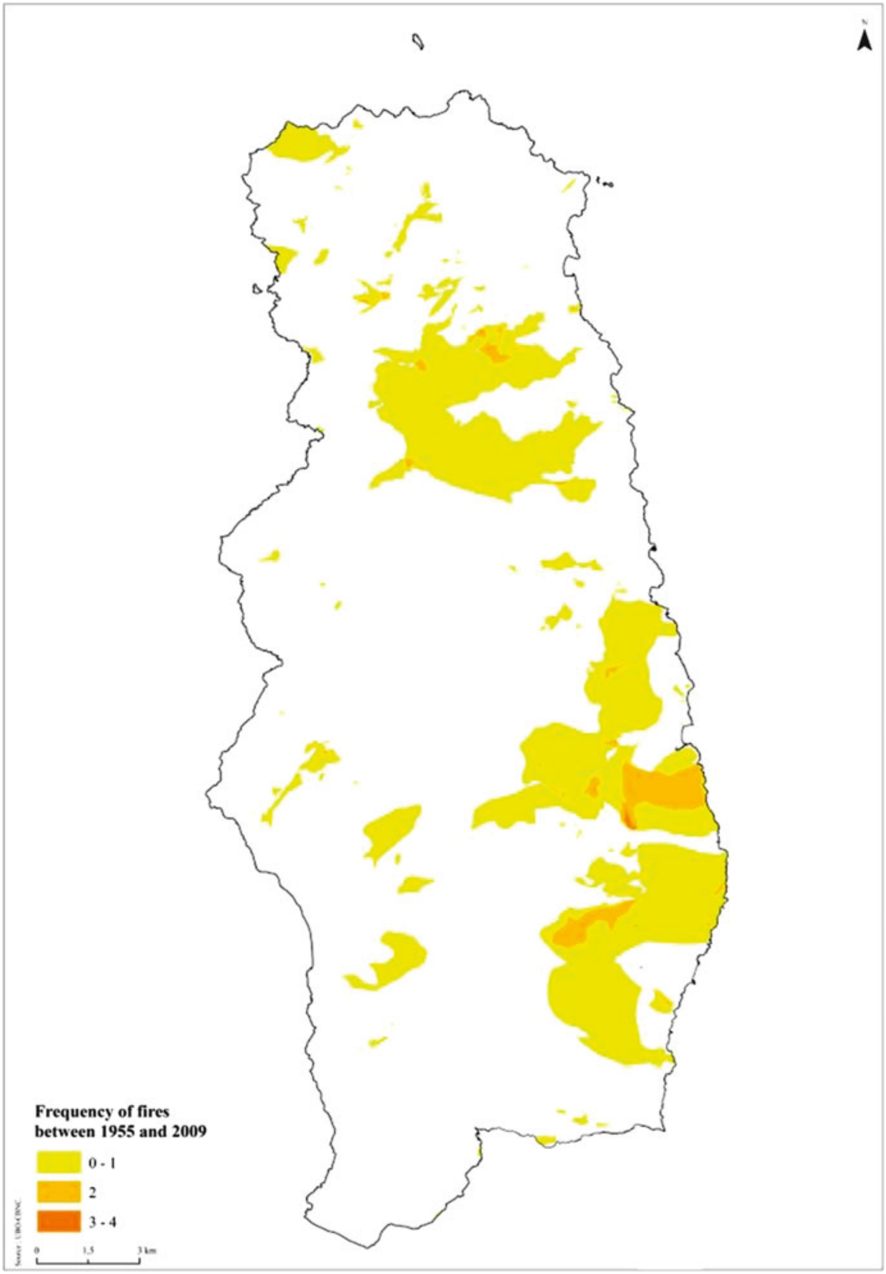

Fig. 12 Frequency of fires between 1955 and 2009 on Cap Corse (after map databse of Office du Développement Agricole et Rural de Corse)

approach with the creation in 1976 of the AOC "*Coteaux du Cap Corse*", followed in 1993 by the AOC "*Muscat du Cap Corse*" (also attached to the AOC Patrimonio). With a production destined to 80% for local consumption and 20% for export, five domains now share these two appellations: Domaine De Pietri occupies 11 ha in the town Morsiglia; Domaine Pieretti covers 11 ha mainly in Luri, with some plots on Pietracorbara and Meria; Clos Nicrosi counts 18 ha (of which 8 in restructuring—2010) in Rogliano; Domaine De Gioielli covers 15 ha in Rogliano, 10 of which are dedicated to production; Finally, the Casa Angeli, the smallest vineyard of Corsica, on one hectare.

The present landscape bears stigma of the past. Many vestiges remain as the old terraces built around the villages (Fig. 13), up to astonishing altitudes, as well as former wheat threshing areas ("aghja" in corsican) up to 1000 m altitude (Simi 1974).

The largest deposit of French asbestos is in the municipality of Canari. From 1949 to 1965, this mine, dubbed "the white hell" by miners, was operated by a subsidiary of Eternit. The deposit was discovered in 1926 and the mine was industrially exploited from 1948 under very poor hygiene and insalubrity conditions, which were obscured for decades and which were denounced later on in view of the miners. The environment was not spared, as all the waste from the mine have been discharged into the sea from the top of the cliff. In 17 years, under the influence of ocean currents, these deposits will clog the marine of Albu (Ogliastro) and Nonza and form a range that places will win up to 300 m of the sea. Asbestos production reached 25,500 tonnes in 1960. In 1965, when it was closed, the factory employed 300 people among which 79% were locals.

1.7 Phytosociological Knowledge of Cap Corse

The first phytosociological study of Cap Corse concerned terrestrial plant communities and biocenoses and marine biotopes (Molinier 1959), followed by a mapping of terrestrial plant groups (Molinier 1962), coastal vegetation analysis (Géhu and Biondi 1994) and habitats of rocky coast description (Paradis 2010). The study of coastal vegetation of Cap Corse (Géhu et al. 1987; Géhu et al. 1990; Paradis and Tomasi 1991; Géhu and Biondi 1994; Paradis et al. 1994; Paradis 2010; Paradis et al. 2013; Piazza and Paradis 1997, 1998; Piazza and Paradis 2002; Paradis 2014) were realized on different substratums (rocks, sand, pebble alluvium, torrential alluvial deposits). Other phytosociological investigations realized on the islets of the Cap (Delaugerre and Guyot 1995; AGENC 1998; Biotope 2006; Moneglia et al. 2012). The temporary pond of Barcaggio was studied in 1991 by Paradis and Tomasi. Paradis (2013) realize floristic and phytosociological inventories of several temporary ponds of Corsica. Complementary studies have been carried out on temporary ponds (Lorenzoni 1997; O.E.C. 2002; Paradis et al. 2009). The serpentinicole vegetation of meso-mediterranean level was studied by Gamisans (2000) and Marsili (2004). In 2004, in the framework on the impact of the "ridge path" and "wind farm"

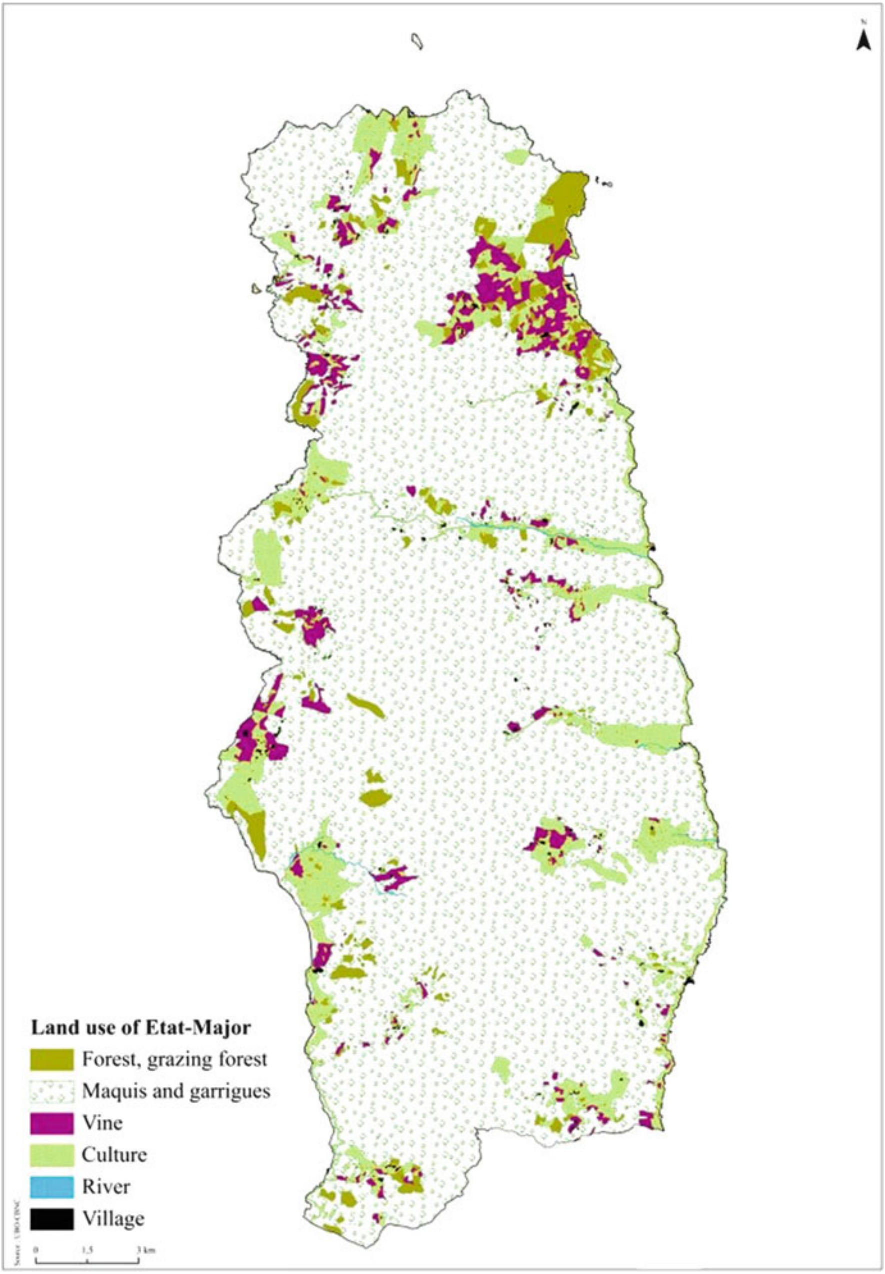

Fig. 13 Map of the land use of État major, sector of Cap Corse

projects, Gamisans inventoried the flora and vegetation of the non-forested crests of Cap Corse. He highlighted the vegetation dynamics after the 2003 fire. In 2000, Angiolini and De Dominicis carried out a study on the synecology of *Santolina corsica* communities.

Technical report of two Natura 2000 sites « FR9400568—Cap Corse nord & îles Finocchiarola, Giraglia, Capense » and « FR9400569 Crêtes du Cap Corse, vallon de Sisco » established a typological and mapping inventory (Biotope 2006; Moneglia et al. 2012).

Gauberville (2010) has established a frame of reference for forestry vegetation, based on several studies (Gamisans 1975, 1979a; Gamisans and Grüber 1979; Gamisans 1981; Gamisans et al. 1981; Boyer et al. 1983; Gamisans 1983). More recently, swampy and riparian forests have been studies (Gamisans 2013).

In parallel, punctual studies carried out by CBNC showed, on the one hand, the interest and originality of vegetation systems (Reymann et al. 2016). Since 2010, the CBNC undertook several phytosociological studies of Corsican vegetation:

- *Myrtus communis* vegetation (Anquez 2010);
- wet meadows (Reymann 2011);
- thermo-mediterranean maquis to supramediterraneens (Lejour 2012; Aurière 2013);
- ruderal vegetation (Delaporte 2013; Vasseur 2014);
- oak forest (Romeyer 2014).

The contributions of Prodrome of France Vegetation allow to refine the synsystematic declination of many vegetations (de Foucault 2011, 2012; de Foucault et al. 2012a, b); de Foucault and Bioret 2010; de Foucault and Catteau 2012; de Foucault 2013, 2015, de Foucault and Catteau 2015).

Table 2 summarizes all the habitats of community interest (Bissardon et al. 1997; Rameau et al. 2001; Gaudillat et al. 2002; Bensettiti et al. 2001, 2004; Bardat et al. 2004; Bensettiti and Herard-Logereau 2004; Bensettiti et al. 2005; Biotope 2006; Moneglia et al. 2012) (Fig. 14).

1.8 Flora

The presence of *Juniperus oxycedrus* subsp. *macrocarpa* in the Cap Corse constitutes a real heritage interest (A.G.E.N.C 1987). In Corsica, scrubland with *Juniperus oxycedrus* subsp. *macrocarpa* evolves under particular ecological conditions: a warm climate and an essentially sandy substrate. Fire, trampling by livestock, human frequentation of the site disturbed the growth and regeneration of *Juniperus oxycedrus* subsp. *macrocarpa* vegetation (Paradis 1991, 1993).

Vitex agnus castus and *Nerium oleander*, infrequent species in Corsica, are present in Cap Corse (Fig. 15.). A protected species accordin to the Flora-Fauna Directive is also present: *Woodwardia radicans* (Delage 2010). The species

Table 2 Habitats of Community interest in Cap Corse

Habitat	Natura 2000	Statut	CORINE BIOTOPE
Dune *Juniperus* thicket sat *Juniperus* spp. Lycian juniper thickets with *Juniperus phoenicea* subsp. *turbinata*	2250-1 and 2250-2 ×5210	P	16.272 and 32.1322
Mediterranean amphibious small herb communities Mediterranean amphibious *Crypsis* swards	3170-1 et 3170-3	P	22.3418 et 22.343
Mediterranean annual communities of shallow soils of *Thero-Brachypodietea retusi* torgrass swards	6220	P	34.511 et 34.513
Sand beaches above the driftline of *Euphorbion peplis*	1210-3	IC	16.12
Western Tethyan sea-cliff communities (*Critmo-Limonietalia*)	1240-2 et 1240-3	IC	18.22
Inland saltmarshes of *Juncion maritimi* and *Plantaginion crassifoliae*	1410-1 et 1410-2	IC	15.51 et 15.53
Shifting coastal dunes Western Tethyan embryonic dunes of *Sporobolo arenarii-Elymenion farcti*	2110-2	IC	16.2112
Western Tethyan white dunes at *Ammophila arenaria* Dunes (*Ammophilion australis*)	2120-2	IC	16.2112
Coastal stable dune grassland (grey dunes) Tethyan dune deep sand therophyte communities	2230-1	IC	16.228
Mediterranean tall humid grassland of lowlands (*Molinio-Holoschoenion*)	6420	IC	37.4
Galleries at*Salix alba* and *Populus alba* Corsican *Alnus cordata* and *Alnus glutinosa* galleries	92A0-4	IC	44.531
Southern riparian galleries and thickets (*Nerio-Tamariciteae* and *Securinegion tinctoriae*)	92D0-2	IC	44.812
Meso-Mediterranean *Quercus ilex* forests	9340-11	IC	45.315
Mediterranean evergreen *Quercus rotundifolia* woodland	9340	IC	45.3

Fig. 14 Example of habitats of Community interest. [1] Western Tethyan sea-cliff communities (*Critmo-Limonietalia*). [2] Mediterranean tall humid grassland of lowlands (*Molinio-Holoschoenion*)

Fig. 15 [1] *Vitex agnus-castus* and *Nerium oleander*. [2] *Santolina corsica*. [3] *Erica multiflora*

develops in warm shady ravines with high atmospheric humidity, above torrents, on siliceous soil, up to 0 and 550 m.

Many rare and localized, as *Cressa cretica* or *Erica multiflora*, are identified in Cap Corse (Fascetti 1997; Paradis and Lorenzoni 1999).

2 Method

The plant landscape, integrating various elements of natural, semi-natural and anthropogenic vegetation, is the result of spatio-temporal interactions expressed at different organizational levels (Burel et al. 1992; Tatoni 1992; Burel and Baudry 1999). Today, the diversity and structural patterns of the plant landscape remain relatively unknown, limiting the understanding of interactions between plant communities and ecological factors.

Different levels of organization of the plant landscape can be specified in an increasingly complex order: organisms (individuals), plant communities, complexes of plant communities (landscapes), phytosphere (Boullet 2003). The dynamico-catenal phytosociological methodology allows this systematic and integrated approach of all the biotic and abiotic components and the complexity of the ecological systems of the plant landscape (Géhu 2006). This methodology represents a pragmatic tool to analyze the plant landscape, from the plant association, to the vegetation series up to vegetation geoseries (Béguin et al. 1979; Géhu 1979). The analysis of a large number of reference publications in dynamico-catenal phytosociology, revealed divergences of approaches and concepts according to time scale, scientific fields (ecology, biology, botany), ecological cultures and scales of analysis (Chalumeau and Bioret 2013).

The dynamico-catenal phytosociological methodology includes several phases: a first synthesis phase link to the compilation of all available data on the study area; A field phase devoted to the individualisation of homogeneous ecological envelopes, then to the realization of synrelevés and geosynrelevés; A phase of statistical analysis of data and cartographic production (Mériaux and Géhu 1977; Béguin et al. 1979; Géhu and Rivas-Martínez 1981; Rivas-Martínez 1982; Géhu 1986, 1991b; Theurillat 1992a, b). The method used in this work is that developed in previous work on the Asco Valley (Delbosc 2015; Delbosc et al. 2015a, b).

2.1 Phytosociological Characterization

The phytosociological surveys were carried out according to the sigmatistic phytosociological method (Braun-Blanquet 1928; Guinochet 1973; Géhu and Rivas-Martínez 1981; Delpech 1996). The synnomenclature and the synsystematic follow the Prodrome of french vegetations (Bardat et al. 2004) up to the rank of the alliance or the sub-alliance, and the Prodrome of Corsica vegetations up to the rank of the sub-association (Reymann et al. 2016), supplemented by additional bibliographic research. The floristic nomenclature follows Flora Corsica (Jeanmonod and Gamisans 2013). Vegetation that have not been phytosociologically linked are described precisely (structure, physiognomy, synecology, syndromics, synchorology, synfloristics, variations...). The synnommenclature follows the recommendations of the International Code of Phytosociological Nomenclature (Weber et al. 2000).

2.2 Symphytosociological Characterization

The phase of symphytosociological work resides in the definition of homogeneous ecological envelopes named tessellas (Tüxen 1979; Géhu 1991a). It consists in a supperposition of ecological data (geology, geomorphology, pedology and bioclimatology):

- ecological data (geology, geomorphology, topography soil. . .) (Rossi and Rouire 1980a, b; Rossi et al. 1994; Rouire 1980; Demartini and Favreau 2011a; Dupias 1963);
- vegetation data (phytosociological maps, habitat maps) (Gamisans (1991; Géhu and Biondi 1994; Gamisans 2004; Biotope 2006; Paradis 2010);
- land cover data (maps of État Major (1820–1866); Corine Land Cover (Bossard et al. 2000).

2.2.1 Synrelevés

Synrelevés or sigmarelevés must be carried out in a very homogeneous territory from the dynamic point of view, that is to say within a single "tessella", in a single potentiality to a single climax vegetation. It is advisable to look for places where there are as many substitution steps as possible (Géhu and Rivas-Martínez 1981).

The choice of area to realize a synrelevé is determined by the search for an ecological homogeneity and of series individuals presenting an important phytocœnotic diversity. The delimitation of tessella represents a fundamental step and requires an understanding of the ecological parameters that determine the distribution of potential vegetation (Fig. 16).

In the first time, it is important to focus on the tessellas with well-expressed climax vegetations. Analysis of the ecological variability of the topographic, soil and

Fig. 16 Delimitation to realize synrelevés on a tessella. Example on *Galio scabri-Querco ilicis* sigmetum. The methodological choice is achieving synrelevés on environmentally homogeneous areas: in this case a single tessella receives several individuals of vegetation series

geological compartment provides important information for the delimitation of tessellas with herbaceous groups.

2.2.2 Geosymphytosociological Approach for Coastal Vegetation

Inspired by spanish and italian symphytosociological works (Rivas-Martínez 1976, 1987; Loidi et al. 2011; Blasi 2010), the study carried out since 2012 by Demartini et al. (2015), within the framework of CarHab program, it was possible to develop a methodology for the inventory and mapping of geopermaseries and geominoriseries of coastal vegetation on the French Manche-Atlantic coast (Demartini 2016). In 2013, this methodology was transposed to Cap Corse (Delbosc 2015).

Geomorphological diversity (sandy beaches, rocky coasts, salt meadows, etc.) and bioclimatology of coastal environments in Corsica induces a diversity of biotopes and an originality of phytocoenoses (Géhu and Biondi 1994). The coastal area concerns the environments directly or indirectly influenced by the sea on a land fringe not exceeding 200 m, and at altitudes still less than 100 m (Gamisans 1991; Paradis 2010). In view of the extreme ecological conditions (spray, wind, climatic drought, nature of the substratum), flora of plant communities is very singular and the dynamics of the vegetation is blocked (permaseries) or truncated (minoriseries) (Rivas-Martínez 2005a; Lazare 2009).

On coastal, permaseries and minoriseries are organized in belts parallel to the sea and occupy areas most often reduced. It seems more pertinent to work at the level of higher landscape integration: the geosymphytosociological level. The neighboring permaseries, of which the permatesselas are situated in a catenal arrangement, are united in a geopermaseries (Fig. 17).

2.2.3 Geosynrelevés or Geosigmarelevés

The geosymphytosociological method is based on the definition of ecological and geomorphological homogeneous envelopes or catenas. For coastal, the delimitation of these entities amounts to distinguishing the different geomorphological systems from the coastal feature (AGENC 1994; Paradis and Piazza 1996; Paradis 2010):

- sand beaches;
- pebble beaches;
- dune systems;
- rocky coasts;
- salt meadows;
- back-dune depressions;
- brackish estuaries.

Each homogeneous geomorphological unit can then be subdivided into one or more entities, in order to distinguish the geopermaseries, the geominoriseries and the

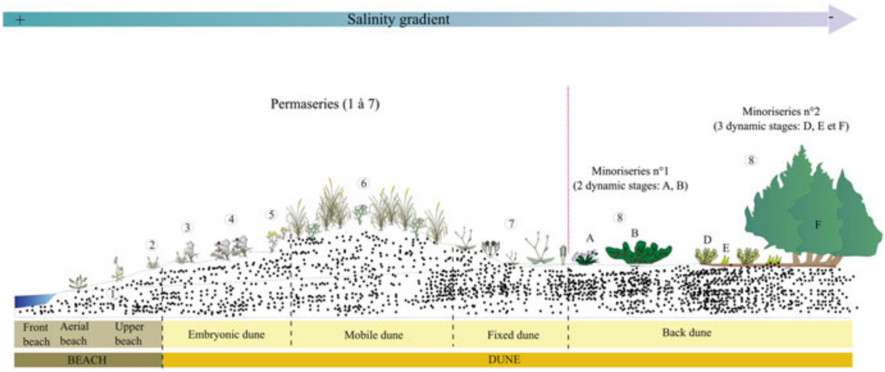

Fig. 17 Organization levels of coastal plant landscape (Delbosc 2015). (1) *Salsolo kali-Cakiletum maritimae*; (2) *Sporoboletum arenarii*; (3) *Sporobolo pungentis-Elymetum farcti;* (4) *Eryngio maritimi-Elymetum farcti*; (5) *Sileno corsicae-Elymetum farcti otanthetosum maritimi;* (6) *Echinophoro spinosae-Ammophiletum arundinaceae;* (7) *Pycnocomo rutifolii-Crucianelletum maritimae;* (8) *Helichryso italici-Cistetum salviifolii*; (9) *Pistacio lentisci-Juniperetum macrocarpae*

Fig. 18 Example of transects made in Cap Corse on the coast [1] and in the mountains [2]

possible series. After the spatial delimitation of the homogeneous ecological envelopes, we proceeded to the realization of geosynrelevés following the classical methodology developed in the part "Symphytosociological characterization".

At the same time, transects are realized to the bottom of the valleys to the crests of study area (Fig. 18). Along these transects, it is necessary to identify the succession of plant communities and to define their distribution and disposition according to an ecological gradient.

The combination of these two methods allows to identify, on the field, the spatial boundaries of the homogeneous ecological entities from the point of view of the ecological factors: substrate, geology, exposition, slope...

2.3 Mapping of Vegetations Series and Geoseries

The mapping work was carried out under the ArcGIS 10® software. For geographic information system, a geodatabase was organized from a database of the type "dynamic relations". Each individual of series is represented by a polygon. The final map rendering represents only the natural potential vegetation. The mapping rendering is planned at 1/25,000 and the field minutes have been realized from 1/2000 to 1/5000.

In the absence of a conventional representation or a national semiological code for graphical representation of vegetation series maps, it has proved important to define principles based on certain nomenclatural semiological principles making it possible to distinguish the fundamental landscape units: permaseries, minoriseries, series, geopermaseries, geominoriseries, geoseries. The second parameters to be taken into account is the color code, using the principles of the phytogeographs work (Gaussen 1933, 1936, 1954, 1961; Dupias 1963; Dupias et al. 1965): orange have been attributed to the mediterranean vegetation, the sub-Mediterranean vegetation has been transcribed in yellow and green, and the montane vegetation is represented by cold colors (blue, purple).

Some choices have been made with regard to the standard defined by European phytosociologists (Géhu 1986; Rivas-Martínez 1987, 2005b; Lazare 2009; Blasi 2010; Biondi et al. 2011):

- in the altitudinal areas, with permaseries occupying very small surfaces, it is essential to work at the level of higher landscape integration, that is to say the geosymphytosociological level. Neighboring permaseries, whose microtesselas are located in a catenal arrangement, are combined into a geopermaseries (Lazare 2009; Rivas-Martínez 2005b, 2007). This is the case of coastal areas, where the various characteristic syntaxa occupy areas often less than half a hectare;
- within certain series, outcrops, anfractuosities or rock slabs containing permaseries are considered as "associated permaseries".

Each series and geopermaseries is the subject of a description and a dynamic diagram. Eachfile is organized according to the following scheme:

Diagnose: Type of series, chorology, bioclimate, lithomorphology, ecology, vegetation level, standardized French name.

Sigmaecology (geology, geomorphology, pedology, exposure, altitude, vegetation level, bioclimate)

Sigmachorology (distribution, general distribution)

Sigmastructural

Structural diagnosis of the head of series (physiognomy, structure, floristic composition, biotic factors).

Structural diagnosis of the stages of the series (progressive and regressive stages, dynamic trajectories)

Sigmasystematic (table, characteristic syntaxa)

Conservation issues (Rarity, endemism, remarkable vegetation, Natura 2000 habitats, species habitats, threats, state of conservation, main uses, conservation factors)

Associated vegetations (For each vegetation series, the associated permasiae are numbered [1], [2] and are described in the associated vegetation section).

3 Results

3.1 Phytosociology

490 phytosociological relevés confirmed the presence of 91 plant communities and allow to establish the phytosociological synopsis of Cap Corse (Appendix). Some original syntaxa have been highlighted. Mesoediterranean and supra-mediterranean thickets description is partly based on the synthesis of the maquis of Corsica (Lejour 2012; Aurière 2013; Reymann et al. 2016; Bioret et al. 2017).

In this paper, four new plant associations are described:

- *Umbilico rupestris-Sedetum andegavense*: vegetation of rock slabs, generally located on xerophilous rock outcrops with *Sedum andegavense*;
- *Sedo albi-Notholaenetum marantae*: meso-mediterranean xerophilous vegetation of serpentinite screes with *Notholaena marantae* and *Sedum album*;
- *Galio parisiense-Mercurialetum corsicae*: meso-mediterranean xerophilous vegetation of scree with *Mercurialis corsica* and *Galium parisiense*;
- Riparian meadow with *Oenanthe crocata* and *Dorycnium rectum*.

3.1.1 *Xerophilous* Vegetation of Rock with *Sedum andegavense* (*Umbilico rupestris-Sedetum andegavense* Delbosc and Bioret *ass. nov. hoc loco*) (Fig. 19)

Symphysionomy This vegetation is characterized by perennial grasslands of low height (≈20 cm). It is an open vegetation, often rich in annual species. The typical form of the community is characterized by the presence of crassulaceous species adapted to the summer drought.

Synecology This xerophilous vegetation colonizes skeletal and well-drained soils around slabs and rocky shales.

Synfloristic Flora is characterized by the dominance of crassulaceous species accompanied by some hemichryptophyte species (Table 3).

Specific average number per survey: 5.
Characteristic species: *Sedum andegavense, Umbilicus rupestris.*
Other species: *Trifolium arvense, Scleranthus annuus.*

Fig. 19 Xerophilous vegetation on rocky shales with *Sedum andegavense*

The very specific ecological conditions of these plant communities (well-drained soils around slabs and rocky shales, serpentinites subtrates) allowed to highlight a combination with *Umbilicus rupestris* and *Sedum andegavense* as characteristic of a new proposed syntaxon: *Umbilico rupestris-Sedetum andegavense* Delbosc and Bioret *ass. nov. hoc loco*. *Sedum cepaea*, *Sedum rupestre* and *Polypodium cambricum* represent rocky neutrophilous lawns, more or less shaded.

Syndynamic, Contacts This vegetation corresponds to permanent vegetation because they evolve in drastic ecological conditions. According to the size of the rock slabs, it is possible to observe colonization by associated hem and sub-scrubland elements.

Synchorology This vegetation occurs regularly in the plant landscape of Corsica. Due to the erodibility and higher fragmentation of the schistous substrates, the distribution of these vegetations remains very limited in the Cap Corse region, unlike the granitic substrates on which they are observed more frequently.

Table 3 *Umbilico rupestris-Sedetum andegavense* Delbosc and Bioret *ass. nov. hoc loco* [holotypus: rel. 3]

Rel. n.	1	2	**3**	4	5	6	7	8	
Area (m2)	2	1	**2**	2	2	1	2	2	
Cover (%)	40	25	**40**	60	80	50	40	40	
Altitude	617	69	**245**	246	268	266	246	246	
Aspect	-	-	**-**	SE	SE	SE	-	S	
Slope (°)	-	-	**-**	6	6	6	-	6	
Average vegetation height (m)	0.15	0.1	**0.1**	0.2	0.2	0.02	0.15	0.6	
Species number	2	3	**4**	4	4	3	2	2	Σ
Characteristic species of association									
Sedum andegavense	3.3	1.3	**2.3**	2.3	5.5	3.3	2.3	2.3	**V**
Umbilicus rupestris	+	+	+	+	+	+			**IV**
Another species									
Sedum rupestre				2.3	+	+	2.3	2.3	**IV**
Sedum stellatum		1.3	**2.3**						**II**
Sedum cepaea				3.3	+				**II**
Polypodium cambricum			+						**I**

Geographic localisation of relevés: 1—Campu di a Torre (Cap Corse) 2013/06/05; 2—Martone (Cap Corse) 2013/05/22; 3—Bergerie de Capraja (Cap Corse) 2013/05/22; 4—Stufanacce (Cap Corse) 2013/06/20; 5—Stufanacce (Cap Corse) 2013/06/20; 6—Stufanacce (Cap Corse) 2013/06/20; 7—Stufanacce (Cap Corse) 2013/06/20; 8—Stufanacce (Cap Corse) 2013/06/20

Heritage Value Because of its localized distribution and the small areas of the stations, these grasslands present a strong heritage interest. The presence of *Sedum andegavense*, a protected species, contributes to the patrimonial interest of this vegetation.

3.1.2 *Meso-mediterranean xerophilous vegetation of serpentinite screes with Notholaena marantae and Sedum album (Sedo albi-Notholaenetum marantae* Delbosc and Bioret *ass. nov. hoc loco)* (Fig. 20)

Symphysiognomy Sparse vegetation dominated by *Notholaena marantae* and *Sedum album*.

These are often rich in annual species. The typical form of the community is characterized by the presence of crassulaceous plants adapted to the summer drought.

Synecology This vegetation can be observed in the meso-mediterranean level, on slides consisting of blocks with an interstitial matrix that is essentially stony on schist rocks. It develops on soils constituted by fine elements accumulated between the blocks.

Fig. 20 Vegetation with *Notholaena marantae* and *Sedum album*

Synfloristic These screes are composed of neutrocline species typical of saxicolous vegetation.

Characteristic species: *Notholaena marantae*, *Sedum album*.

Other species: *Umbilicus rupestris*, *Asplenium trichomanes*, *Sedum andegavense.*

This plant communities is close to floristic and ecological *Notholaeno marantae-Silenetum paradoxae* described by Gamisans (2000) but is distinguished by the absence of *Silena paradoxa* and the presence of many species of *Asplenietea trichomanis* (*Sedum album, Asplenium trichomanes, Asplenium adiantum-nigrum Asplenium obovatum, Arenaria serpilifolia*).

According to the species composition recorded in the relevés (Table 4), the plant communities of *Notholaena marantae* could be attached to *Notholaenaetum marantae* P. Silva (1970) belongs to the *Phagnalo saxatilis-Cheilanthion maderensis* (order *Cheilanthetalia maranto-maderensis*, class *Asplenietea trichomanis*), which represents the characteristic vegetation of serpentine outcrops in the western Mediterranean (García-Barriuso et al. 2011).

Table 4 *Sedo albi-Notholaenetum marantae* Delbosc and Bioret *ass. nov. hoc loco* [Holotypus: rel. 10]

Rel. n.	1	2	3	4	5	6	7	8	9	**10**	11	
Area (m2)	5	5	5	8	5	5	8	5	4	**8**	5	
Cover (%)	60	60	70	75	50	65	60	45	40	**80**	30	
Altitude	400	450	406	430	400	460	460	430	452	**435**	462	
Aspect	SE	SE	SE	E	E	E	E	E	SE	**E**	SE	
Slope (°)	14	14	14	10	14	14	14	14	14	**14**	14	
Average vegetation height (m)	0.2	0.2	0.15	0.3	0.15	0.15	0.15	0.2	0.2	**0.2**	0.15	
Species number	4	8	8	9	6	6	6	6	16	**6**	3	∑
Characteristic species of association												
Notholaena marantae	44	44	23	44	34	44	44	3.3	+	**4.4**	2.3	**V**
Sedum album	+	+	44	12	12	12	12	+	1.3	**2.3**		**V**
Species of *Asplenietea trichomanis*												
Umbilicus rupestris		+		+					+		+	**II**
Asplenium trichomanes				+				+	+			**II**
Sedum andegavense									+			+
Asplenium adiantum nigrum					+							+
Asplenium obovatum									+			+
Arenaria serpyllifolia			+									+
Cardamine sp.		12										+
Species of *Cistion ladaniferi*												
Euphorbia spinosa subsp. *spinosa*									1.3			+
Helichrysum italicum subsp. *italicum*									+			+
Scrophularia nodosa										+		+
Stachys glutinosa									2.3			+
Species of *Helianthemion guttati*												
Briza maxima		+				+	+	+	+	+		**III**
Bromus madritensis			+	+	+						1.3	**II**
Lolium perenne			+	+	+	+						**II**
Avena barbata	+					+	+			+		**II**
Brachypodium retusum		+			+				3.3			**II**
Geranium purpureum	+	+		+								**II**
Rumex bucephalophorus subsp. *gallicus*			11					1.3				**I**
Trifolium campestre			+							+		**I**
Asphodelus ramosus						12		+				**I**
Pancratium illyricum							+		+			**I**
Carlina corymbosa									1.3			+
Dactylis glomerata									1.3			+
Geranium robertianum									1.3			+
Lathyrus clymenum									+			+
Petrorhagia sp.				+								+
Poterium sanguisorba							+					+
Papaver rhoeas			+									+
Pteridium aquilinum		+										+
Trifolium arvense				+								+

Geographic localisation of relevés: Col de San Stefano, San Giovanni—Cap Corse (2013/06/27)

Our relevés are impoverished compared to the Levantine Mediterranean (eastern Iberian Peninsula) and many species as *Alyssum serpyllifolium* subsp. *lusitanicum, Anogramma leptophylla, Anthyllis vulnearia* subsp. *sampaioana* are absent. We choose to define a new plant communities with *Sedum album* and *Notholaena marantae* which may represent a vicariant *Notholaenaetum marantae* P. Silva 1970 in central Mediterranean areas. Since *Notholaena marantae* is the only characteristic taxon of the order *Cheilanthetalia marantomaderensis*, it may represent a basal community of the order with *Sedum album*.

Our relevés allowed to highlight a combination with *Sedum album* and *Notholanae marantae* as characteristic of a new proposed syntaxon: *Sedo albi-Notholaenetum marantae* Delbosc and Bioret *ass. nov. hoc loco.*

Syndynamics, Contacts This vegetation corresponds to permanent vegetation due to the drastic mesological conditions. Depending on the size of the rock slabs, it is possible to observe colonization by associated heath (*Stachyo glutinosae-Genistetum corsicae* Gamisans and Muracciole 1984).

Synchorology This vegetation occurs regularly in the vegetal landscape of Corsica. Due to the erodibility and higher fragmentation of the schistous substrates, its distribution remains very limited in the Cap Corse region. In the Mediterranean, the presence of *Notholaena marantae* in Tuscany has a thyrenian distribution (Selvi 2007).

Heritage Value The restricted distribution area and the ecological conditions provide a high heritage value to this vegetation.

3.1.3 Meso-Mediterranean xerophilous Vegetation of Screes with *Mercurialis corsica* and *Galium parisiense (Galio parisiense-Mercurialetum corsicae* Delbosc and Bioret *ass. nov. hoc loco)* (Fig. 21)

Symphysionomy This grassland is generally characterized by the abundance of *Mercurialis corsica* and *Galium parisiense* with many perennial species (*Stachys glutinosa*, *Euphorbia spinosa* subsp. *spinosa*, *Helichrysum italicum* subsp. *italicum*).

Synecology This vegetation is present on skeletal soils rich in coarse elements, a few centimeters thick, drying strongly in summer. It develops on fine elements accumulated between the blocks, often the less mobile substrate, at the periphery of the scree.

Synfloristic

Characteristic species: *Mercurialis corsica*, *Galium parisiense*
Other species: *Stachys glutinosa, Brachypodium retusum*

Syndynamics, Contacts Its position on the periphery of the scree, on stabilized subsrates and the presence of numerous species of sub-scrubland of the *Stachyo glutinosae-Genistetum corsicae* suggests that this vegetation can evolve towards these sub-scrubland. Further surveys would confirm this hypothesis.

Fig. 21 Vegetation with *Mercurialis corsica and Galium parisiense*

Synchorology In Cap Corse, this vegetation is observed regularly at low altitudes (200–300 m). On the rest of the island, the presence of *Mercurialis corsica* in different valleys of Corsica suggests that this vegetation could express on varied altitudes (Migliore et al. 2011) (Table 5).

No plant communities at *Mercurialis* corsica were identified until today. Gamisans (1991, 2000) indicates the presence of *Mercurialis corsica* within *Genisto salzmannii-Alyssetum robertiani.* Bioret and Sturbois (2009) note the punctual presence of *Mercurialis corsica* within the thermophilous screes on the ridges of the "Col de Teghime". The authors relate these vegetations to the *Pimpinello tragium-Gouffeion arenarioidis* Br.-Bl. *In* Br.-Bl., Roussine and Nègre 1952.

Mercurialis corsicae is an endemic species of Corsica and Sardinia. Our relevés allow to define a plant communities with *Mercurialis corsica* and *Galium parisiense* (*Galio parisiense-Mercurialetum corsicae* Delbosc and Bioret *ass. Nov. hoc loco*) in Corsica but we don't confirm currently if this vegetation is present in Sardinia. More

Table 5 *Galio parisiense-Mercurialetum corsicae* Delbosc and Bioret *ass. nov. hoc loco* [Holotypus: rel. 8]

Rel. n.	1	2	3	4	5	6	7	**8**	
Area (m2)	8	7	4	7	8	10	7	**8**	
Cover (%)	70	80	80	100	100	80	70	**40**	
Altitude	440	425	423	423	516	428	428	**602**	
Aspect	E	E	E	E	E	E	E	**E-SE**	
Slope (°)	27	27	27	27	27	27	27	**27**	
Average vegetation height (m)	0.3	0.4	0.3	0.3	0.2	0.2	0.3	**0.3**	
Species number	14	11	13	17	19	8	8	**14**	**Σ**
Characteristic species of association									
Mercurialis corsica	44	45	45	4.4	4.4	55	2.3	**4.4**	
Galium parisiense	+	12	22	2.3	+	11	+	+	**V**
Species of Teucrion mari									
Stachys glutinosa	12	12	23		1.3	12	2.3	+	**V**
Helichrysum italicum	ij	+							**II**
Euphorbia spinosa subsp. *spinosa*								**1.3**	**I**
Stachys corsica				3.3					**I**
Teucrium marum						+			**I**
Species of *Asplenietea trichomanis*									
Asplenium adiantum-nigrum	12	12	+	+					**III**
Umbilicus rupestris	+	+	+	+	+			+	**IV**
Notholaena marantae	+				+		1.3	+	**III**
Asplenium obovatum					+			+	**II**
Sedum album	+				1.3			+	**III**
Asplenium trichomanes				+					**I**
Sedum andegavense								+	**I**
Sedum cepaea				+					**I**
Another species									
Brachypodium retusum	23	33	22	1.3	2.3	22	3.3	+	**V**
Avena barbata	+		+	+	1.3	+	1.3	+	**V**
Carlina corymbosa		+	+		+	+	+		**IV**
Geranium robertianum				+	1.3			+	**III**
Briza maxima	+			+	1.3				**III**
Vicia cracca		+		+				+	**III**
Rubia peregrina		+	11		+				**III**
Geranium purpureum	+		+						**II**
Bromus madritensis				+	1.3				**II**
Rubus ulmifolius			13	+					**II**
Pteridium aquilinum			+		+				**II**
Trifolium campestre			+		+				**II**
Dactylis glomerata				1.3		+			**II**
Sanguisorba minor	+						+		**II**
Allium sp.		+							**I**
Carduus tenuiflorus	+								**I**
Agrostis capillaris subsp. *castellana*					+				**I**
Anthoxanthum odoratum					+				**I**
Dianthus sylvestris subsp. *longicaulis*					+				**I**
Hypochaeris glabra				+					**I**
Lathyrus clymenum				+					**I**
Pancratium illyricum								+	**I**

Geographic localisation of relevés: Col de San Stefano, San Giovanni (2013/06/27) investigations seem to be necessary to clarify its chorology and its floristic composition.

Heritage Value The patrimonial interest of this vegetation must be precised but it appears therefore relatively uncommon in the Cap Corse because it is probably linked to schistous substrates and meso-mediterranean screes. *Mercurialis corsica* is a corso-Sardinian endemic species (Jeanmonod and Gamisans 2013). Although this species is widespread in Corsica and was not threatened until the 1960s (Briquet and de Litardière 1936; Contandriopoulos 1962), the populations of this taxon are decreasing: 60 populations were recorded in 2000 compared to 20 in 2006 (Hugot et al. 2006).

3.1.4 Meso-hygrophilous Meadow with *Oenanthe crocata* and *Dorycnium rectum (Oenantho crocatae-Scirpoidetum holoschoeni* Delbosc and Bioret *ass. nov. hoc loco)* (Fig. 22)

Symphysionomy This dense and high 40–50 cm tall herb vegetation is composed of various hygrophilous to mesohygrophilous species (*Dorycnium rectum*, *Oenanthe crocata*, *Scirpoides holoschoenus*, *Carex microcarpa*, *Mentha aquatica*, *Dittrichia viscosa*), the lower stratum is carcaterized by some species of less height as *Bellium bellidioides* or *Samolus valerandi*.

Synecology This sciaphilous vegetation, grows preferentially in shaded areas near the alder trees of *Alnus glutinosa*. It occupies restricted and discontinuous surfaces bordering streams. It develops on rich, eutrophic substrates and is regularly flooded. The phenological optimum of the vegetation is between may and july.

Synfloristic

Characteristic species: *Dorycnium rectum, Scirpoides holoschoenus, Oenanthe crocata, Juncus acutus* subsp. *acutus, Ranunculus lanuginosus*.

Other species: *Hypericum hircinum, Mentha aquatica, Festuca arundinacea, Scrophularia auriculata, Epilobium hirsutum, Mentha suaveolens.*

Syndynamics, Contacts This vegetation evolves towards wet thickets with *Salix cinerea*. Trampling and steady passage of livestock tend to alter the dynamics towards thickets of *Rubus ulmifolius* and *Pteridium aquilinum*. The vegetation of *Oenanthe crocata* and *Dorycnium rectum* is an integral part of the *Scrophularia auriculata* and *Alnus glutinosa* edaphohygrophilous riparian series. From a catenal point of view, this vegetation is in contact with amphibian vegetations with *Glyceria fluitans* and *Nasturtium officinalis* in the lower levels, and from thermophilous forests with *Viburnum tinus* subsp. *tinus* and *Quercus ilex* in the upper levels.

Synchorology This vegetation is present very sporadically and discontinuously in the creeks of Cap Corse. Additional phytosociological investigations at the scale of Corsica would allow to precize the distribution of this vegetation (Table 6).

Fig. 22 Tall herb meadow with *Oenanthe crocata and Dorycnium rectum*

These hygrophilous plant communities are mediterranean to subtropical grasslands, characterizing the end of the class towards the south, especially differentiated by:

- the great rarity or absence of tall-herb taxa (*Filipendulo ulmariae-Convolvuletea sepium* (Preising apud Hülbusch 1973) Géhu and Géhu-Franck 1987) which confirm that these vegetations must be included in *Agrostietea stoloniferae*;
- the presence of *Scirpoides holoschoenus* and *Dittrichia viscosa*: they are included the order of *Holoschoenetalia vulgaris* Braun-Blanq. ex Tchou 1948 (de Foucault and Catteau 2012).
- These vegetations should not be integrated into the *Agrostio stoloniferae - Scirpoidion holoschoeni* because these meadows are hygrophilous mediterranean on substrate with phreatic level still quite high during the year and are characterized largely by *Molinia caerulea* subsp. *arundinacea, Sonchus aquatilis*, *Juncus acutus* subsp. *acutus*.

Table 6 *Oenantho crocatae-Scirpoidetum holoschoeni* Delbosc and Bioret *ass. nov. hoc loco* [Holotypus: rel. 4]

Rel. n.	1	2	3	**4**	5	6	7	
Area (m2)	10	15	10	**10**	15	15	10	
Cover (%)	100	100	100	**100**	100	100	100	
Altitude	530	245	280	**55**	59	11	250	
Aspect	-	-	-	**-**	-	-	-	
Slope (°)	-	-	-	**-**	-	-	-	
Average vegetation height (m)	1.2	1.1	1.3	**1.2**	0.9	0.8	1	
Species number	11	7	8	**17**	7	4	14	∑
Characteristic species of association								
Scirpoides holoschoenus	1.3	5.5	3.3	**4.4**	3.3		3.3	**IV**
Oenanthe crocata		+	1.3	+	3.3	1.3	1.3	**IV**
Species of *Agrostio stoloniferae-Scirpoidion holoschoeni*								
Holcus lanatus	+	1.3		**1.3**			1.3	**III**
Dorycnium rectum	1.3	1.3	2.3	**3.3**			2.3	**IV**
Mentha suaveolens		2.3		+			+	**III**
Schoenus nigricans			2.3					**I**
Festuca arundinacea			2.3	**1.3**			2.3	**III**
Agrostis stolonifera				**1.3**				**I**
Carex divulsa					2.3			**I**
Juncus acutus subsp. *acutus*			3.3	**2.3**	2.3	5.5	2.3	**IV**
Mentha aquatica			2.3	+			+	**III**
Calystegia sepium				+	2.3	1.3		**III**
Eupatorium cannabinum subsp. *corsicum*								**I**
Rumex obtusifolius							1.3	**I**
Rumex conglomeratus				+				**I**
Species of *Alnion glutinosae*								
Rubus ulmifolius	1.3	2.3		**1.3**	2.3		1.3	**IV**
Hypericum hircinum	+			+				**III**
Ranunculus lanuginosus				+			1.3	**II**
Carex punctata			2.3	**1.3**				**II**
Potentilla reptans		+	+					**II**
Scrophularia auriculata		1.3		+				**II**
Brachypodium sylvaticum								
Equisetum telmateia							2.3	**I**
Rubia peregrina	+							**I**
Osmunda regalis	5.5							**I**
Urtica dioica								
Poa trivialis							1.3	**I**
Carex microcarpa	+							**I**
Epilobium hirsutum								
Species of *Glycerio fluitantis-Sparganion neglecti*								
Veronica anagallis-aquatica				+			+	**II**
Apium nodiflorum							2.3	**I**
Another species								
Dittrichia viscosa				**1.3**	1.3	1.3		**III**
Pteridium aquilinum	2.3		2.3					**III**
Smilax aspera	+	+						**II**
Juncus inflexus								**I**
Samolus valerandi						1.3		**I**
Cyclamen repandum subsp. *repandum*	+							**I**
Asparagus acutifolius	+							**I**
Briza maxima				+				**I**
Typha latifolia					2.3			**I**
Malva cretica subsp. *althaeoides*					+			**I**
Bromus hordeaceus subsp. *hordeaceus*							1.3	**I**

Geographic area: 1—Punta Gravinacce 2013/06/18; 2—Bergerie de Capraja 2013/06/20; 3—village of Piazza 2013/06/27; 4—Punta di Mazzata 2013/06/03; 5—St Léonard 2013/06/06; 6—Monte Maggiore 2013/05/22; 7—Barcaggio 2013/05/02; 8—Guinchetto stream 2013/06/03

Table 7 Type and number of symphytosociological relevés per vegetation level

	Geopermasynrelevés	Minorisynrelevés	Synrelevés	Σ
Coastal area	98	22	–	120
Thermo-mediterranean level	–	–	5	5
Meso-mediterranean level	14	16	149	179
Supraméditerranean level	16	3	30	49
Riparian azonal area	11	–	12	23
	139	41	191	376

- They are close to the *Deschampsion mediae* Braun-Blanq. in Braun-Blanq. et al. 1952 represented by mediterranean wet meadows on often marly substrates that can dry up considerably during the year.

The very specific ecological conditions of these plant communities (thalwegs, flooded in winter and drying up in summer, oligohalin level, serpentinites subtrates): our surveys allowed to highlight a combination with *Oenanthe crocata* and *Scirpoides holoschoenus* as characteristic of a new proposed syntaxon: *Oenantho crocatae-Scirpoidetum holoschoeni* Delbosc and Bioret *ass. nov. hoc loco.* More investigations seem to be necessary to clarify its chorology and its floristic composition.

Heritage Value The threats to this vegetation are related to the small areas of its localities. The restricted chorology of this vegetation, as well as its open character, which makes it a favorable habitat for many faunistic species (insects, birds...), contributes both to its rarity and to its patrimonial value.

3.2 Symphytosociology

371 symphytosociological relevés were carried in this study (Table 7). Sigmetal and geosigmetal units are presented per vegetation level.

3.2.1 Coastal Azonal Units

West coast of Corsica dunes beaches geopermaseries, thermo-mediterranean subhumid to dry: *Sileno corsicae-Ammophilo arundinaceae* geopermasigmetum

Sigmaecology Sandy systems are present in the funds of bays, offshore bars, clogging coves and estuaries of coastal rivers. Bioclimatically, sandy systems depends on wind exposure and their geographic position on the coast: a cooler regime of the west coast and a drier regime of the east coast. Geomorphologically, sandy vegetation systems are distinguished according to the substrate granulometry:

- dune (coastal or continental geomorphological formation, formed by the accumulation of sand transported by wind) [1, 2];
- river-marine terrace (extent of aeolian sand, very heterometric sediments, with a gravel dominance (grain size greater than 2 mm) [3].

Ombrotype: dry upper, lower dry to lower sub-humid. Thermotype: thermo and inframediterranean.

Sigmachorology Sandy and sandy-gravelly systems are present along the coast of the Eastern Plain, between Bastia and Porto-Vecchio (AGENC 1994; Géhu and Biondi 1994; Paradis 2014).

Sigmastructure Sandy gravel geopermaseries are composed by open grassland vegetations. Vegetation sequence is expressed in general over a length of 15–25 m. The transect may be truncated due to urbanization or geomorphological context fixed dune (rocky cliffs, coastal wetlands...).

This endemic corsican psammophilous geopermaseries, heliophilous and salt-tolerant, grows on the west coast of the island and is characterized bythe *Sileno corsicae-Ammophiletum arundinaceae*. It is composed offoreshore vegetations (*Salsolo kali-Cakiletum maritimae*, *Sporoboletum arenarii, Sporobolo pungentis-Elymetum farcti, Eryngio maritimi-Elymetum farcti*). Vegetation sequence grows about twentymeters but may exceptionally develop over a 100 m, for example on the Roccapina site.

Sigmasystematic [*Holotypus*: rel. 1-Table 8]

19 geopermasynrelevés.
Average syntaxonomic richness: 2.9 syntaxa per geopermasynrelevé.

Tables analysis shows that the geopermaseries presents an impoverished facies (B. Table 8) characterized by the absence of *Sileno corsicae-Ammophiletum arundinaceae* and a higher frequency of *Sileno gallicae-Brometum gussonei* (zoo-anthropogenic grassland). This geopermaseries is often located on the lower contact to *Pistacio lentisci-Junipero macrocarpae* minorisigmetum.

Bacchetta et al. (2010) identified an only psammophilous and halophilous geosigmetum of dune system. Their geomorphological approach is based on the consideration of plant units; they develop on all the dune systems, without taking into account the type of dynamics of each unit.

The shape and the area occupied by the sandy systems depends above all on the geomorphological configuration of the coastline. When sandy systems are intersected by rocky coast or when they are at the front of a rocky coast, the vegetation sequence may be truncated. In this case, it is possible to consider it as individuals of fractogeosigmetum.

Conservation Issues Although frequent on the whole part of the coastal zone, these geopermaseries always appear in a punctual way. They are regularly subjected to human pressure: human use and trampling of sandy gravel sites have changed the vegetation sequence and promoted the development of secondary vegetation.

Table 8 *Sileno corsicae-Ammophilo arundinaceae* geopermasigmetum

	A						B													
Geopermasynrelevé n.	**1***	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Σ
Geographic area	**Cap Corse**	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	
Area (ha)	**1.5**	0.7	2	3.7	4.8	0.4	1	0.9	2.2	0.4	1.9	3.8	1.1	1.1	13.59	0.2	1.4	0.21	0.4	
Cover (%)	**70**	60	70	45	70	65	70	70	40	50	10	50	40	40	80	20	20	15	15	
Permasigmataxa number	**4**	5	4	3	5	4	4	3	4	3	2	3	2	2	3	2	1	1	1	
Characteristic permasigmataxa																				
Sileno corsicae-Ammophilo arundinaceae permasigmetum	**O4**	O2	O3	…1	o1	o1														**II**
Permasigmataxa of sandy beaches																				
Salsolo kali-Cakilo maritimae permasigmetum	**o1**	o+	o1	…1	O1	O2	o1	/2	O2	O2	o+	o2	O2	O2	…r	o1	O2	O2	O2	**V**
Sporobolo arenarii permasigmetum		O2	O2		O2	O3	o2		O2		O2									**II**
Permasigmataxa of embryonic dunes																				
Sileno corsicae-Elymo farcti permasigmetum	**O2**	O2			O/2	O2	O2													**II**
Eryngio maritimi-Elymo farcti permasigmetum	**O2**	O2	O2	O2				O3	O2	O2										**II**
Permasigmataxa of backshore dunes																				
Sileno gallicae-Bromo gussonei permasigmetum									O2			O3	O3	O2						**II**
Other permasigmataxa																				
Sileno sericeae-Matthiolo tricuspidatae permasigmetum							O3			o2					O4					**I**
Plantagino humilis-Loto cytisoidis permasigmetum					O2															+
Catapodio marini-Parapholiso incurvae permasigmetum																O2				+
Catapodio marini-Evaco rotundatae permasigmetum variant with *frankenia intermedia*								o1												+
Elytrigio juncei-Crithmo maritimi permasigmetum															.O3					+
Permasigmetum with *Carpobrotus edulis*												o1								+

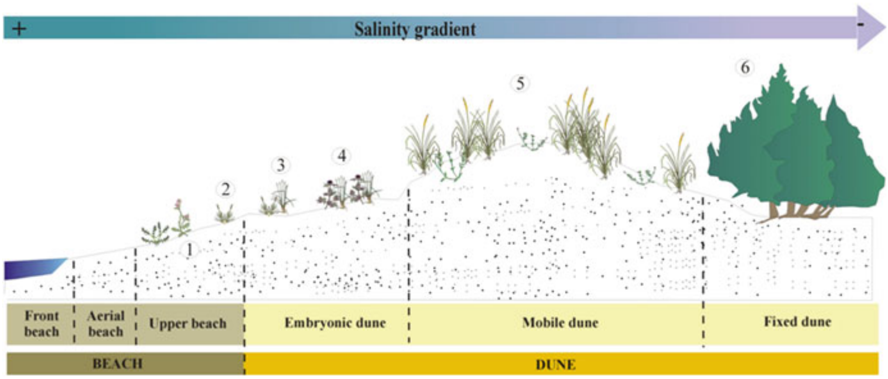

Fig. 23 Catenal structuration of the vegetation sequence of dune sandy beaches. (1) *Salsolo kali-Cakiletum maritimae*; (2) *Sporoboletum arenarii;* (3) *Sporobolo pungentis-Elymetum farcti;* (4) *Eryngio maritimi-Elymetum farcti*; (5) *Sileno corsicae-Elymetum farcti otanthetosum maritimi;* (6) *Echinophoro spinosae-Ammophiletum arundinaceae;* (7) *Pycnocomo rutifolii-Crucianelletum maritimae;* (8) *Pistacio lentisci-Juniperetum macrocarpae*

Under the Flora Fauna Habitats Directive (DHFF), these geopermaseries are included into many Habitats of Community Interest (HCI):

- (1210) Annual vegetation of the foreshore (*Salsolo kali-Cakiletum aegyptiacae*);
- (2110) Embryonic shifting dunes (*Sporoboletum arenarii, Sporobolo pungentis-Elymetum farcti, Echinophoro spinosae-Elymetum farcti, Sileno corsicae-Elymetum farcti, Eryngio maritimi-Elymetum farcti, Inulo crithmoidis-Elymetum farcti, Plantagino humilis-Lotetum cytisoidis*);
- (2120) Mobile dunes with *Ammophila arenaria* (dunes blanches) (*Echinophoro spinosae-Ammophiletum arundinaceae, Sileno corsicae-Ammophiletum arundinaceae*);
- (2210) Fixed dune of *Crucianellion maritimae* (*Crucianello maritimae-Armerietum pungentis, Pycnocomo rutifolii-Crucianelletum maritimae*) (Fig. 23).

Bacchetta et al. (2007, 2010) described a psammophilous and halophilous Sardinian geosigmetum of dune systems. The catenal structuration corresponds more or less to the sequence observed in Corsica (*Salsolo kali-Cakiletum maritimae*, *Atriplicetum hastato-tornabaeni*, *Sporobolo pungentis-Elymetum farcti, Sileno corsicae-Elymetum farcti, Sileno corsicae-Ammophiletum arundinacea*, *Crucianellion maritimae*, *Maresio nanae-Malcolmion ramosissimae, Pistacio lentisci-Juniperetum macrocarpae*). Comparisons of synrelevés would allow to describe corso-sardinian geopermaserial and curtaserial units.

Corsican geopermaseries, thermo-mediterranean subhumid of pebble ridges [*Glaucio flavi-Crithmo maritimi* geopermasigmetum]

Sigmaecology This heliophilous and hyperhalophilous geopermaseries grows on pebble beaches. The substrate is regularly removed by the sea and has a unstable character. It is necessary to distinguish the pebble beaches by their geomorphological origin: Fango and Porto beaches are natural; those of Cap Corse, Nonza and Farinole, are linked to anthropogenic releases of a former asbestos quarry. Ombrotype: lower subhumid. Thermotype: Thermo inframediterranean.

Sigmachorology This geopermaseries is limited to some areas of Corsica (Fango Crovani, Porto, Cap Corse). At the island scale, it grows on beaches including some pebbles from the adjacent rivers. Vegetation sequence is expressed on a wide strip of ten meters. In the Fango, this geopermaseries is located on the lowercontact of *Helichryso italici-Genistetum corsicae*.

Sigmastructure This unit is composed of foreschore very sparse vegetation which recovery rarely exceeds 30%.

Sigmasystematic [*holotypus*: rel. 3 - Table 9]

9 geopermasynrelevés.
Average syntaxonomic richness: 3 syntaxa per geopermasynrelevé.

Conservation Issues This geopermaseries includes *Euphorbia peplis*, protected sepcies in Corsica. *Senecio transiens*, corso-sardinia endemic species is also present. Several HCI were observed: (1210) Annual vegetation of drift lines; (2110) Embryonic shifting dunes; (2210) *Crucianellion maritimae* fixed beach dunes (1310-4*) Salicornia* and other annuals colonizing mud and sand (15.12) Mediterranean halo-nitrophilous pioneer communities (*Frankenion pulverulentae*): formations of halo-nitrophilous annuals (*Frankenia pulverulenta, Suaeda splendens, Salsola soda, Cressa cretica, Parapholis incurva, P. strigosa, Hordeum marinum, Sphenopus divaricatus*) colonizing salt muds of the Mediterranean region, susceptible to temporary inundation and extreme drying; (2230) *Malcolmietalia* dune grasslands (Fig. 24).

Corsican psammophilous and edaphoxerophilous minoriseries, thermo-mediterranean dry to subhumid of *Pistacia lentiscus* and *Smilax aspera*
[*Clematido cirrhosae-Pistacio lentisci* minorisigmetum variant with *Smilax aspera*]

Sigmaecology This supralittoral calcifuge minoriseries is a major and often dominant component of the coastal bushes installed in various edaphic situations (sands, pebbles, rocks...), always on low slopes (<5°). The very shallow substrate is sandy to sandy loam. In the most salt spray sheltered areas, this minoriseries can develop close to the sea at the upper contact of the *Crithmo maritimi-Staticetea* vegetation and regularly at the lower contact of the *Galio scabri-Querco ilicis* sigmetum variant with *Fraxinus ornus*. Ombrotype: dry (lower and upper) and lower subhumid. Thermotype: thermo and inframéditerranéen.

Sigmachorology This minoriseries is present on the whole coastal zone but it remains more punctual on the west coast due to its more rugged topographic character. It is generally located at the upper contact of the halophilous

Table 9 *Glaucio flavi-Crithmo maritimi* geopermasigmetum

Geopermasynrelevé n.	1	2	**3***	4	5	6	7	8	9*	
Geographic area	Cap Corse	Cap Corse	**Cap Corse**	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	
Area (ha)	1.4	V	**1.8**	0.6	21.6	3.8	0.5	1.6	2.02	
Cover (%)	20	15	**60**	30	40	50	50	80	60	
Permasigmataxa number	2	2	**3**	4	3	4	3	3	3	
										∑
Characteristic permasigmataxon										
Glaucio flavi-Crithmo maritimi permasigmetum	O1	O2	**O2**	O2	O2	O2	O1	o1	*O*3	**V**
Permasigmataxons of pebble beach										
Salsolo kali-Cakilo maritimae permasigmetum	O2	O2	**O2**	O2	O2	o2	O3	O2		**V**
Sporobolo pungentis-Elymo farcti permasigmetum									O1	**I**
Eryngio maritimi-Elymo farcti permasigmetum			**O2**							**I**
Galio halophili-Senecio transientis permasigmetum									…1	**I**
Other permasigmataxons										
Sileno gallicae-Bromo gussonei permasigmetum				o2	O2	O3	O2			**III**
Permasigmetum with *Carpobrotus edulis*				o+		o1				**II**
Tamarico africanae permasigmetum								O4		**I**

This geopermaseries is characterized by the *Glaucio flavi-Crithmetum maritimi* Paradis and Piazza 2011

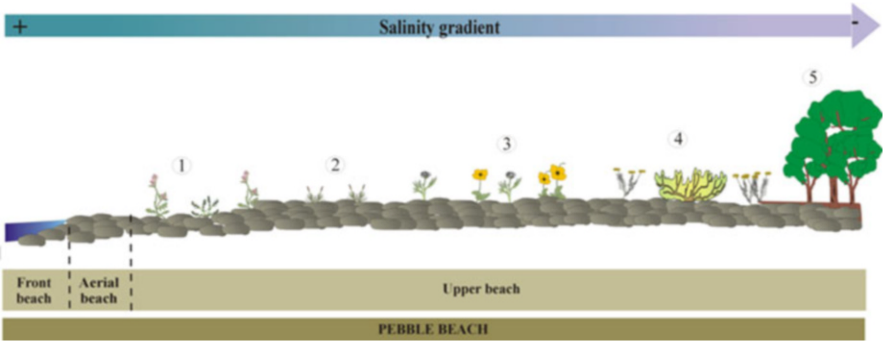

Fig. 24 "Typical" catenal arrangement of the pebble beach vegetation sequence. (1) *Salsolo kali-Cakiletum maritimae*; (2) *Sporoboletum arenarii;* (3) *Glaucio flavi-Crithmetum maritimi*; (4) *Scrophulario ramosissimae-Genistetum salzmanii*; (5) *Galio scabri-Quercetum ilicis*

Table 10 *Clematido cirrhosae-Pistacio lentisci* minorisigmetum, *Smilax aspera* variant

Synrelevé n.	1	2	3	4	5	6	7	**8***	
Geographic area	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	**Cap Corse**	
Area (ha)	0.65	1.49	0.18	1.89	7.15	3.38	1.16	**1.44**	
Cover (%)	100	60	100	100	70	75	90	**95**	
Average altitude (m)	3	2	1	10-10,5	0-3	3	4	6	
Slope (in °)	6	-	-	14	< 6	< 6	< 6	**6**	
Aspect	E	NW	SW	SE	SW	SW	W	**NW**	
Syntaxonomic richness	2	2	3	3	3	4	3	**3**	∑
Characteristic syntaxa of progressive dynamic									
Clematido cirrhosae-Pistacietum lentisci smilacetosum asperae	O5	O4	O5	O5	O1	O+	O5	**O4**	**V**
Euphorbio pithyusae-Helichrysetum italici			O2	O2	O4	O3	O2	**O3**	**IV**
Loto cytisoidis-Dactyletum hispanicae dactyletosum hispanicae	…1	…1	…1	…1	…1	…1	…1	**…o2**	**V**
Characteristic syntaxa of regressive dynamic									
Allietum chamaemoly						…O3			**I**

geopermaseries of sandy and rocky systems and at the lower contact of the meso-mediterranean series of *Quercus ilex*.

Sigmastructure The head of minoriseries is represented by an anemomorphic lining with *Smilax aspera* and *Pistacia lentiscus* with a maximum height of 1.5 m. The dynamic stages are composed of a lawn of the *Loto cytisoidis-Dactyletum hispanicae* and a low sub-scrubland of the *Euphorbio pithyusae-Helichrysetum italici.*

Sigmasystematic [*holotypus*: rel. 8—Table 10]

8 synrelevés.
Average syntaxonomic richness: 2,9 syntaxa by synrelevé.

Conservation Issues This minoriseries is very common on the coastal zone of Corsica. It is subject to increasing urbanization, thus reducing its expression. No protected species has been identified. It includes two HIC:

- (9320-3) «Thermo-mediterranean *Olea* and *Ceratonia* forest» (*Clematido cirrhosae-Pistacietum lentisci*);
- (5410-3) « West mediterranean clifftop phryganas » (*Euphorbio pithyusae-Helichrysetum italici*).

Corsican edaphoxerophilous minoriseries, thermo-mediterranean dry to subhumid of rocky coast with *Euphorbia pithyusa* and *Helichrysum italicum* subsp. *italicum*
[*Euphorbio pithyusae-Helichryso italici* minorisigmetum]

Sigmaecology This minoriseries develops on shallow, xeric substrates regularly exposed to salt spray. It develops in the upper contact of the hyperhalophilous geopermaseries of the rocky coasts. It generally frequents the slopes of rocky promontories on low to medium slopes (up to 14°). This minoriseries forms a low and stable shrub fringe in relation to the decrease of saline deposit. Ombrotype: upper dry and lower subhumid. Thermotype: thermo and inframediterraneen.

Sigmachorology *Euphorbio pithyusae-Helichryso italici* minorisigmetum develops on almost all the rocky coasts, with an optimal development in the regions of Cap Corse and Balagne. On the west coast, the very rugged topographic context in the creeks of Porto and Piana is unfavorable. It is located in the upper contact of the hyperhalophilous geopermaseries and in the lower contact of the *Clematido cirrhosae-Pistacio lentisci* minorisigmetum.

Sigmastructure The natural progressive dynamics of this minoriseries is characterized by two dynamic stages: a grassland of the *Loto cytisoidis-Dactyletum hispanicae* and a low sub-scrubland dominated by *Euphorbia pithuysa* and *Helichrysum italicum* subsp. *italicum*. Trampling and opening of these minoriseries favor the development of therophytic stages such as *Catapodio marini-Parapholidetum incurvae* or *Centaurio acutiflori-Hordeetum gussoniani*.

Sigmasystematic [*holotypus*: rel. 2—Table 11]
12 synrelevés.
Average syntaxonomic richness: 2.5 syntaxa by synrelevé.
This minoriseries presents an anthropic facies with *Thymelaeo hirsutae-Helichrysetum italici* (B) (North of Cap Corse, Galeria and Lumio).

[B] *Thymelaeo hirsutae-Helichryso italici* minorifacies. This facies develops in the more sheltered areas. It develops on shallow soils or fine elements accumulated in the rocks interstices. The symphytosociological table suggests that this unit constitutes a minoriseries. However, Géhu and Biondi (1994) raised the nitrophilous character of *Thymelaea hirsuta*. This characteristic combined with the xeric edaphic conditions shows that the sub-scrubland *Thymelaeo hirsutae-Helichrysetum italici* is integrated into a secondary dynamics. It replaces the sub-scrubland of *Euphorbio pithyusae-Helichrysetum italici* on the most degraded areas by the cattle trampling.

Table 11 *Euphorbio pithyusae-Helichryso italici* minorisigmetum

	A								B				
Synrelevé n.	1	**2***	3	4	5	6	7	8	9	10	11	12	
Geographic area	Cap Corse	**Cap Corse**	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	
Area (ha)	2.14	**0.44**	0.38	0.53	2.39	0.34	9.6	1.55	1.21	0.82	0.18	2.7	
Cover (%)	75	**80**	60	90	95	70	70	30	70	80	70	80	
Average altitude (m)	40	**25**	20	11	60	15	50	8	10	10	10	10	
Slope (in °)	6	**6**	6	6	6	6	6	6	14	6	6	6	
Aspect	NW	**W**	W	S	N	E	E	W	SW	E	NW	N	
Syntaxonomic richness	2	**2**	2	2	3	3	2	3	3	4	2	2	∑
Characteristic syntaxa of progressive dynamic													
Euphorbio pithyusae – Helichrysetum italici	O4	**O5**	O4	O5	O4	O4	O3	O4					**IV**
Loto cytisoidis-Dactyletum hispanicae dactyletosum hispanicae	o2	**…+**	o2	…2	…+	…1		o2	o1	o1	…1		**V**
Characteristic syntaxa of regressive dynamic													
Thymelaeo hirsutae-Helichrysetum italici									O3	O5	O4	O4	**II**
Catapodio marini-Parapholisetum incurvae					.+	o1	O3	o1	o+	o1		…+	**III**
Centaurio acutiflori-Hordeetum gussoniani										…1			+

Conservation Issues
Several threats weigh on this minoriseries: the urbanization of coastaline has reduced its expression and the regular trampling favor the development of secondary vegetation. In Balagne and in some points of the Cap Corse, this minoriseries is locally invaded by *Carpobrotus edulis*. *Euphorbio pithyusae-Helichrysetum italici* corresponds to a habitats of community interest: (5410-3) "West mediterranean clifftop phryganas" (*Euphorbio pithyusae-Helichrysetum italici*).

Corsican chasmophytic and chomophytic geopermaseries of rocky coast

Sigmaecology This geopermaseries is dependent on the crystalline, limestone and schistous rocky coasts. The substrate, mainly mineral, consists on micro-cuvettes where sand and gravel can be accumulated. Salt spray regularly waters this geopermaseries and gives it a very marked halin character. Ombrotypes: upper dry, lower dry and lower subhumid. Thermotype: thermo and inframediterranean.

Sigmachorology This geopermaseries is widespread on the coastal of Corsica. It appears discontinuous on the east coast as it is interrupted by sandy and sandy-gravelly systems, sometimes over several kilometers.

Sigmastructure This geopermaseries is composed of permanent low and open chasmophytic and chomophytic vegetations generally occupying small areas (0.2 m^2). The sequence of vegetation from the sea to the inland is generally limited to a few meters (up to 15 m maximum). This unit is monostratified (sparse grassland and veil)

Sigmasystematic

47 geopermasynrelevés.
Average syntaxonomic richness: 2.8 syntaxa per geopermasynrelevé

[1] Corsican chasmophytic and chomophytic, thermo-mediterranean dry to subhumid of rocky coast with *Crithmum maritimum* and *Limonium contortirameum*
[*Crithmo maritimi-Limonio contortiramei* geopermasigmetum]
[*holotypus*: rel. 17—Table 12**]**

This geopermaseries is characterized by the association of *Crithmo maritimi-Limonietum contortiramei*. It is represented by the sub-association *frankenietosum laevis* developed on micro-terraces with accumulation of of fine sand. Human pressures and various disturbances favor the development of the therophytic vegetation of *Catapodio marini-Parapholidetum incurvae*. The covering of this geopermaseries is low, of the order of 20–30%. It is located at the lower contact of *Euphorbia pithyusa* subsp. *pithyusa* and *Helichrysum italicum* subsp. *Italicum* community.

Table 12 shows that geopermaseries presents two variations:

- a variation (B) related to the rocky slopes of the cliffs and marked by the association of *Crithmo maritimi-Limonietum contortiramei frankenietosum laevis*;
- a hyperventilated variation (C) at *Catapodio marini-Parapholidetum incurvae*.

Table 12 *Crithmo maritimi-Limonio contortiramei* geopermasigmetum

	A																B						
Geopermasynrelevé n.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**17***	18	19	20	21	22	23
Geographic area	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse
Area (ha)	0.9	12.8	2.3	6.3	2.5	2.3	2.1	0.3	0.8	0.4	2.8	18.8	4	8.2	3.9	2.4	**2.4**	1.2	0.6	16	12	0.6	2.7
Cover (%)	70	60	70	75	30	30	40	40	20	10	60	60	60	80	60	30	**50**	70	70	45	50	60	80
Permasigmataxa number	1	1	1	1	1	1	2	1	1	1	1	3	2	2	1	3	**3**	5	4	2	2	2	4
Characteristic permasigmataxa																							
Crithmo maritimi-Limonio contortiramei permasigmetum	o1	o1	o2	o1	o+	/1	…1	o/1	o+	o1	o2	O3	o1	O1	O2	O2	**O2**	o+	O2	o2	o2		O2
Permasigmataxons of cliff ledge																							
Crithmo maritimi-Limonio contortiramei permasigmetum variant with *Frankenia laevis*																	**o+**	o+	o1	o+	o+	o1	O+
Crithmo maritimi-Limonio contortiramei permasigmetum variant with *Halimium portulacoides*																O2	**o+**	o1					
Crithmo maritimi-Limonio contortiramei permasigmetum variant with *Dianthus sylvestris*																		.r					
Crithmo maritimi-Limonio contortiramei permasigmetum variant with *Lotus cytisoides*													O1										O2
Catapodio marini-Hymenolobo revelieri permasigmetum							.r																
Permasigmataxons of skinned lawns																							
Frankenio laevis-Spergulario macrorhizae permasigmetum																							
Frankenio laevis-Spergulariomacrorhizae permasigmetum variant with *Sporobolus pungens*																							
Other permasigmataxons																							
Catapodio marini-Parapholiso incurvae permasigmetum												O2				o+		o+	o1				…+
Centaurio acutiflori-Hordeo gussoniani permasigmetum												o1							o1				
Atriplici hastato-tornabeni permasigmetum																							
Lavatero arboreae-Atriplici prostratae permasigmetum																							
Senecio transientis-Halimiono portulacoidis permasigmetum																							
Hyoscyami albi-Parietario judaicae permasigmetum																							
Permasigmetum with *Lotus cytisoides* and *Schoenus nigricans*																						o1	
Polypogono subspathacei permasigmetum														O2									
Galio halophili-Senecio transientis permasigmetum																							
Permasigmetum with *Senecio cineraria*														O4	O1								
Permasigmetum with *Carpobrotus edulis*																							

(continued)

Table 12 (continued)

	C																							
Geopermasynrelevé n.	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	
Geographic area	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	
Area (ha)	15.9	1.9	3.5	14.3	8	2.5	12.7	8.4	2.4	0.2	0.6	0.2	0.4	0.3	5.4	6.2	13	30	6.9	2.5	1.02	34.6	4.05	1.35	
Cover (%)	70	80	60	80	70	75	95	75	50	60	60	50	50	60	30	75	70	60	25	40	30	50	85	90	
Permasigmataxa number	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	4	6	∑
Characteristic permasigmataxa																									
Crithmo maritimi-Limonio contortiramei permasigmetum	o2	O2	O2	O1	O3	O2	O2	o+	O2	O2	o+	o1	o+	O2	o1	O2	o+	O2	o1	o/1	o+	o+	./1	O2	**IV**
Permasigmataxons of cliff ledge																									
Crithmo maritimi-Limonio contortiramei permasigmetum variant with *Frankenia laevis*																									**I**
Crithmo maritimi-Limonio contortiramei permasigmetum variant with *Halimium portulacoides*																									+
Crithmo maritimi-Limonio contortiramei permasigmetum variant with *Dianthus sylvestris*																									**r**
Crithmo maritimi-Limonio contortiramei permasigmetum variant with *Lotus cytisoides*																									**r**
Catapodio marini-Hymenolobo revelieri permasigmetum																							.+		
Permasigmataxons of skinned lawns																									
Frankenio laevis-Spergulario macrorhizae permasigmetum																									**r**
Frankenio laevis-Spergulariomacrorhizae permasigmetum variant with *Sporobolus pungens*																									**r**
Other permasigmataxons																									
Catapodio marini-Parapholiso incurvae permasigmetum	o1	o1	o+	o1	O2	…1	.+	o+	o1	…1	.+	.+	.r	o+	o1	o1	o+	O1	o1	.r	o+	o1	.o1	o+	**III**
Centaurio acutiflori-Hordeo gussoniani permasigmetum		…1																							+
Atriplici hastato-tornabeni permasigmetum																								.+	**r**
Lavatero arboreae-Atriplici prostratae permasigmetum																							.O2		**r**
Senecio transientis-Halimiono portulacoidis permasigmetum																								O5	**r**
Hyoscyami albi-Parietario judaicae permasigmetum																								o1	**r**
Permasigmetum with *Lotus cytisoides* and S*choenus nigricans*																									**r**
Polypogono subspathacei permasigmetum																									**r**
Galio halophili-Senecio transientis permasigmetum																								o+	**r**
Permasigmetum with *Senecio cineraria*	o1	O2																							+
Permasigmetum with *Carpobrotus edulis*					O2													o+							**r**

Table 13 *Crithmo maritimi-Limonio patrimoniense* geopermasigmetum

Geopermasynrelevé n.	**1***
Geographic area	**Cap Corse**
Area (ha)	**1.9**
Cover (%)	**50**
Permasigmataxa number	**2**
Characteristic permasigmataxons	
Crithmo maritimi-Limonio patrimoniense permasigmetum	**O3**
Permasigmataxons of cliff ledge	
Crithmo maritimi-Limonio contortiramei permasigmetum	**o2**

[2] Corsican chasmophytic and chomophytic, thermo-mediterranean dry to subhumid of schist rocky coast with *Crithmum maritimum* and *Limonium patrimoniense*
[*Crithmo maritimi-Limonio patrimoniense* geopermasigmetum]
[*holotypus*: rel. 1—Table 13**]**

Its originality is linked to the presence of *Limonium patrimoniense* endemic of the Cap Corse. This species is strictly localised to the limestone cliffs of Patrimonio region which represent a very short coastline linear. The symphytosociological material is based on a single geopermasynrelevé composed by two syntaxa. This geopermasigmetum appears in the lower contact of the *Euphorbio pithyusae-Helichryso italici* minorisigmetum.

Conservation Issues The singular ecological conditions (halophilous gradient, substrate) and the presence of several Corsican endemic species of *Limonium* (*L. patrimoniense*, *L. bonifaciense*, *L. obtusifolium*) and corso-sardinian endemic species (*L. articulatum*) confer at this geopermaseries a high heritage value. They include several habitats of community interest:

- (1240-1) vegetated sea cliffs of the limestone Mediterranean coasts (*Crithmo maritimi-Limonietum patrimoniensis, Crithmo maritimi-Limonietum obtusifolii*);
- (1240-2) vegetated sea cliffs of the crytalline Mediterranean coasts (*Crithmo maritimi-Limonietum contortiramei, Crithmo maritimi-Limonietum articulati, Frankenio laevis-Spergularietum macrorhizae*).

The main threats to these vegetations are urbanization, trampling and the development of exotic species (*Opuntia ficus-indicus* and *Carpobrotus edulis* in particular). These anthropogenic pressures tend to reduce the surfaces of these geopermaseries and favor degraded and fragmentary forms of them (Figs. 25 and 26).

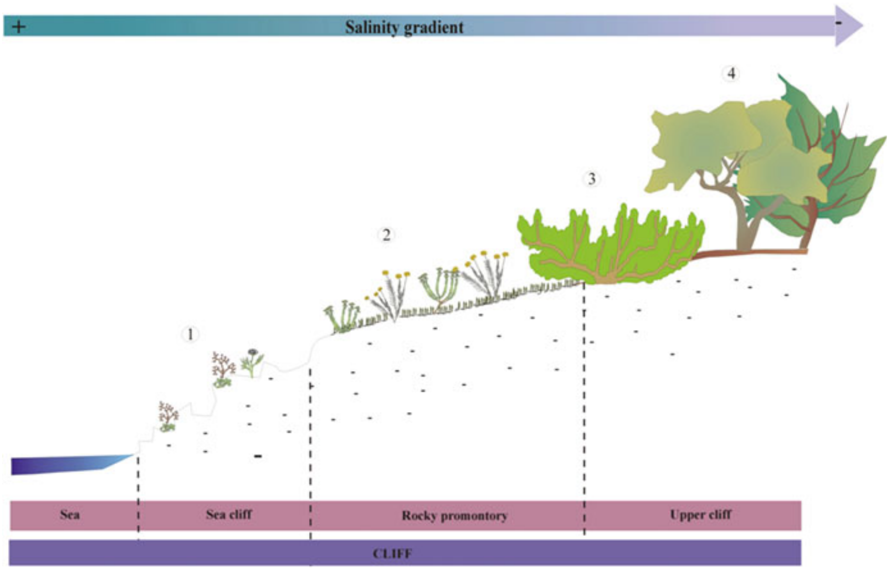

Fig. 25 Catenal structuration of vegetation sequence of acidicline to neutrocline bedrock vegetation systems. (1) *Crithmo maritimi-Limonio articulati* geopermasigmetum or *Crithmo maritimi-Limonio patrimoniense* geopermasigmetum; (2) *Euphorbio pithyusae-Helichryso italici* minorisigmetum; (3) *Clematido cirrhosae-Pistacio lentisci* minorisigmetum variant with *Smilax aspera*; (4) *Oleo sylvestris-Junipero turbinatae* sigmetum

3.2.2 Thermo-Mediterranean Units

Corsica-Sardinian edaphoxerophilous series, thermo-mediterranean dry to subhumid of neutro-alcalinous rocky coast with *Olea sylvestris* and *Juniperus phoenicea* subsp. *turbinata*
[*Oleo sylvestris-Junipero turbinatae* sigmetum Bacchetta et al. 2010**]**

Sigmaecology This series is expressed on the last littoral fringe of the neutro-alkaline rocky coasts, on exposed slopes south to south-east. *The Oleo sylvestris-Junipero turbinatae* sigmetum is halo-tolerant and can be expressed by the sea in areas where the salt spray is attenuated. For Amandier et al. (1984), Gamisans and Murracciole (1984), Paradis (1991) and Gamisans (1991, 2010), *Juniperus phoenicea* subsp. *turbinata* is a bioindicator species of thermo-mediterranean bioclimatic level. Ombrotype: dry lower than subhumid lower. Thermotype: thermo-mediterranean.

Sigmachorology In Corsica, this series is frequent and develops over fairly large areas (on the order of 2–6 ha). This series is present in Sardinia and in the region of Calabria in Italy.

Fig. 26 [A] *Sileno corsicae-Ammophilo arundinaceae* geopermasigmetum*;* [B] *Glaucio flavi-Crithmo maritimi* geopermasigmetum*;* [C] *Crithmo maritimi-Limonio contortiramei* geopermasigmetum*;* [D] *Euphorbio pithyusae-Helichryso italici* minorisigmetum*;* [E] *Clematido cirrhosae-Pistacio lentisci* minorisigmetum*, Smilax aspera* variant

Catenal Positioning This series is in the upper contact of the *Clematido cirrhosae-Pistacio lentisci* minorisigmetum variant with *Smilax aspera* and at the lower contact of the *Galio scabri-Querco ilicis* sigmetum.

Sigmastructure This series is a thicket or a shruland characterized by the dominance of *Juniperus phoenicea* subsp. *turbinata* and *Olea europaea* subsp. *sylvestris*. The undergrowth is characterized by thermophilous species: *Pistacia lentiscus*, *Phillyrea angustifolia*, *Smilax aspera* and *Rubia peregrina* (Table 14).

Sigmasystematic [*holotypus:* rel. 1 - Table 15]

3 synrelevés.
Average syntaxonomic richness: 1.8 syntaxa by synrelevé.

Bacchetta et al. (2009, 2010) and Angius et al. (2011) describe a thermophilous dynamic stage as *Asparago albi-Euphorbietum dendroidis*. In Corsica, this dynamic stage is present in the creeks of Porto, near the site of Ostriconi and in the south-west of the island at Palombaggia. This stage could correspond to ecological variation on xeric and shallow substrate.

Paradis et al. (2014) identify, in the Baracci valley, a regressive dynamic stage of *Oleo sylvestris-Juniperetum turbinatae* towards a thicket with *Pistacia lentiscus* and

Table 14 Bioindicator species of *Oleo sylvestris-Junipero turbinatae* sigmetum Bacchetta et al. 2010

Physiognomy of vegetations	Plant communities	Bioindicator species
Forest	*Oleo sylvestris-Juniperetum turbinatae*	*Juniperus phoenicea* subsp. *turbinata, Olea europaea* subsp. *sylvestris, Pistacia lentiscus, Phillyrea angustifolia*
Maquis	*Pulicario odorae-Arbutetum unedonis phillyreetosum latifoliae*	*Phillyrea latifolia, Arbutus unedo, Erica arborea, Pulicaria odora, Quercus ilex*
Sub-scrubland	*Stachyo glutinosae-Genistetum corsicae teucrietosum mari*	*Genista corsica, Stachys glutinosa, Teucrium marum*
Grassland	*Melico ciliatae-Brachypodietum retusi*	*Melica ciliata* subsp. *ciliata, Brachypodium retusum, Dactylis glomerata* subsp. *hispanica, Asphodelus ramosus* subsp. *ramosus, Carlina corymbosa* subsp. *corymbosa*

Table 15 *Oleo sylvestris-Junipero turbinatae* sigmetum Bacchetta et al. 2010

	A	**B**		
Synrelevé n.	**1***	2	3	
Geographic area	**Cap Corse**	Cap Corse	Cap Corse	
Area (ha)	**0.82**	3.2	1.8	
Cover (%)	**95**	100	100	
Average altitude (m)	**10**	40	50	
Slope (in °)	**14**	6	14	
Aspect	**W**	N	N	
Syntaxonomic richness	**1**	2	2	∑
Characteristic syntaxa of progressive dynamic				
Oleo sylvestris-Juniperetum turbinatae	**O5**			**1**
Thymelaeo tartonrairae-Helichrysetum italici	**O2**			**1**
Characteristic syntaxa of regressive dynamic linked to fire				
Genisto corsicae-Ericetum multiflorae		O5	O5	**2**
Helichryso italici-Cistetum cretici calicotometosum spinosae		O2		**1**
Stachydi glutinosae-Genistetum corsicae teucrietosum mari		o2	o2	**1**

Juniperus turbinata. This regression is related to the anthropic pressure (fires in particular). Further surveys would make it possible to refine the diagnose of the dynamics of this series.

Erica multiflora vegetation (*Genisto corsicae-Ericetum multiflorae*) in the north of Cap Corse is integrated in this series.

Conservation Issues This series does not present any particular remarkable plant species. Head of this series (*Oleo sylvestris-Juniperetum turbinatae*) is a priority HIC (5210) "Arborescent matorral with *Juniperus phoenicea*". Despite of anthropic pressures (fires, frequentation and urbanization) and its regression in Corsica, this series presents a wide distribution at the Mediterranean scale and does not seem currently threatened.

Associated Vegetations Two associated permaseries have been recorded on Campomoro site: meso-hygrophilous vegetations associated with temporary water pond (*Romuleo requienii-Isoetetum histricis* Bagella, Caria, Farris and Filigheddu 2009 and *Radiolo linoidis-Isoetetum Histricis* Chevassut and Quézel 1956) (Figs. 27 and 28).

3.2.3 Meso-mediterranean Sigmetal and Geosigmetal Units

Corsica-Sardinia Climatophilous Series, Meso-Mediterranean with *Quercus ilex*

Sigmaecology These series are widely distributed in Corsica. They represent a major unit of the landscape of meso-mediterranean level with a surface coverage of more than 80%. They develop mainly on a siliceous crystalline and on poorly evolved substrates (lithosol, regosol and thin brunisol). These series range from 200 to 700 m altitude or even 800 m on the sunniest slopes. This series also occupies the alluvial plain on sablo-silty substrates. Ombrotype: subhumid lower than upper subhumid. Thermotype: lower meso-mediterranean to upper meso-mediterranean.

Sigmachorology This series is typical of the meso-mediterranean level. In Corsica, this series occupies almost the entire meso-mediterranean level.

Catenal Positioning It occupies the majority of the slopes of the meso-mediterranean level. It also appears in alluvial plain either behind the riparian series of *Alnus glutinosa* and *Eupatorium cannabinum* subsp. *corsicum*, or in juxtaposition with the series of peat swamps of *Dryopteris carthusiana* and *Alnus glutinosa*.

Sigmastructure The head of this series is *Galio scabri-Quercetum ilicis*. Shrub stratum (0.5–1.5 m) is dominated by *Erica arborea* and *Arbutus unedo*. The sporadic herbaceous stratum is dominated by *Galium rotundifolium, Cyclamen repandum* subsp. *repandum*, *Viola alba* subsp. *dehnhardtii*, *Asplenium onopteris*, *Luzula forsteri* and *Carex distachya*.

The grassland presents annual and perennial species: *Tuberaria guttata* var. *guttata, Plantago bellardii* subsp. *bellardii, Trifolium stellatum*. This stage evolves

Fig. 27 *Oleo sylvestris-Junipero turbinatae* sigmetum

towards the sub-scrubland with *Cistus monspeliensis* and *Cistus salviifolius*, then towards a low maquis (less than 2 m) then a high thicket to *Erica arborea* and *Phillyrea angustifolia* (with a *Pinus pinaster* subsp. *Hamiltonii* facies). The degradation stages of the series are linked to various factors:

- grazing: nitrophilous lawns with *Asphodelus ramosus* subsp. *ramosus* [*Echio lycopsis-Galactitetum tomentosa*e] and recolonization heath with *Crataegus monogyna s*ubsp. *monogyna* [*Pruno spinosae-Rubion ulmifolii*].
- soil erosion: on the less degraded soils, the sub-scrubland with *Helichrysum italicum* subsp. *italicum* and *Cistus creticus* [*Helichryso italici-Cistetum cretici genistetosum corsicae*]. On the most eroded soils, the dwarf heath is present with *Stachys glutinosa* and *Genista corsica* [*Stachyo glutinosae-Genistetum corsicae*

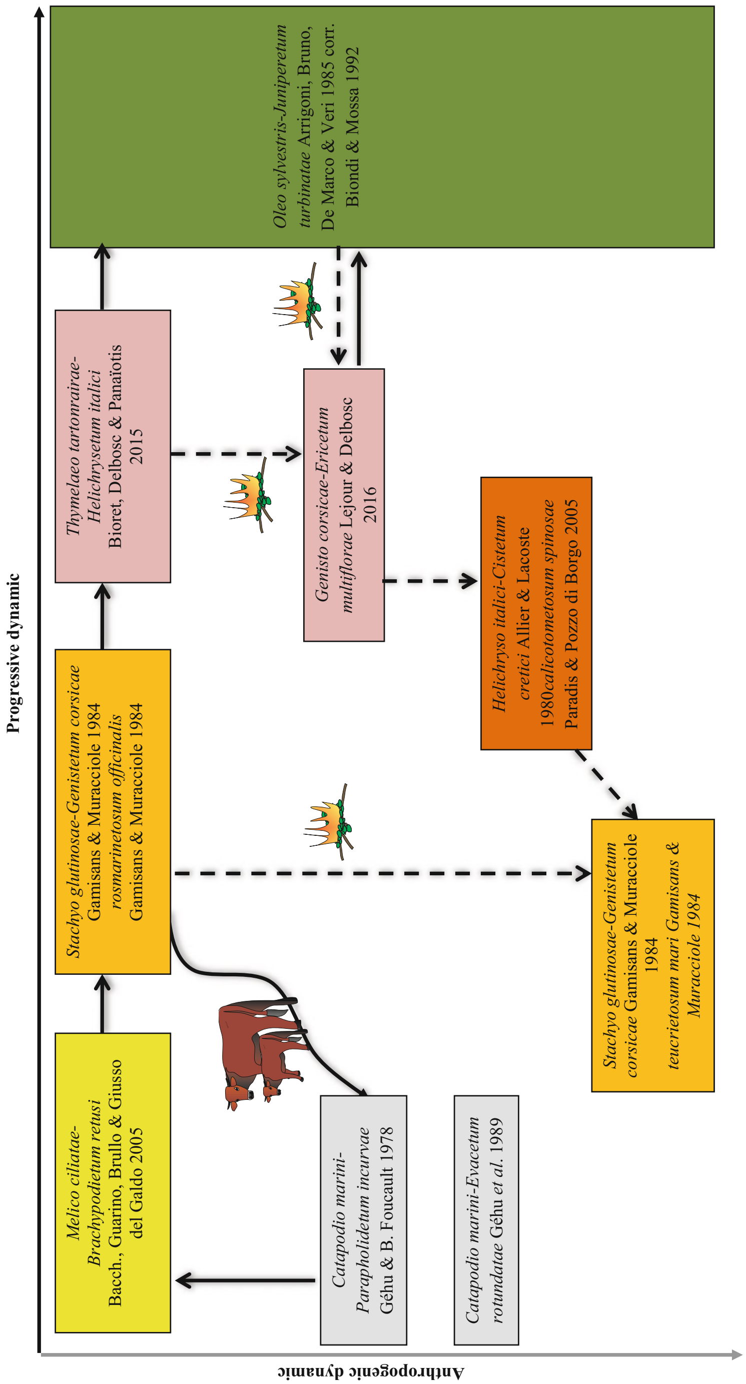

Fig. 28 *Oleo sylvestris-Junipero turbinatae* sigmetum Bacchetta et al. 2010

Table 16 Bioindicator species of *Galio scabri-Querco ilicis* sigmetum variant with *Lathyrus venetus*

Physiognomy of vegetations	Plant communities	Bioindicator species
Forest	*Galio scabri-Quercetum ilicis lathyretosum veneti*	*Quercus suber, Galium scabrum, Hedera helix* subsp. *helix, Cytisus villosus, Viburnum tinus*
Maquis	*Pulicario odorae-Arbutetum unedonis pinetosum hamiltonii*	*Pinus pinaster* subsp. *hamiltonii, Helleborus lividus* subsp. *corsicus, Teucrium scorodonia* subsp. *scorodonia, Clinopodium vulgare* subsp. *vulgare*
Sub-scrubland	*Helichryso italici-Cistetum cretici*	*Helichrysum italicum* subsp. *italicum, Cistus creticus, Cistus monspeliensis, Cistus salviifolius,*
Grassland	*Tuberario guttatae-Plantaginetum bellardii*	*Plantago bellardii* subsp. *bellardii, Tuberaria guttata* var. *guttata, Ornithopus compressus, Linum trigynum, Lupinus micranthus*

teucrietosum and *Stachyo glutinosae-Genistetum corsicae rosmarinetosum officinalis*].

- on the abandoned terraces, an anthropogenic grouping is developed in *Olea europaea* var. *Sylvestris* and *Pistacia lentiscus*.

Sigmasystematic

88 synrelevés
Average syntaxonomic richness: 2.8 syntaxa by synrelevé.

[1] Mesophilous variant, meso-mediterranean subhumid, of Acidophilous-neutroalcalinous substrate with *Lathyrus venetus* and *Quercus ilex*
[*Galio scabri-Querco ilicis* sigmetum variant with *lathyrus venetus*]
[*holotypus*: rel. 6—Table 18**]**

Galio scabri-Querco ilicis sigmetum variant with *Lathyrus venetus* is characteristic of the upper meso-mediterranean level, from 200–300 to 600 m on the northern slopes and up to 900 m on the sunny slope. This series differs by the almost total absence of thermophilous species and by elements of a mesophilous flora (*Galium rotundifolium*, *Teucrium scorodonia* subsp. *scorodonia*, *Lonicera implexa*...).

Table 18b shows a depleted *Galio scabri-Querco ilicis* sigmetum variant with *Lathyrus venetus* (B) which is characterized by the absence of the head of series and a higher frequency of open media such as *Helichryso italici-Cistetum cretici* or *Pulicario odorae-Arbutetum unedonis* (Table 16).

[2] Thermophilous variant, meso-mediterranean subhumid of acidophilous or neutro-alkaline substrates with *Fraxinus ornus* and *Quercus ilex*
[*Galio scabri-Querco ilicis* sigmetum variant with *Fraxinus ornus*]
[*holotypus*: rel. 3 - Table 18**]**

This thermophilous series develops in the lower meso-mediterranean, from the littoral to 300 or even 400 m altitude in a cool and temperate humid climate. It is distinguished from the [3] by the presence of many thermophilous species such as

Fig. 29 Head of series of *Galio scabri-Querco ilicis* sigmetum variant with *Lathyrus venetus*

Table 17 Bioindicator species of *Galio scabri-Querco ilicis* sigmetum variant with *Fraxinus ornus*

Physiognomyof vegetations	Plant communities	Bioindicator species
Forest	*Galio scabri-Quercetum ilicis fraxinetosum orni*	*Fraxinus ornus* var. *ornus, Quercus ilex, Arisarum vulgare, Viburnum tinus, Pistacia lentiscus, Smilax aspera*
High maquis	*Pulicario odorae-Arbutetum unedonis pinetosum hamiltonii*	*Pinus pinaster* subsp. *hamiltonii, Helleborus lividus* subsp. *corsicus, Teucrium scorodonia* subsp. *scorodonia, Clinopodium vulgare*
Low maquis	*Pulicario odorae-Arbutetum unedonis phillyreetosum latifoliae*	*Phillyrea latifolia, Arbutus unedo, Erica arborea, Pulicaria odora, Quercus ilex*
Sub-scrubland	*Helichryso italici-Cistetum cretici*	*Helichrysum italicum* subsp. *italicum, Cistus creticus, Cistus monspeliensis, Cistus salviifolius*
Grassland	*Tuberario guttatae-Plantaginetum bellardii*	*Plantago bellardii* subsp. *bellardii, Tuberaria guttata* var. *guttata, Ornithopus compressus, Linum trigynum, Lupinus micranthus*

Pistacia lentiscus, *Arisarum vulgare*, *Viburnum tinus* subsp. *tinus*, *Phillyrea angustifolia*, *Rubia peregrina*... Table 28b shows an impoverished facies of *Galio scabri-Querco ilicis* sigmetum variant with *Fraxinus ornus* (B) which is characterized by the absence of the head and a higher frequency of open media such as *Stachyo glutinosae-Genistetum corsicae teucrietosum marum* or *Helichryso italici-Cistetum cretici* (Fig. 29, Table 17).

Fig. 30 *Galio scabri-Querco ilicis* sigmetum variant with Fraxinus ornus

The results obtained here confirm partly those obtained by Gamisans (1986): there are two holm oak series linked to the bioclimatic and vegetation levels (a lower meso-mediterranean series holm oak and a upper meso-mediterranean series holm oak) (Fig. 30, Table 18).

These series are largely dominated by the green oak which, on the scale of a human life, is not supplanted by other climax species (*Quercus pubescens* in particular). This fact has already been observed in the Taravu valley (Gamisans et al. 1981). Nevertheless, it should be noted that *Quercus pubescens* intervenes punctually in the series of holm oak on shallow soil. When *Quercus pubescens* becomes more abundant, it is generally on more evolved soils, and the series is attached to the *Galio scabri-Querco ilicis* sigmetum variant with *Quercus pubescens.*

Conservation Issues The historical data (Reille 1975, 1988b) show that the development of the holm oak in the forest is contemporary, resulting from the significant increase of the human impact on the natural environments, 5000 years ago. The floristic interest of this series is reflected by the presence of *Thymelaea tartonraira* subsp. *thomasii*, protected and very localized taxon in Corsica. *Santolina corsica*, a Corsican-Sardinian endemic species, has been observed sporadically in the Cap Corse region. From a landscape point of view, this series is marked by a large number of dynamic stages linked to pastoral management. The best conserved green oak forests are located in the Moltifao communal forest, where they are remarkable stands of forest type. The top seed with green oak and the stage of maquis with maritime pine are two HIC corresponding respectively to (9340-11) " Meso-Mediterranean holm-oak forests " and to (9540-1.5) "Mediterranean pine forests with endemic Mesogean pines".This vegetation series is frequent in Corsica and occupies almost the entire Meso-mediterranean floor. In the valley of Asco, it speaks on 2500 ha. More widely in the Mediterranean this series is very common; It was recorded in Sardinia (Bacchetta et al. 2010), Peninsular Italy (Blasi 2010) and Spain (Rivas-Martínez 1987).

Associated Vegetations The relief occupied by this series includes many rocky outcrops on which thrive:

Table 18 *Galio scabri-Querco ilicis* sigmetum variant with *Lathyrus venetus*

	A						B																				
Synrelevé n.	1	2	3	4	5	**6***	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	
Geographic area	Cap Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	**Cap Corse**	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap Corse	
Area (ha)	10.6	4.5	5.5	9	49.5	**67**	4.9	3.8	4.8	13.6	4.5	8	13.6	1.4	16	20.2	15	57	73.6	84	30	16.5	15.4	11.2	10	0.93	
Cover (%)	100	100	100	100	95	**95**	90	100	70	95	85	95	100	100	90	90	95	95	90	90	95	100	100	70	90	70	
Average altitude (m)	530	640	550	630	417	**500**	580	377	630	650	500	500	380	460	558	420	450	430	408	400	326	547	466	430	820	5	
Slope (in °)	60	60	60	60	10	**5**	70	60	40	5	10	15	10	40	5	-	10	5	5	5	5	5	20	20	10	10	
Aspect	N	NE	N	N	S	**NE**	N	S	SW	N	SE	NW	N-NE	SW	NE	-	SW	S	S-SE	E	SW	E	S	S-SE	S-SW	S-SE	
Syntaxonomic richness	2	2	2	2	4	**6**	1	1	2	3	3	3	3	2	4	3	2	2	2	5	1	3	3	3	2	2	Σ
Characteristic syntaxa of progressive dynamic																											
Galio scabri-Quercetum ilicis lathyretosum veneti	O2	O2	O2	O2	O2	**O3**																					**I**
Pulicario odorae-Arbutetum unedonis	O5	O5	O5	O4	O4	**O2**	O4			O3	O4	O5	O5				O2			O4	O4	O4				O3	**III**
Helichryso italici-Cistetum cretici								O2	…3	O3	o3	O2	o1	o1	O2	O4											**II**
Tuberario guttatae-Plantaginetum bellardii					…2	**…2**			…2	…1	…1	…+	…+	…+	…2	…2	…2	…1	…1	…2		…1	…2	…+	…1		**III**
Characteristic syntaxa of regressive dynamic linked to fire																											
Stachydo glutinosae-Genistetum corsicae																				O2				O2			+
Stachydo glutinosae-Genistetum corsicae rosmarinetosum officinalis						**O4**													o1				o2				+
Stachydo glutinosae-Genistetum corsicae teucrietosum mari					…2	**O3**										O2		o2		O3			O4	O3	o1		**II**
Characteristic syntaxa of regressive dynamic linked to trampling																											
Pruno spinosae-Rubion ulmifolii																										O3	**r**
Pruno spinosae-Rubion ulmifolii communities with *Rubus ulmifolius* and *Prunus spinosa*						**o1**									.+												+
Pruno spinosae-Rubion ulmifolii communities with *Pteridium aquilinum* and *Rubus ulmifolius*																						O3					**r**
Echio lycopsis-Galactitetum tomentosae															o1					…1							+

- edaphoxerophilous of rocky slabs permaseries: *Sedo brevifolii-Dianthetum godroniani*, *Saxifrago tridactylitis-Sedetum stellati*;
- chasmophytic permaseries of *Asplenietea thrichomanis* (Fig. 31, Table 19).

Edapho-anthropophilous series, meso-mediterranean subhumid on acidiclinous to neutro-alcalinous substrate with *Galium scabrum* and *Quercus pubescens*

[*Galio scabri-Querco ilicis* sigmetum variant with *Quercus pubescens*]
[*holotypus*: rel. 1—Table 21**]**

Sigmaecology This series is limited in Corsica most often around svillages and hamlets of the upper meso-mediterranean level. It is the result of anthropogenic agropastoral activities that have shaped the landscape in a terraced system. This morphological configuration of the landscape implies a soils differentiation, the latter being more developed (brunisol) than the xeric soils favorable to the series of the holm oak (*Galio scabri-Querco ilicis* sigmetum Bacchetta et al. 2007). The geological substrate is crystalline and siliceous (granite). This edapho-anthropophilous series extends from 400 to 700 m of altitude, even 800 m on the sunniest slopes. Ombrotype: subhumid lower than upper subhumid. Thermotype: lower meso-mediterranean to upper meso-mediterranean.

Sigmachorology This series appears punctually throughout Corsica and mainly around the villages.

Catenal Positioning It occupies the slopes of the upper meso-mediterranean level and spreads out on the old terraces. It marks the series of the holm oak (*Galio scabri-Querco ilicis* sigmetum), a major unit of the landscape of the meso-mediterranean floor in Corsica.

Structural Diagnosis The head of series is *Galio scabri-Quercetum ilicis quercetosum pubescentis*. This plant communitie is characterized by species of thicket such as *Erica arborea* and *Arbutus unedo*, regularly accompanied by *Cytisus villosus*. The herbaceous stratum is dominated by *Pulicaria odora*, *Galium scabrum*, *Carex distachya*, *Viburnum tinus*, *Clematis flammula*, and *Smilax aspera*.

The stages are hardly perceptible in the landscape. Elements of grassland are expressed on very small areas, with *Tuberaria guttata* var. *guttata*, *Plantago bellardii* subsp. *bellardii, Trifolium stellatum*. This stage is often interwoven in the high sub-scrubland with *Cytisus villosus* mixed with some species of thicket, as *Erica arborea* or *Phillyrea angustifolia* (Table 20).

Sigmasystematic

1 synrelevé
Average syntaxonomic richness: 5 syntaxa by synrelevé (Table 21).

Conservation Issues Given the fragmentary data on the dynamic stages, conservation issues are difficult to assess. Only the head of series is a HIC (9340-11)

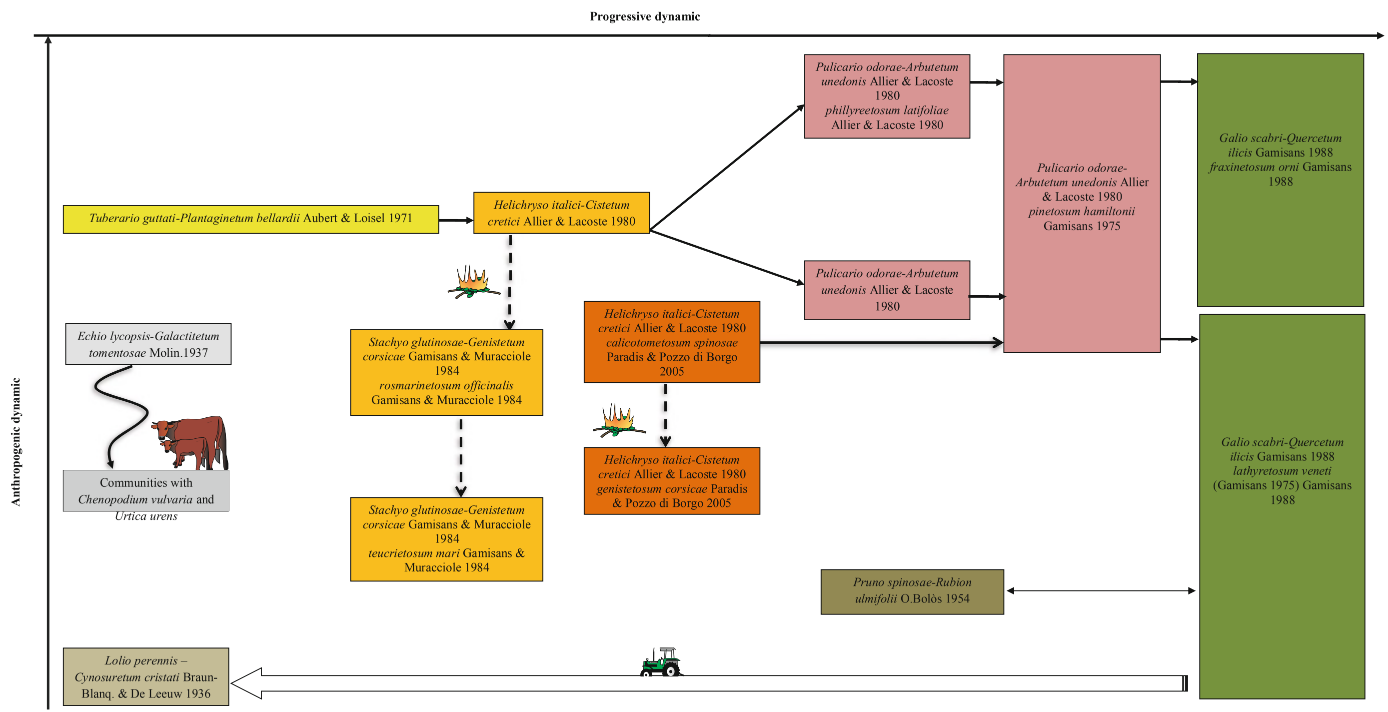

Fig. 31 *Galio scabri-Querco ilicis* sigmetum Bacchetta, Bagella, Biondi, Farris, Filigheddu and Mossa 2009

Table 19 *Galio scabri-Querco ilicis* sigmetum variant with Fraxinus ornus

	A						B																															
Synrelevé n.	1	2	**3***	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
Geographic area	Cap Corse	Cap Corse	**Cap Corse**	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse
Area (ha)	3.1	4	**2**	2.6	2.4	3.2	19.8	7.6	6.8	22.5	9.12	5.8	15.2	43	6.1	9.5	10.3	8.2	6.4	5	3.2	4.5	8.4	5.3	6.8	6.05	6.6	0.9	42	12.4	11.27	7.7	17.1	4.7	2.9	2.6	34.5	16.3
Cover (%)	90	100	**100**	80	100	100	90	95	95	80	95	95	95	95	95	95	98	95	98	95	90	90	70	95	95	95	100	100	80	98	85	100	95	85	95	95	70	90
Average altitude (m)	345	350	**377**	430	406	465	230	211	274	353	250	150	300	72	210	267	230	361	250	350	190	94	130	359	281	130	264	160	350	160	90	250	150	400	180	300	320	210
Slope (in °)	30	30	**30**	20	30	40	45	20	20	20	20	20	20	10	10	10	5	20	10	15	15	15	10	10	10	10	10	10	40	10	5	10	5	15	15	15	15	10
Aspect	S	S	**S**	SE	E	NE	S	NW	SW	NW	SW	SW	NW	NE	N	NW	SW	NW	NE	NW	S	N	NW	SE-E	SW	SE	N	NW	N	W	W	SE	W	S	NE	NW	N-NW	W
Syntaxonomic richness	3	3	**4**	2	2	4	4	4	3	4	3	3	4	2	3	3	3	3	2	3	4	4	5	3	3	2	2	3	4	3	3	3	3	3	2	3	4	3
Characteristic syntaxa of progressive dynamic																																						
Galio scabri-Quercetum ilicis fraxinetosum orni	O2	O3	**O2**	O2	O2	O3																																
Pulicario odorae-Arbutetum unedonis phillyreetosum latifoliae	O4	O2	**O4**	O3	O5	O4	O1																															
Pulicario odorae-Arbutetum unedonis								O3	O4	O4	O3	O4	O4	O5	O3	O5	O4	O3	O5	O4	O3	O2	O2	O2		O5	O5	O5	O2			O4	O5	O3	O5	O5	O2	O4
Helichryso italici-Cistetum cretici	…1	O2	**…3**					O3	O2	O2	O3	O2	O2	O2	O3	O2	O2	O3	O2	O2	O3	O4	O2	O4	O4	o2	o2	O2	O3	O2	O2	O2	O2	o2	o2	O2	O2	O2
Tuberario guttatae-Plantaginetum bellardii			**…+**			…+	…2	…1		…1	…2	…1	…1		…2					o1	…2	…2	O2	…2	…2			…1		o2		…1	…2			…1	…2	
Characteristic syntaxa of regressive dynamic linked to fire																																						
Helichryso italici-Cistetum cretici calicotometosum spinosae																													…2	O5								
Helichryso italici-Cistetum cretici genistetosum corsicae																															O3							
Stachydo glutinosae-Genistetum corsicae								…2																														
Stachydo glutinosae-Genistetum corsicae rosmarinetosum officinalis						…1	O2																O2														O2	O2
Stachydo glutinosae-Genistetum corsicae teucrietosum mari							O2			O2			o1			o1	o2	O2			O2		O3		O2				O2		O3							
Characteristic syntaxa of regressive dynamic linked to trampling																																						
Pruno spinosae-Rubion ulmifolii																																						
Pruno spinosae-Rubion ulmifolii communities with *Rubus ulmifolius* and *Prunus spinosa*																						O2																
Pruno spinosae-Rubion ulmifolii communities with *Pteridium aquilinum* and *Rubus ulmifolius*																																						
Echio lycopsis-Galactitetum tomentosae communities with *Carlina corymbosa* and *Asphodelus ramosus*									o2																									O3				
Echio lycopsis-Galactitetum tomentosae																																						
Lolio perennis – Cynosuretum cristati																																						
Communities with *Chenopodium vulvaria* and *Urtica urens*																																						

	C																								
Synrelevé n.	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	
Geographic area	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Bonifacio	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	
Area (ha)	8.3	2.3	3.4	4.4	3.4	8.02	13	14.7	15.7	11.8	4.34	17.2	3.4	5.48	2.1	0.4	3	4.8	16.6	10.4	10.4	1.9	9.1	11.5	
Cover (%)	90	95	95	90	95	90	95	100	95	95	100	100	95	100	100	95	100	90	95	95	90	100	100	95	
Average altitude (m)	160	160	253	207	161	184	296	305	132	150	160	300	310	65	60	360	250	320	160	120	350	380	170	150	
Slope (in °)	10	15	10	15	10	10	10	15	20	15	10	10	5	20	10	15	20	15	15	5	20	30	20	10	
Aspect	W	NW	NW	NW	NW	NW	SE	NW	NW	NE	SE	SE	N	SE	NW	NW	NW	N	W	SW	E	S	E	E-SE	
Syntaxonomic richness	3	2	2	4	3	3	2	2	2	3	2	3	3	3	1	3	1	1	2	2	2	2	1	3	
Characteristic syntaxa of progressive dynamic																									∑
Galio scabri-Quercetum ilicis fraxinetosum orni																									**+**
Pulicario odorae-Arbutetum unedonis phillyreetosum latifoliae																									**I**
Pulicario odorae-Arbutetum unedonis	O3	O4	O5	O4	O5	O2	O5	O5	O5	O5	O5	O4	O5	O2	O5	O4	O5	o5	O5	O2					**IV**
Helichryso italici-Cistetum cretici	O4	O3	O2	O2	O2	O4	…1	O2	O2	…1															**III**
Tuberario guttatae-Plantaginetum bellardii				…1	…1	o2				…1	…1	…1	…1	o+											**III**
Characteristic syntaxa of regressive dynamic linked to fire																									
Helichryso italici-Cistetum cretici calicotometosum spinosae														O4									O5	O4	**+**
Helichryso italici-Cistetum cretici genistetosum corsicae																									**r**
Stachydo glutinosae-Genistetum corsicae																									**r**
Stachydo glutinosae-Genistetum corsicae rosmarinetosum officinalis																				O5					**I**
Stachydo glutinosae-Genistetum corsicae teucrietosum mari	O2											O3	o2			O2								O2	**II**
Characteristic syntaxa of regressive dynamic linked to trampling																									
Pruno spinosae-Rubion ulmifolii																									
Pruno spinosae-Rubion ulmifolii communities with *Rubus ulmifolius* and *Prunus spinosa*																o1								o1	**I**
Pruno spinosae-Rubion ulmifolii communities with *Pteridium aquilinum* and *Rubus ulmifolius*																			O2		O2	O2			**+**
Echio lycopsis-Galactitetum tomentosae communities with *Carlina corymbosa* and *Asphodelus ramosus*				…1																					**r**
Echio lycopsis-Galactitetum tomentosae																									**+**
Lolio perennis – Cynosuretum cristati																					O5	O5			**r**
Communities with *Chenopodium vulvaria* and *Urtica urens*																									**r**

Table 20 Biodindicator species of *Galio scabri-Querco ilicis* sigmetum variant à *Quercus pubescens*

Physiognomy of vegetations	Plant communities	Bioindicator species
Forest	*Galio scabri-Quercetum ilicis quercetosum pubescentis*	*Quercus pubescens, Ostrya carpinifolia, Fraxinus ornus* var. *ornus, Arbutus unedo, Erica arborea, Castanea sativa*
Maquis	*Pulicario odorae-Arbutetum unedonis*	*Arbutus unedo, Erica arborea,Pulicaria odora, Brachypodium retusum, Quercus ilex*
Sub-scrubland	*Helichryso italici-Cistetum cretici*	*Helichrysum italicum* subsp. *italicum, Cistus creticus, Cistus monspeliensis, Cistus salviifolius,*
Grassland	*Tuberario guttatae-Plantaginetum bellardii*	*Plantago bellardii* subsp. *bellardii, Tuberaria guttata* var. *guttata, Ornithopus compressus, Linum trigynum, Lupinus micranthus*

Table 21 *Galio scabri-Querco ilicis* sigmetum variant with Quercus pubescens

Synrelevé n.	**1***
Geographic area	**Cap-Corse**
Area (ha)	**20.6**
Cover (%)	**100**
Aspect	**E**
Average altitude (m)	**460**
Slope (en °)	**15**
Syntaxonomic richness	**5**
Characteristic syntaxa of progressive dynamic	
Galio scabri-Quercetum ilicis quercetosum pubescentis	**o2**
Pulicario odorae-Arbutetum unedonis	**O5**
Characteristic syntaxa of regressive dynamic linked to fire	
Pulicario odorae-Arbutetum unedonis communities with *Cytisus villosus*	**O2**
Characteristic syntaxa of regressive dynamic linked to trampling	
Pruno spinosae-Rubion ulmifolii communities with *Pteridium aquilinum* and *Rubus ulmifolius*	**O1**
Helichryso italici-Cistetum cretici calicotometosum spinosae	**O2**

"Meso-Mediterranean holm-oak forests". This series illustrates the agrosylvopastoral history of Corsica, hence its strong landscape interest. It is found mainly on the old terraces, near villages. Fires which represent the main threat of regression of the series, induce soil erosion. Game, such as wild boar and deer, play a major role in the physiognomic and floristic destructuration of herbaceous stratum, which becomes more ruderal. More generally, the dynamics of forests are modified with a greater or lesser impact, notably on the regeneration of hardwood species. However, this pressure tends to diminish and, in some places, there is a real enrichment of these various terraces.

Associated Vegetations This series includes associated permaseries, particularly at the level of the stone walls of the old cultivated terraces. These correspond to vegetations of *Asplenietea trichomanis* with *Umbilicus rupestris*, *Asplenium trichomanes* subsp. *trichomanes*, *Hepatica nobilis* and *Anogramma leptophylla* (Fig. 32).

Corso-Sardinian edaphophilous series, low mediterranean subhumid on acidophilous substrate with *Galium scabrum* and *Quercus suber*
[*Galio scabri-Querco suberis* sigmetum Bacchetta et al. 2010**]**

Sigmaecology This thermophilous series develops within the thermo-mediterranean level on deep soils (Brunisoil) resting on crystalline substrates and. This series extends from 50 to 300 m of altitude. It requires a certain atmospheric humidity. Ombrotype: lower subhumid. Thermotype: thermo-mediterranean.

Sigmachorology In Corsica, this series is present on the whole of the thermo-mediterranean level in which it constitutes a major component of the landscape. It occupies the plains and valleys of the east coast of Cap Corse as well as the Eastern Plain until the region of Porto-Vecchio. More broadly, this series has a Corso-Sardinian range (Angius et al., 2011). It is very localized on the west coast of the island.

Catenal Positioning This series is present at the upper contact of the *Clematido cirrhosae-Pistacio lentisci* minorisigmetum variant with *Smilax aspera* and at the lower contact of the *Galio scabri-Querco ilicis* sigmetum.

Sigmastructure The head of series is characterized by cork oak forests with a height of between 4 and 6 m (up to 10 m). The undergrowth of these oak groves is dominated by maquis to *Erica arborea* and *Arbutus unedo*. The herbaceous flora is characterized by the thermophilous species (*Rubia peregrina, Smilax aspera, Lonicera implexa*).

The series includes stages of degradation linked to various factors:

- effects of grazing: nitrophilous lawns with *Asphodelus ramosus* subsp. *ramosus* [*Echio lycopsis-Galactitetum tomentosae*] and recolonization scrubland with *Crataegus monogyna* subsp. *monogyna* [*Pruno spinosae-Rubion ulmifolii*].
- soil erosion: on the most eroded soils, dwarf sub-scrubland develop to *Stachys glutinosa* and *Genista corsica* [*Stachyo glutinosae-Genistetum corsicae teucrietosum mari* and *Stachyo glutinosae-Genistetum corsicae rosmarinetosum officinalis*].
- on the abandoned terraces, an anthropogenic grouping is developed in *Olea europaea* var. s*ylvestris* and *Pistacia lentiscus* (Table 22).

Sigmasystematic [*holotypus:* rel. 1 - Table 23]

7 synrelevés.

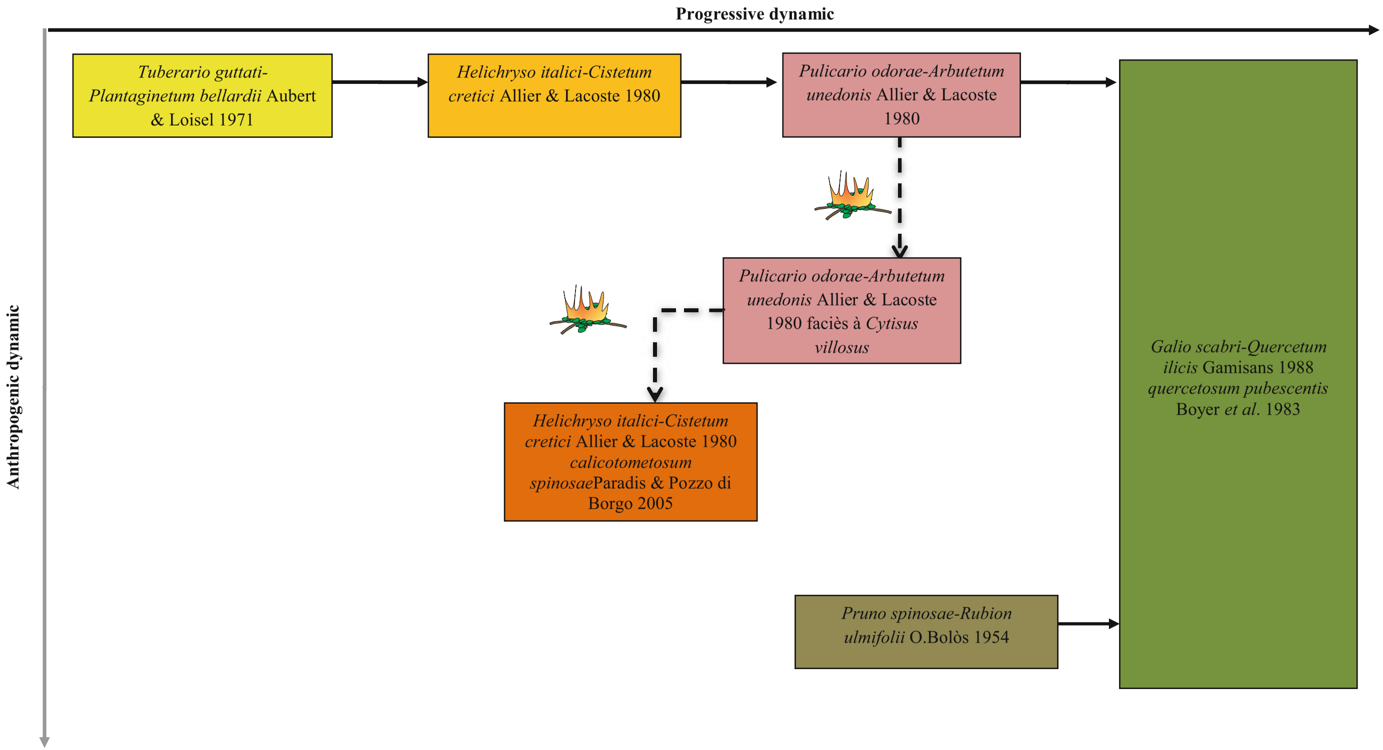

Fig. 32 *Galio scabri-Querco ilicis* sigmetum variant with Quercus pubescens

Table 22 Bioindicator species of *Galio scabri-Querco suberis* sigmetum Bacchetta et al. 2010

Physiognomy of vegetations	Plant communities	Bioindicator species
Forest	*Galio scabri-Quercetum suberis*	*Quercus suber, Galium scabrum, Hedera helix* subsp. *helix, Fraxinus ornus* var. *ornus, Cytisus villosus, Viburnum tinus*
Maquis	*Pulicario odorae-Arbutetum unedonis phillyreetosum latifoliae*	*Phillyrea latifolia, Arbutus unedo, Erica arborea, Pulicaria odora, Quercus ilex*
Sub-scrubland	*Helichryso italici-Cistetum cretici*	*Helichrysum italicum* subsp. *italicum, Cistus creticus, Cistus monspeliensis, Cistus salviifolius,*
Lawn	*Tuberario guttatae-Plantaginetum bellardii*	*Plantago bellardii* subsp. *bellardii, Tuberaria guttata* var. *guttata, Ornithopus compressus, Linum trigynum, Lupinus micranthus,*

Average syntaxonomic richness: 4.6 syntaxa by synrelevé.

Table 25 shows a facies of *Galio scabri-Querco suberis* sigmetum (B) which is characterized by the absence of the head of series and a higher frequency of anthropogenic vegetation (*Pruno spinosae-Rubion ulmifolii*).

Conservation Issues The head of series (*Galio scabri-Quercetum suberis*) is a priority HIC (9330-3) "Tyrrhenian cork-oak forests". No remarkable species were recorded during investigations but it that the series contains endemic Corsican or Corso-sardinian species (Gamisans and Marzocchi 2010). Frequent fires and urbanization are the main threats of degradation. The presence of invasive species (*Agave americana* var. *americana, Opuntia ficus-indica*...) tends to disrupt the natural vegetation of this series. The old oark oak forest spared from fires correspond to one of the habitats of Hermann's tortoise (*Testudo hermanni* Gmelin 1789).

Associated Vegetations No associated vegetation was observed (Figs. 33 and 34).

Corsican edaphohygrophilous series, meso-mediterranean subhumid on schistous subtrates with *Ostrya carpiniflia* and *Quercus ilex* [*Ostryo carpinifoliae-Querco ilicis* sigmetum]

Sigmaecology This meso-oligotrophic, hygrophilous and acidiphilous series develops in the meso-mediterranean plateau between 400 and 700 m above sea level on steeply sloped slopes on deep and humid soils (brunisoil) with a humid horizon which may be thick (moder). It is representative of a moist meso-mediterranean climate. Ombrotype: subhumid lower than humid lower. Thermotype: lower meso-mediterranean.

Sigmachorology In Cap Corse, this series is localized in the heights of Sisco and Pietracorbara valley. In Corsica, it would seem that this series is also frequent in Castagniccia where it would occupy more substantial areas.

Table 23 *Galio scabri-Querco suberis* sigmetum Bacchetta, Bagella, Biondi, Farris, Filigheddu and Mossa 2010

	A			B				
Synrelevé n.	**1***	2	3	4	5	6	7	
Geographic area	**Cap-Corse**	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	Cap-Corse	
Area (ha)	**6.9**	3.21	11.4	5.8	26.5	5.2	3.9	
Cover (%)	**95**	100	100	100	95	100	100	
Average altitude (m)	**80**	50	150	100	100	150	85	
Slope (in °)	**14**	10	5	10	20	10	5	
Aspect	**S**	-	W	NW	W	N	NW	
Syntaxonomic richness	**5**	6	4	3	6	6	2	
								∑
Characteristic syntaxa of progressive dynamic								
Galio scabri-Quercetum suberis	**O2**	O2	O2					**III**
Pulicario odorae-Arbutetum unedonis quercetosum suberis	**O2**	O2	O3	O2	O2	O2	O4	**V**
Pulicario odorae-Arbutetum unedonis	**O4**			O4				
Helichryso italici-Cistetum cretici	**O2**	O2	O2					**III**
Tuberario guttatae-Plantaginetum bellardii	**…1**	…2			…1	…1		**IV**
Characteristic syntaxa of regressive dynamic linked to fire								
Pulicario odorae-Arbutetum unedonis communities with *Cytisus villosus*								
Helichryso italici-Cistetum cretici calicotometosum spinosae			O4					**I**
Helichryso italici-Cistetum cretici genistetosum corsicae				O1				**I**
Stachydo glutinosae-Genistetum corsicae teucrietosum mari								
Characteristic syntaxa of regressive dynamic linked to trampling								
Pruno spinosae-Rubion ulmifolii								
Pruno spinosae-Rubion ulmifolii communities with *Pteridium aquilinum* and *Rubus ulmifolius*					O3	O2	O2	**III**
Onopordetum illyrici								
Echio lycopsis-Galactitetum tomentosae					O4	O2		**II**
Other syntaxa								
Lino biennis – Cynosuretum cristati					o2			**I**
Lino biennis-Festucetum arundinaceae		O3				O3		**II**
Lolio perennis – Cynosuretum cristati		O3			O2	O3		**III**

Fig. 33 *Galio scabri-Querco suberis* sigmetum

Catenal Positioning From an altitudinal point of view, it is located at the upper contact of *Galio scabri-Querco ilicis* sigmetum and the lower contact *Buxo semperviventi-Querco ilicis* sigmetum.

Sigmastructure The physiognomy is dominated by the forest of *Ostrya carpinifolia* and *Quercus ilex* (*Ostryo carpinifoliae-Quercetum ilicis*). The head of series corresponds to a dense forest marked by the dominance of *Ostrya carpinifolia*. *Quercus ilex* appears more sporadically. The shrub stratum is dominated by more or less dense thickets of *Rubus ulmiifolius*. The herbaceous layer is sporadic in view of the high overlap of the upper strata.

This series is expressed only in the arborescent stratum. However, future prospects in Castagniccia should make it possible to define more precisely its dynamic trajectories.

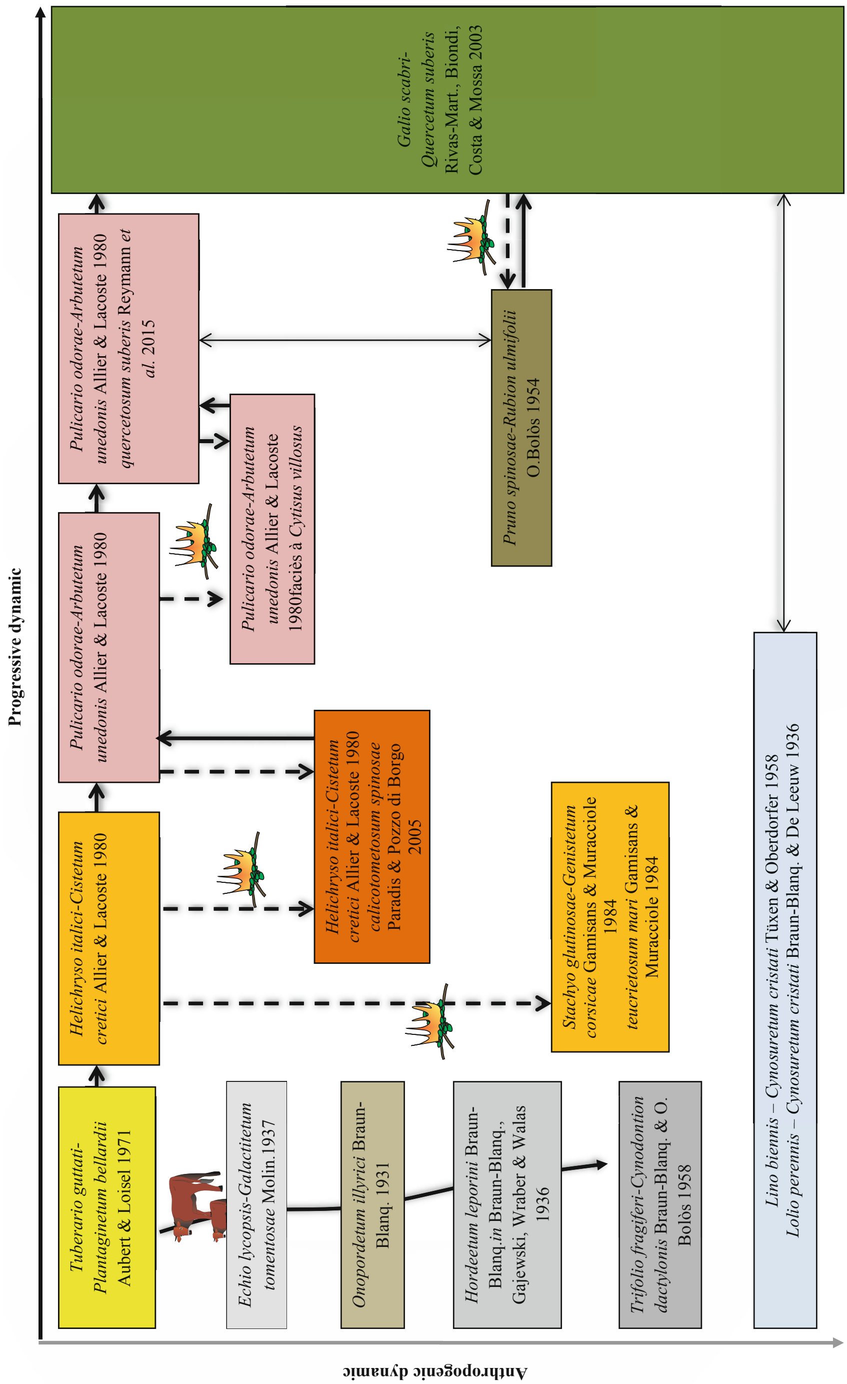

Fig. 34 *Galio scabri-Querco suberis* sigmetum Bacchetta, Bagella, Biondi, Farris, Filigheddu and Mossa 2010

Sigmasystematic [*holotypus:* rel. 7, Table 24]

14 synrelevés
Average syntaxonomic richness: 1.8 syntaxa by synrelevé.

Conservation Issues Given the fragmentary data on the dynamic stages, conservation issues are difficult to assess. With regard to restricted range and singular ecological conditions, this series does not appear to be threatened. Further investigations would make it possible to better understand the conservation issues.

Associated Vegetations This series includes chasmophytic permaseries of the rock walls *Selaginello denticulatae-Anogrammetum leptophyllae* or groups of the *Adiantion capilli-veneris*. These plant communities are generally dominated by *Selaginella denticulata* and *Adiantum capillus-veneris*.

Corsican edaphophilous minoriseries, low mediterranean subhumid on acidophilous to neutro-alkaline substrate of *Stachys glutinosa* and *Genista corsica*
[*Stachyo glutinosae-Genisto corsicae* minorisigmetum]

Sigmaecology This oligotrophic minoriseries develops on granite rock outcrops with topography and on cliffs on the meso-mediterranean level (up to 900 m on the sunniest outcrops). The substrate (lithosoil), which is shallow, is sandy-loamy and rich in coarse and xeric elements. This unit presents a truncated dynamics at two stages due to xeric edaphic conditions which do not allow the expression of a forest stage. Ombrotype: lower subhumid. Thermotype: lower and upper meso-mediterranean.

Sigmachorology This minoriseries is common in Corsica. It occupies numerous rock outcrops from the thermo-mediterranean to the meso-mediterranean levels.

Catenal Positioning It grows both on rocky outcrops of steep cliffs and in rocky slabs located in the openings of the *Galio scabri-Querco ilicis* sigmetum.

Sigmastructure The head of this series corresponds to *Stachyo glutinosae-Genistetum corsicae*. This dwarf sub-scrubland is dominated by *Stachys glutinosa* and *Genista corsica* associated with other species such as *Teucrium marum* subsp. *marum* or *Rosmarinus officinalis*. The sporadic herbaceous stage is dominated by sparse elements of the *Helianthemetea guttati*: *Tuberaria guttata* var. *guttata, Aira caryophyllea* subsp. *caryophylla, Ornithopus compressus*, *Vulpia ciliata* subsp. *ciliata* var. *ciliata*, *Vulpia myuros* subsp. *myuros*.

Two successive stages are distinguished: lawn of *Tuberario guttati-Plantaginetum bellardii* and the chamephytic stage of *Stachyo glutinosae-Genistetum corsicae*. Some individuals of *Juniperus oxycedrus* subsp. *oxycedru*s can be present within the sub-scrubland. Most often, only the chamephytic stage is present.

Sigmasystematic [*holotypus*: rel. 3, Table 25]

13 synrelevés
Average syntaxonomic richness: 1.6 syntaxa by synrelevé.

Table 24 *Ostryo carpinifoliae—Querco ilicis* sigmetum

Synrelevé n.	1	2	3	4	5	6	**7***	8	9	10	11	12	13	14	
Geographic area	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	**Cap Corse**	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	
Area (ha)	13.1	8	6.7	6.9	6.8	8.5	**11.9**	10.7	0.5	2.9	3.34	4.6	6.86	11.1	
Cover (%)	100	100	100	100	100	100	**100**	98	100	100	100	100	100	100	
Average altitude (m)	700	749	670	198	451	522	**460**	570	520	540	530	500	671	548	
Bioclimat	14	5	5	10	10	10	**0.15**	15	5	10	5	10	10	10	
Slope (in °)	N	NE	NE	W	N	NE	**NW**	NE	NW	NE	NW	NW	N	NE	
Syntaxonomic richness	1	1	1	2	2	2	**2**	2	2	2	2	2	2	2	∑
Characteristic syntaxa of progressive dynamic															
Ostryo carpinifoliae-quercetum ilicis	O5	O5	O5	O5	O5	O5	**O5**	O5	O5	O5	O5	O4	O5	O4	**V**
Characteristic syntaxa of regressive dynamic linked to fire															
Pruno spinosae-Rubion ulmifolii communities with *Rubus ulmifolius* and *Prunus spinosa*				O2	o+	o+	**O2**	o1	O2	O2	o2	O3	O2	O3	**IV**

Table 25 *Stachyo glutinosae-Genisto corsicae* minorisigmetum

Synrelevé n.	1	2	**3***	4	5	6	7	8	9	10	11	12	13	
Geographic area	Cap Corse	Cap Corse	**Cap Corse**	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	
Area (ha)	1.53	1.53	**2.7**	2.3	7.1	1.1	6.4	7.2	0.5	0.15	0.5	0.3	0.2	
Cover (%)	70	60	**80**	75	25	15	25	40	15	10	15	10	10	
Average altitude (m)	292	200	**233**	246	250	305	350	281	130	290	310	300	215	
Slope (in °)	2	-	**-**	-	-	-	-	-	-	-	-	-	-	
Aspect	N	-	**-**	-	-	-	-	-	-	-	-	-	-	
Syntaxonomic richness	2	2	**2**	2	2	2	2	2	1	1	1	1	1	Σ
Characteristic syntaxa of progressive dynamic														
Stachydo glutinosae-Genistetum corsicae teucrietosum mari	O4	O4	**O4**	O4	O2	O2	O3	O3	o2	o2	O2	O2	O2	V
Tuberario guttati-Plantaginetum bellardii	…1	…1	**…2**	…2	…+	…1	…1	…1						IV

Conservation Issues This minoriseries is structured by two endemic species: *Stachys glutinosa* (endemic Corso-Sardinian and Capraia) and *Genista corsica* (endemic Corso-Sardinian). Given the singular ecological conditions (steep relief, lean and superficial soil, very sunny exposure), no threat seems to weigh on this minoriseries.

Associated Vegetations This unit includes numerous rock outcrops on which develops as *Sedo brevifolii-Dianthetum godroniani* (Fig. 35).

Corsican geopermaseries, meso-mediterranean dry-subhumide on acidophilous to neutro-alkaline substrate
[*Saxifrago tridactylites-Sedo stellati* geopermasigmetum]
[*holotypus*: rel. 1, Table 26**]**

This geopermaseries has been recorded on very sunny rocky outcrops in a south-south-east position.

3 geopermasynrelevés

Average syntaxonomic richness: 2.5 permasigmataxa by geopermasynrelevé.

Corsican geopermaseries, meso-mediterranean dry-subhumide on acidophilous to neutro-alkaline oozing walls
[*Selaginello denticulatae-Anogrammo leptophyllae* geopermasigmetum]
[*holotypus*: rel. 1, Table 27**]**

These permaseries are represented by vegetation of the oozing walls. They are characterized by a blocked dynamics and by the abundance of *Adiantum capillus-veneris* and *Selaginella denticulata*. These vegetations are observed under sciaphilous conditions in the coolest and most humid areas.

2 geopermasynrelevés

Average syntaxonomic richness: 2 permasigmataxa by geopermasynrelevé.

Corsican geopermaseries, meso-mediterranean dry on neutro-alkaline screes
[*Notholanae marantae-Sileno paradoxae* geopermasigmetum]

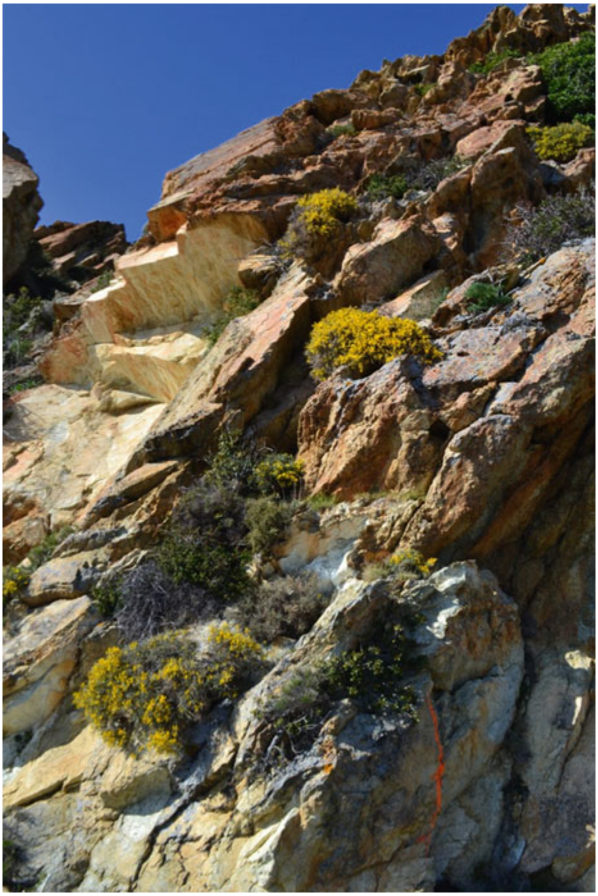

Fig. 35 *Stachyo glutinosae-Genisto corsicae* minorisigmetum

Table 26 *Saxifrago tridactylites-Sedo stellati* geopermasigmetum

Geopermasynrelevé n.	**1***	2	3	
Geographic area	**Cap Corse**	Cap Corse	Cap Corse	
Area (ha)	**1.1**	39	4	
Cover (%)	**30**	85	3	
Permasigmataxa number	**3**	3	2	∑
Saxifrago tridactylitis-Sedo stellati permasigmetum	**.+**	o1	.r	**3**
Sedo brevifolii-Diantho godroniani permasigmetum	**.r**	.r	.r	**3**
Umbilico rupestris-Sedo andegavense permasigmetum	**.r**			**1**

Table 27 *Selaginello denticulatae-Anogrammo leptophyllae* geopermasigmetum

Geopermasynrelevé n.	**1***	2	
Geographic area	**Cap Corse**	Cap Corse	
Area (ha)	**0.01**	0.01	
Cover (%)	**70**	50	
Permasigmataxa number	**3**	1	∑
Selaginello denticulatae-Anogrammo leptophyllae permasigmetum	**O4**	o3	**2**
Permasigmetum with *Soleirolia soleirolii*	**.r**		**1**
Permasigmetum with *Adiantus capilli-veneris*	**.r**		**1**

Table 28 *Notholanae marantae-Sileno paradoxae* geopermasigmetum

Geopermasynrelevé n.	**1***	2	3	
Geographic area	**Cap Corse**	Cap Corse	Cap Corse	
Area (ha)	**1**	1.3	0.8	
Cover (%)	**40**	40	60	
Permasigmataxa number	**3**	3	2	
				∑
Notholaeno marantae-Sileno paradoxae permasigmetum	.+	o1	O2	**2**
Sedo albi-Notholaeno marantae permasigmetum			O1	**1**
Sedo rupestris-Hieracio pilosellae permasigmetum	O2	o1	.+	**3**
Galio parisiense-Mercurialo corsicae permasigmetum	O2	O2	O3	**3**

[***holotypus*: rel. 1 du** Table 28]

These permaseries are represented by communities with blocked dynamics, subservient with scree in xerophilous to meso-xerophilous conditions.

From a catenal point of view, these permaseries are associated with the climatophilous series of the holm oak.

3 geopermasynrelevés

Average syntaxonomic richness: 3.3 permasigmataxa by geopermasynrelevé.

3.2.4 Supra-Mediterranean Sigmetal and Geosigmetal Units

Corsican climatophilous series, supra-mediterranean humid with *Ilex aquifolium* and *Quercus ilex*
[*Ilici aquifoliae-Querco ilicis* sigmetum]

Sigmaecology This unit develops on acidophilous edaphoxoclinous crystalline or schistous substrates between 700 and 1200 m altitude. It occupies the south and west slopes. The soils are superficial and little evolved (lithosoils and sometimes ochrous alocrisoils), stony and whose interstitial matrix is sandy loam. Ombrotype: lower wet. Thermotype: supra-mediterranean.

Sigmachorology This series is frequent on the whole of the supra-mediterranean level but on small areas.

Catenal Positioning This series is in upper contact with the *Galio scabri-Querco ilicis* sigmetum and in the lower contact of the *Galio rotundifolii-Pino laricionis* sigmetum variant with *Erica arborea* or *Poo balbisii-Fago sylvaticae* sigmetum.

Sigmastructure The head of this series is represented by a forest (6–8 m high) dominated by *Quercus ilex* and *Ilex aquifolium*. The shrub layer consists essentially of *Ilex aquifolium*, *Fraxinus ornus* var. *ornus* and *Crataegus monogyna*. The herbaceous stage consists of species such as *Festuca heterophylla*, *Galium rotondifolium*, *Potentilla micrantha*, *Lathyrus venetus*, *Geranium nodosum*, *Veronica officinalis*.

From a dynamic point of view, this series is part of a secondary dynamic following the destruction of deciduous oak trees or supra-mediterranean beech trees (Table 29).

Table 29 Bioindicator species of *Ilici aquifoliae-Querco ilicis* sigmetum

Physiognomy of vegetations	Plant community	Bioindicator species
Forest	*Ilici aquifoliae-Quercetum ilicis*	*Juniperus oxycedrus* subsp. *oxycedrus, Quercus ilex, Carex distachya*
Maquis	*Rubo ulmiifolii-Ericetum arboreae*	*Erica arborea, Rubus ulmifolius, Galium rotondifolium, Helleborus lividus* subsp. *corsicus*
Sub-scrubland	*Helichryso italici-Genistetum salzmannii*	*Helichrysum italicum* subsp. *italicum, Genista salzmannii var. salzmannii, Teucrium marum, Anthyllis hermanniae* subsp. *corsica, Carlina macrocephala* subsp. *macrocephala, Silene nodulosa, Peucedanum paniculatum*
Grassland	*Caricion caryophylleae*	*Carex caryophyllea, Lotus corniculatus, Bellis perennis, Festuca rubra* subsp. *rubra* var. *rubra, Cynosurus cristatus, Anthoxanthum odoratum* subsp. *odoratum, Poa bulbosa* subsp. *bulbosa, Asphodelus cerasiferus, Polygala vulgaris* subsp. *vulgaris*

Table 30 *Ilici aquifoliae-Querco ilicis* sigmetum

Synrelevé n.	1	**2***	3	
Geographic area	Cap Corse	**Cap Corse**	Cap Corse	
Area (ha)	10.7	**12.3**	13.1	
Cover (%)	100	**100**	100	
Bioclimat	N	**N**	NW	
Slope (in °)	1004	**986**	977	
Aspect	14	**14**	14	
Syntaxonomic richness	1	**1**	2	Σ
Characteristic syntaxa of progressive dynamic				
Ilici aquifolii-Quercetum ilicis	O5	**O4**	O3	**3**
Rubo ulmiifolii-Ericetum arboreae		**O2**	O4	**2**

This series has a regressive dynamic stages link to grazing, characterized by sub-scrubland of recolonization with *Crataegus monogyna* subsp. *monogyna*, *Prunus spinosa* or *Pteridium aquilinum* belonging to *Pruno spinosae-Rubion ulmifolii*.

Sigmasystematic [*holotypus:* rel. 2 du Table 30]
3 synrelevés.

Average syntaxonomic richness: 1.8 syntaxa by synrelevé.

Conservation Issues This series is charaterized by a secondary dynamic and does not present any particular floristic interest. This series comprises two HIC:

- (9340–12) “Supra-Mediterranean holm-oak forests”;
- (4090–7) “Cyrno-Sardian hedge hog-heaths. *Carici-Genistetalia* (*Carlinetalia macrocephalae*)”.

This series is frequent in the supra-mediterranean level but fires and silvicultural exploitation tend to reduce its expression in plant landscape. Bovine, and sometimes porcine grazing has an impact on vegetations, reducing seedlings and discards of tree species. The impact is mainly on forest regeneration.

Associated Vegetations No associated vegetation was observed (Fig. 36).

Corsican edaphoxerophilous series, supra-mediterranean humid with *Cardamine chelidonia* and *Buxus sempervirens* [*Cardamino chelidoniae-Buxo sempervirentis* sigmetum]

Sigmaecology This edaphoxerophilous series develops on sunny slopes of the supra-mediterranean level between 1100 and 1300 m altitude on schistous substrates with superficial, shallow and stony soils (mesosaturated neoluvisoils). It is part of a secondary dynamic, the fires having destroyed the primitive vegetation. Ombrotype: wet lower than upper wet. Thermotype is supra-mediterranean.

Fig. 36 *Ilici aquifoliae-Querco ilicis* sigmetum

Sigmachorology This series is subservient to the crests of Cap Corse and is endemic to Corsica.

Catenal Positioning This unit is in the upper contact of the *Galio scabri-Querco ilicis* sigmetum et and the lower contact of the geopermaseries of the schistous rock outcrops.

Sigmastructure The head of this series is characterized by a thicket (6 m) of *Buxus sempervirens*. The high density of the forest of *Buxus sempervirens* implies an almost non-existent underbrush where only individuals of boxwood persist. The herbaceous stratum is also sporadic, characterized by the presence of *Cardamine chelidonia*, *Carex digitata*, *Galium rotundifolium*, *Festuca heterophylla* and *Mercurialis perennis*.

The repeated passage of fires induces soil erosion and favors the development of a dwarf sub-scrubland in *Thymus herba-barona* (*Thymo herba-baronae-Genistetum lobelioidis*) (Table 31).

Sigmasystematic [*holotypus*: rel. 5—Table 32]
12 synelevés

Average syntaxonomic richness: 3.3 syntaxon by synrelevé.

Table 32 shows that *Cardamino chelidoniae-Buxo sempervirentis* sigmetum has a facies marked by the absence of the seed. The recurring passages of the fires have favored the expression of the maquis of *Rubo ulmiifolii-Ericetum arboreae*.

Conservation Issues The floristic interest is linked to the presence of *Cardamine chelidonia*. This species protected regionally is endemic Corsica-Italy-Sicily-Croatia and its distribution area in Corsica is limited to the massifs of Cap Corse, Tenda and

Table 31 Bioindicator species of *Cardamino chelidoniae-Buxo sempervirentis* sigmetum

Physiognomy	Plant communities	Bioindicator species
Forest	*Cardamino chelidoniae-Buxetum sempervirentis*	*Cardamine chelidonia, Mercurialis perennis, Taxus baccata, Buxus sempervirens*
Maquis	*Rubo ulmiifolii-Ericetum arboreae*	*Erica arborea, Rubus ulmifolius, Galium rotondifolium, Helleborus lividus* subsp. *corsicus*
Sub-scrubland	*Genisto salzmannii-Alyssetum robertiani*	*Alyssum robertianum, Cerastium boissierianum, Euphorbia spinosa, Anthyllis hermanniae, Thymus herba-barona, Viola corsica*
Lawn	*Caricion caryophylleae*	*Carex caryophyllea, Lotus corniculatus, Bellis perennis, Festuca rubra* subsp. *rubra* var. *rubra, Cynosurus cristatus, Anthoxanthum odoratum* subsp. *odoratum, Poa bulbosa* subsp. *bulbosa, Asphodelus cerasiferus, Polygala vulgaris* subsp. *vulgaris*

Castagniccia. This series comprises a HIC (4090-7) "Cyrno-Sardinian hedgehog-heaths. *Carici-Genistetalia* (*Carlinetalia macrocephalae*)" (*Genisto salzmannii-Alyssetum robertiani*).

Associated Vegetations This series includes an associated vegetation represented by amphibious permanent vegetation in *Juncus capitatus* and *Morisia monanthos* (*Junco capitati-Morisietum monanthi*). *Morisia monanthos* is an endemic Corso-Sardinian species (Fig. 37).

Corsican edaphohygroclinous series, supra-mediterranean humid on screes with *Fraxinus ornus* and *Acer monspessulanum* [*Fraxino orni-Acero monspessulani* sigmetum]

Sigmastructure This oligo-mesotrophic, acidiphilous, hygroclinous series of the supra-mediterranean level develops within crystalline screes, downhill colluvial to shallow soil, within talwegs between 800 and 1200 m. Ombrotype: lower humid. Thermotype: supra-mediterranean.

Sigmachorology This series is present from 700 to 1200 m, on the enclosed sectors. The series is present in, Cap Corse, in the Tartagine valley, in the Balagne region and in the Niolu valley. Elsewhere, the data remain fragmentary.

Catenal Positioning This series develops on the landlocked areas and is intercalated between the slopes occupied *Ilici aquifoliae-Querco ilicis* sigmetum on the slopes exposed to the north or occupied by *Cardamino chelidoniae-Buxo sempervirentis* sigmetum on the slopes exposed to the south.

Sigmastructure The head of this series corresponds to a forest with *Fraxinus ornus* var. *ornus* and *Acer monspessulanum*. The floristic composition of the shrub and herbaceous strata results in the presence of hygrocline species: *Fraxinus ornus* var. *ornus*, *Cyclamen repandum* subsp. *repandum, Carex distachya, Sanicula europaea, Luzula forsteri, Helleborus lividus* subsp. *corsicus.*

Table 32 *Cardamino chelidoniae-Buxo sempervirentis* sigmetum

	A					B							
Synrelevé n.	1	2	3	4	**5***	6	7	8	9	10	11	12	
Geographic area	Cap Corse	Cap Corse	Cap Corse	Cap Corse	**Cap Corse**	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	
Area (ha)	2.51	2.25	3	17.1	**12.5**	3.3	9.7	6.8	2.5	7.3	5.13	6.4	
Cover (%)	100	95	95	50	**100**	100	100	98	75	98	95	98	
Average altitude (m)	775	850	795	1256	**950**	1050	650	1100	836	684	700	1276	
Slope (in °)	5	5	10	15	**15**	10	10	10	10	5	5	10	
Aspect	S-SE	SE	NW	NW	**SW**	N	SE	NW	S	SE	SE	NE	
Syntaxonomic richness	4	3	4	3	4	3	2	4	3	4	3	3	∑
Characteristic syntaxa of progressive dynamic													
Cardamino chelidoniae-Buxetum sempervirentis	o2	O2	O4	O3	**O3**								**III**
Rubo ulmiifolii-Ericetum arboreae	O4	O2	O2		**O3**	O4	O5	O5	O4	O4	O4	…1	**V**
Genisto salzmannii-Alyssetum robertiani			…o2	O2	**O2**	o2	O2	…1	O2	O2	O3	O5	**V**
Caricion caryophylleae	…1		…+	…1	**…1**	…1		…1	o1	…1	…1	…1	**V**
Characteristic syntaxa of regressive dynamic linked to fire													
Thymo herba-baronae-Genistetum lobelioidis genistetosum lobelioidis	O2												+
Characteristic syntaxa of regressive dynamic linked to trampling													
Pruno spinosae-Rubion ulmifolii Communities with *Rubus ulmifolius* and *Prunus spinosa*								O2		O2			**I**
Pruno spinosae-Rubion ulmifolii Communities with *Pteridium aquilinum* and *Rubus ulmifolius*		O4											+

Fig. 37 *Cardamino chelidoniae-Buxo sempervirentis* sigmetum

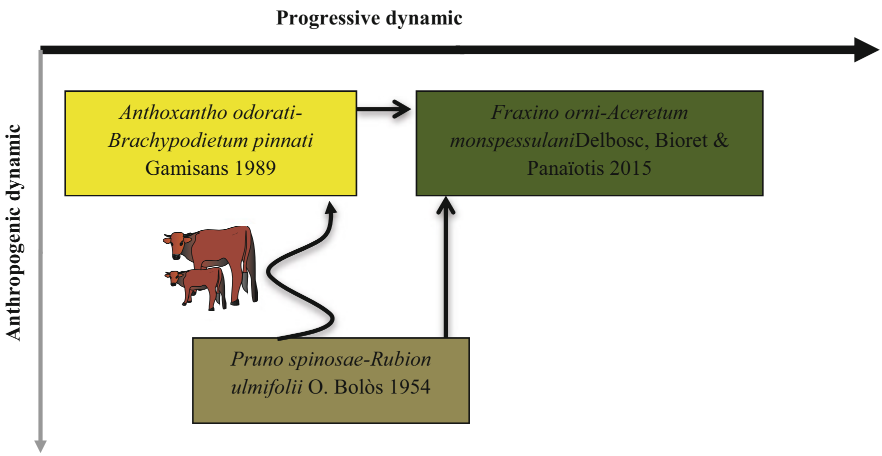

Fig. 38 *Fraxino orni-Acero monspessulani* sigmetum Delbosc, Bioret and Panaïotis 2015

The dynamics of the series are not very visible in the field. A forest of *Buxus sempervirens* appears to be a pre-forest stage. The very sporadic herbaceous stratum indicates some floristic elements of the lawns of *Caricion caryophyllaae* (*Festuca rubra* subsp. *rubra* var. *rubra, Bellis perennis, Lotus corniculatus*). This series has a regressive dynamics linked to the grazing, characterized by fructicetum of recolonization to *Crataegus monogyna* subsp. *Monogyna*, *Prunus spinosa* and *Pteridium aquilinum* of *Pruno spinosae-Rubion ulmifolii* (Fig. 38, Table 33).

Table 33 Bioindicator species of *Fraxino orni-Acero monspessulani* sigmetum

Physiognomy	Plant communities	Bioindicator species
Forest	*Fraxino orni-Aceretum monspessulani*	*Acer monspessulanum, Fraxinus ornus* var. *ornus. Buxus sempervirens*, *Hedera helix* subsp. *helix, Asplenium onopteris*, *Helleborus lividus* subsp. *corsicus*, *Euphorbia characias* subsp. *characias*
Lawn	*Anthoxantho odorati-Brachypodietum pinnati*	*Brachypodium pinnatum* subsp. *rupestre, Anthoxanthum odoratum* subsp. *odoratum, Arrhenatherum elatium* subsp. *sardous, Lotus corniculatus, Rumex acetosella* subsp. *pyrenaicus, Bellium bellidioides*

Table 34 *Fraxino orni-Acero monspessulani* sigmetum

Synrelevé n.	**1***	2	
Geographic area	**Cap Corse**	Cap Corse	
Area (ha)	**4**	5	
Cover (%)	**70**	70	
Average altitude (m)	**641**	697	
Slope (in °)	**NW**	NW	
Aspect	**20**	20	
Syntaxonomic richness	**3**	3	∑
Characteristic syntaxa of progressive dynamic			
Fraxino orni-Aceretum monspessulani	**O3**	O3	**2**
Caricion caryophylleae	**…+**	…r	**2**
Characteristic syntaxa of regressive dynamic linked to trampling			
Pruno spinosae-Rubion ulmifolii	**O2**		**1**
Communities with *Pteridium aquilinum* and *Rubus ulmifolius*		o2	**1**

Sigmasystematic [*holotypus:* rel. 1—Table 34]

2 synrelevés
Average syntaxonomic richness: 3 syntaxa by synrelevé.

Conservation Issues Given the fragmentary data on the dynamic stages of the series, conservation issues are difficult to assess. With regard to restricted range and singular ecological conditions (enclavement), this series does not seem to be threatened. Further investigations would make it possible to better understand the stakes of the series.

Fig. 39 *Fraxino orni-Acero monspessulani* sigmetum

Associated Vegetations No associated vegetation was observed (Fig. 39).

Corsican edaphohygroclinous series, supra-mediterranean subhumide-humid on neutro-alkaline substrates with *Asperula odora* and *Taxus baccata* [*Asperulo odorae-Taxo baccatae* sigmetum]

Sigmaecology This acidiphilous series develops on the ubacs of Cap Corse and in the massif of Tenda, between 900 and 1200 m of altitude. The soils are quite thick, rich in humus and often wet (saturated brownish). This series evolves under a cool and perhumid microclimate. Ombrotype: upper subhumid, lower to upper humid. Thermotype: upper supra-mediterranean.

Sigmachorology This series is expressed on very small surfaces within the supra-mediterranean leve. The distribution on a Corsican scale is not well known. Further surveys would make it possible to specify its chorology. Nevertheless, given the edaphic conditions on which it evolves, it would seem that this series has a limited distribution.

Catenal Positioning This series occupies the ubacs of the supra-mediterranean level. It is juxtaposed to the edaphoxerophilous minoriseries with *Stachys glutinosa* and *Genista corsica* in the most rocky areas, and to the series with *Buxus sempervirens* and *Quercus ilex* on thicker soils.

Sigmastructure The head of this series corresponds to a forest dominated by *Buxus sempervirens* entangled with *Taxus baccata* and more punctually *Alnus cordata*. The shrub stratum is absent. The herbaceous stratum remains sparse due to the low luminosity reaching the soil and is dominated by hygrosciaphilous species: *Luzula forsteri*, *Cyclamen repandum* subsp. *repandum, Geranium nodosum, Hedera helix* subsp. *helix*.

Table 35 *Asperulo odorae-Taxo baccatae* sigmetum

Synrelevé n.	1	2	**3***	
Geographic area	Cap Corse	Cap Corse	**Cap Corse**	
Area (ha)	1.4	2	**2.5**	
Cover (%)	100	100	**100**	
Average altitude (m)	1100	1200	**1100**	
Slope (in °)	NW	NW	**N**	
Aspect	15	15	**15**	
Syntaxonomic richness	1	1	**1**	Σ
Characteristic syntaxa of progressive dynamic				
Asperulo odorae-Taxetum baccatae	O5	O5	**O5**	**3**

Further phytosociological investigations would make it possible to refine the knowledge about the dynamics of the series.

Sigmasystematic [*holotypus:* rel. 3—Table 35]

3 synrelevés
Average syntaxonomis richness: 1 syntaxon by synrelevé.

The association of the head of series must not be confused with the Sicilian plant associations "*Ilici aquifoliae-Taxetum baccatae*" and Sardinian "*Polistycho setiferi-Taxetum baccatae*" (Farris et al. 2012). *Asperulo odorae-Taxetum baccatae* is distinguished by the presence of numerous species of *Querco-fagetea* (*Quercus pubescens*, *Asperula odorata*, *Lathyrus venetus*, *Allium ursinum*, *Sanicula europea*...).

Conservation Issues In the Cap Corse, this series is limited to supra-mediterranean ubacs. The fires and the grazing reduced the expression this series. The wooded formations with *Buxus sempervirens* and *Taxus baccata* have been extremely degraded and may disappear if the action of fire and grazing is too recurrent and intensive. This series includes a priority HIC (9580–1) "Corsican yew woods".

Associated Vegetations No associated vegetation was observed (Fig. 40).

Corsican edaphoxerophilous minoriseries, supra-mediterranean subhumide on neutro-alkaline substrates with *Genista salzmannii* and *Alyssum robertianum* [*Genisto salzmanni-Alysso robertiani* minorisigmetum]

Sigmaecology This minoriseries develops between 700 and 1300 m on the southern and southeastern slopes. It frequents the shallow, xeric substrates on the crests of Cap Corse. It is subjected to strong winds and supports a summer dry season. Ombrotype: humid inferior. Thermotype: supra-mediterranean.

Fig. 40 *Asperulo odorae-Taxo baccatae* sigmetum

Sigmachorology This Corsican endemic minoriseries is strictly subversient with the schist crests of the supra-mediterranean level of Cap Corse, Tenda and San Pedrone massifs.

Catenal Positioning This minoriseries is in contact with *Cardamino chelidoniae-Buxo sempervirentis* sigmetum in Cap Corse and in contact with the *Stellario montanae-Buxo sempervirentis* sigmetum in the San Pedrone massif.

Sigmastructure The head of series physiognomy is marked by a low chamephytic vegetation whose height does not exceed 0.6 m and whose average coverage is about 40–70%.

This minoriseries is composed of two stages:

- a lawn stage of *Caricion caryophyllae* with *Viola corsica* subsp. *corsica, Cerastium boissieranium*, *Petrorhagia saxifraga* subsp. *gasparrinii, Peucedanum paniculatum, Silene nodulosa*...;
- a sub-scrubland stage with *Genista salzmannii* var. *salzmannii* and *Alyssum robertianum*.

Sigmasystematic [*holotypus:* rel. 2 of Table 36]
3 synrelevés

Average syntaxonomic richness: 2 syntaxa by synrelevé.

Conservation Issues The originality of this minoriseries rests on the floral cortege which includes a large number of Corsican endemic species (*Alyssum robertianum, Viola corsica* subsp. *corsica*) and Corsican-Sardinian (*Silene nodulosa*). The head of minoriseries is a HIC (4090-7) "Cyrno-Sardinian hedge hog-heaths. *Carici-Genistetalia* (*Carlinetalia macrocephalae*)" according to the DHFF. The opening

Table 36 *Genisto salzmanni-Alysso robertiani* minorisigmetum

Synrelevé n.	1	**2***	3	
Geographic area	Cap Corse	**Cap Corse**	Cap Corse	
Area (ha)	3.9	**8.8**	1.6	
Cover (%)	30	**40**	35	
Average altitude (m)	930	**975**	1200	
Slope (in °)	10	**10**	10	
Aspect	NE	**NW**	W	
Nombre de syntaxons	2	**2**	2	∑
Characteristic syntaxa of progressive dynamic				
Genisto salzmannii-Alyssetum robertiani	O3	**O3**	O3	**3**
Caricion caryophyllae	…1	**…2**	…1	**3**

of the supra-mediterranean forests of Cap Corse by fires, cuts and grazing favors the extension of this minoriseries which is maintained on superficial soils.

Associated Vegetations No associated vegetation was observed (Fig. 41).

Corsican geopermaseries, supra-mediterranean subhumid of chasmophytic vegetation on schist cliffs
[*Elymo corsici-Ptychoto saxifragae* geopermasigmetum]
[*holotypus*: rel. 2—Table 37**]**

This geopermaseries develops essentially within the supra-mediterranean level between 1000 and 1400 m altitude, on a mineral substrate and on marked slopes (27–70°) of the sunny slopes, at the upper contact of the *Genisto Salzmanni-Alysso robertiani* minorisigmetum in Cap Corse, or in the upper contact of the *Stellario montanae-Buxo sempervirentis* sigmetum in San Pedrone massif.

This geopermaseries includes two HICs: (8210-19) “Calcareous rocky slopes with chasmophytic vegetation” (*Elymo corsici-Ptychotetum saxifragae*) and (8220-11) “Cyrno-Sardinian siliceous montane cliff vegetation” (*Armerio leucocephalae-Potentilletum crassinerviae*).

2 geopermasynrelevés.

Average syntaxonomic richness: 2 permasigmataxa by geopermasynrelevés.

Corsican geopermaseries, supra-mediterranean subhumid onacidophilous to neutroalkaline screes
[*Arrhenathero sardoi* geopermasigmetum]
[*holotypus*: rel. 2—Table 38**]**

This geopermaseries develops within the supra-mediterranean level, between 800 and 1000 m. It frequents the sunny slopes, on a mineral substrate and on slopes

Fig. 41 *Genisto salzmanni-Alysso robertiani* minorisigmetum

often marked (>45°). It is located in contact with the *Galio rotundifolii-Pino laricionis ericetoso arboreae* sigmetum.

This geopermaseries includes a HIC (8220-11) "Cyrno-Sardinian siliceous montane cliff vegetation" (*Sedo annui-Coincyetum rectangularis*).

2 geopermasynrelevés.

Average syntaxonomic richness: 2.8 permasigmataxa by geopermasynrelevés (Fig. 42).

3.2.5 Riparian Azonal Units

Corsican edaphohygrophilous series on neutroalkaline substrate with *Apium graveolens* and *Alnus glutinosa*
[*Apio graveolentis-Alno glutinosae* sigmetum]

Table 37 *Elymo corsici- Ptychoto saxifragae* geopermasigmetum

Geopermasynrelevé n.	1	**2***	
Geographic area	Cap Corse	**Cap Corse**	
Area (ha)	0.1	**0.1**	
Cover (%)	10	**10**	
Permasigmataxa number	2	**2**	Σ
Elymo corsici-Ptychoto saxifragae permasigmetum	O2	**o2**	**2**
Armerio leucocephalae-Potentillo crassinerviae permasigmetum	.+	**.+**	**2**

Table 38 *Arrhenathero sardoi* geopermasigmetum

Geopermasynrelevé n.	1	**2***	3	4	5	6	7	
Geographic area	Cap Corse	**Cap Corse**	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	
Area (ha)	0.1	**0.1**	0.2	0.2	0.1	0.3	0.1	
Cover (%)	10	**70**	15	25	15	5	15	
Permasigmataxa number	2	**3**	3	3	3	3	3	Σ
Arrhenathero sardoi permasigmetum	O2	**O4**	o+	o1	o1	o1	O3	**V**
Permasigmetum with *Cerastium boisserianum*	o1	**o1**	.+	O2	.+	.+	.+	**V**
Sedo annui-Coincyo rectangularis permasigmetum		**.+**	.+	.+	.+	.+	.+	**V**

Sigmaecology This oligo-mesotrophic acidicline series develops on poor mor humus substrates. It extends from 10 to 50 m in alluvial plain. Drainage ditches mean that this medium is little flooded, but in the middle of summer, the water table is always present at 20–30 cm below the soil.

Chorological Diagnosis *Apio graveolentis-Alno glutinosae* sigmetum is only present in Cap Corse. This series is expressed on small areas and is found in two localities of Cap Corse: Sisco marine and Pietracorbara marine.

Catenal Positioning It is located behind the sandy coastline dominated by coastal geopermaseries and juxtaposed to *Galio scabri-Querco ilicis* sigmetum.

Sigmastructure The head of series is caraterized by a more or less dense forest of *Alnus glutinosa*. The shrub layer often diversified and dominated by the abundance of *Ficus carica* and *Salix atrocinerea*. The flora and the ecological conditions allow to connect this vegetation with *Alnetea glutinosae*. The herbaceous stratum is abundant, its covering varies between 85 and 95%. It consists of hygrophilous to mesohygrophilous species such as *Euphorbia cannabinum* subsp. *corsicum,*

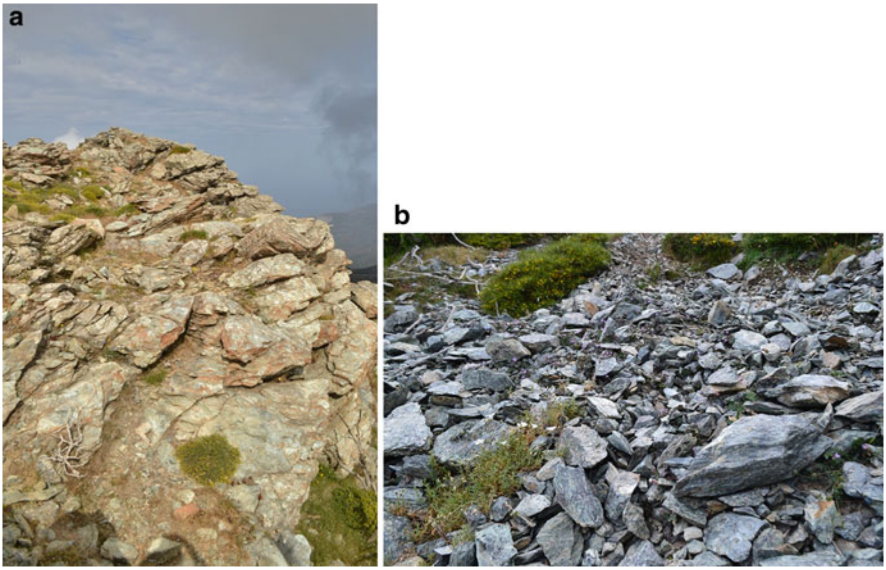

Fig. 42 *Elymo corsici- Ptychoto saxifragae* geopermasigmetum [A]; Arrhenathero sardoi geopermasigmetum [B]

Calystegia sepium subsp. *sepium, Brachypodium sylvaticum* subsp. *sylvaticum, Euphorbia hirsuta* (Table 39).

Sigmaystematic [*holotypus:* rel. 1—Table 40]
4 synrelevés

Average syntaxonomic richness: 6.5 syntaxa by synrelevé.

Conservation Issues The presence of *Euphorbia cannabinum* subsp. *corsicum*, an endemic corso-Sardinian species, is a particular floristic interest for this series. Its originality is linked to its distribution area limited to the Cap Corse region, which gives it a Corsican endemic status. Since this series requires constant flooding to maintain itself, drainage ditches are the main threat. The construction of the D80 departmental road and the cutting of the forest reduced the expression of the series.

Associated Vegetations This series comprises two associated vegetations of small streams of *Potametum denso-nodosi* and *Glycerio fluitantis-Sparganietum neglecti* (Figs. 43 and 44).

Corsican edaphohygrophilous series on neutroalkaline alluvium with *Scrophularia auriculata* and *Alnus glutinosa* [*Scrophulario auriculatae- Alno glutinosae* sigmetum]

Sigmaecology This mesoeutrophilous, thermophilous series constitutes the low-lying riparian unit. It is located in the bottom of valleys with waters and flows fast but can dry out in summer period.

Table 39 Bioindicator species of *Apio graveolentis-Alno glutinosae* sigmetum

Physiognomy	Plant communities	Bioindicator species
Forest	*Apio graveolentis-Alnetum glutinosae*	*Alnus glutinosa, Apium graveolens, Euphorbia hirsuta*
Thicket	Saulaie à *Salix atrocinerea*	*Salix atrocinerea, Rubus ulmifolius,*
Reedbed	*Phragmitetum australis calystegietosum sepii*	*Phragmites australis* subsp. *australis, Calystegia sepium* subsp. *sepium*
Tall-herb communitie	*Cirsio cretici-Dorycnietum recti*	*Dorycnium rectum, Cirsium creticum* subsp. *triumfetti, Althaea officinalis, Mentha aquatica, Lythrum salicaria*
Meadow	*Agrostio stoloniferae-Scirpoidion holoschoeni*	*Eupatorium cannabinum* subsp. *corsicum, Carex punctata, Dittrichia viscosa* subsp. *viscosa, Cyperus longus* subsp. *longus*

Table 40 *Apio graveolentis-Alno glutinosae* sigmetum

Synrelevé n.	**1***	2	3	4	
Geographic area	**Cap Corse**	Cap Corse	Cap Corse	Cap Corse	
Area (ha)	**23.3**	3.8	9.5	8	
Cover (%)	**100**	100	100	100	
Average altitude (m)	**25**	30	10	63-96	
Slope (in °)	**3**	2	-	2	
Aspect	**E**	E	-	E	
Syntaxonomic richness	**6**	6	9	5	Σ
Characteristic syntaxa of progressive dynamic					
Apio graveolentis-Alnetum glutinosae	**O2**	;O2	O3	O3	**4**
Salicion cinereae	**O2**				**1**
Phragmitetum australis calystegietosum sepii	**o2**	o1			**2**
Cirsio cretici-Dorycnietum recti		.+	o+	o1	**3**
Communities with *Carex pendula*			o1		**1**
Iridetum pseudacori			o1		
Agrostio stoloniferae-Scirpoidion holoschoeni Communities with *Agrostis stolonifera*	**O4**				**1**
Characteristic syntaxa of regressive dynamic					
Pruno spinosae-Rubion ulmifolii Communities with *Rubus ulmifolius and Prunus spinosa*	**o1**	o2			**2**
Pruno spinosae-Rubion ulmifolii Communities with *Pteridium aquilinum*			o2	o2	**2**
Arundo donacis-Convolvuletum sepium		O2	O2	o2	**3**
Lino biennis – Cynosuretum cristati	**O2**		o2	O3	**3**
Lino biennis-Festucetum arundinaceae		O3	o2		**2**
Lolio perennis – Cynosuretum cristati			o+		**1**

Sigmachorology This series is located in the rocky talwegs of the massifs of Cap Corse and Tenda. It develops discontinuously and occupies small areas (2–3 ha).

Catenal Positioning This series is in contact with the series of slopes of the *Galio scabri- Querco ilicis* sigmetum.

Fig. 43 *Salicion atrocinerea* [A] and *Agrostio stoloniferae-Scirpoidion holoschoeni* [B]

Sigmastructure The head of this series corresponds to a linear forest dominated by *Alnus glutinosa*. The shrub stratum is poorly recovered (10–30%) and consists of a few individuals of *Ficus carica*. The herbaceous stratum has an overlap of about 80% and is characterized by species of *Caricion microcarpae: Hypericum hircinum* subsp. *hircinum, Scrophularia auriculata, Symphytum bulbosum, Euphorbia amygdaloides* subsp. *semiperfoliata, Athyrium filix-femina*.

This series comprises several dynamic stages. The prairial stage corresponds to a meadow of the *Cirsio cretici-Dorycnietum recti*. The latter is colonized by the woodland of *Salix cinerea*. This woodland is then replaced by a *Ficus carica* and *Alnus glutinosa* pre-mantle of *Scrophulario auriculatae-Alnetum glutinosae ficetosum caricae* (Table 41).

Sigmasystematic [*holotypus:* rel. 6 – Table 42]

8 synrelevés.
Average syntaxonomic richness: 3.25 syntaxa by synrelevé.

Conservation Issues This series does not present any particular remarkable species. Head of series is an HCI of the FFHD, (92A0-4) "*Salix alba* and *Populus alba* galleries". Given its topographic position (talweg), this series does not seem to be threatened.

Associated Vegetations No associated vegetation was observed (Figs. 45 and 46).

Geopermaseries of running water (*Glycerio fluitantis-Sparganion neglecti, Batrachion fluitantis*)
[*Nasturtio officinalis* geopermasigmetum]
[*holotypus*: rel. 1—Table 43**]**

These meso-eutrophic acidophilous permaseries are observed at low elevations in the meso-mediterranean level along well-oxygenated and shallow streams. They are rarer in the supra-mediterranean level. These permaseries occupy small areas, of the

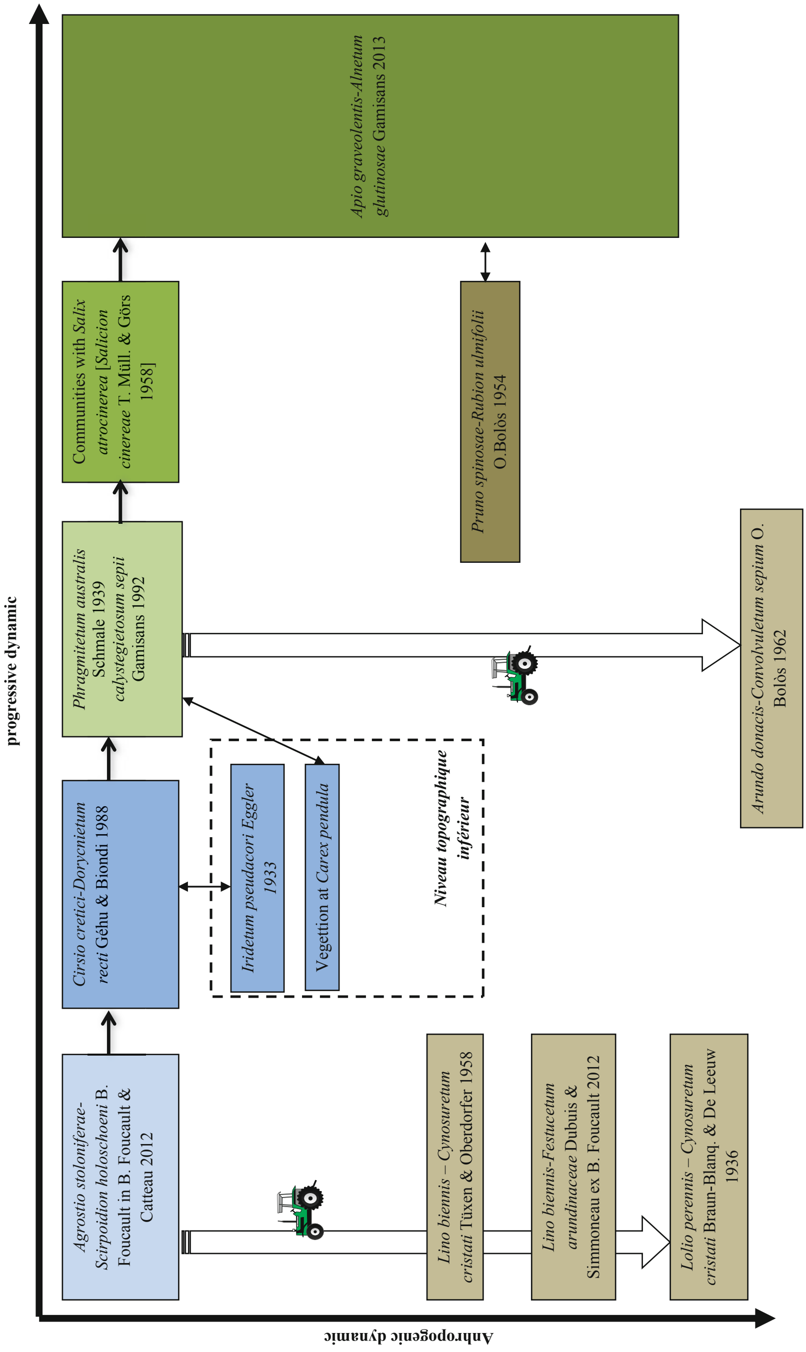

Fig. 44 *Apio graveolentis- Alno glutinosae* sigmetum

Table 41 Espèces indicatrices du *Scrophulario auriculatae-Alno glutinosae* sigmetum

Physiognomy	Plant communities	Bioindictor species
Forest	*Scrophulario auriculatae-Alnetum glutinosae*	*Scrophularia auriculata, Symphytum bulbosum, Alnus glutinosa*
Thicket	*Communities with Salix cinerea*	*Salix cinerea*
Tall-herb communitie	*Cirsio cretici-Dorycnietum recti*	*Dorycnium rectum, Cirsium creticum* subsp. *triumfetti, Althaea officinalis, Calystegia sepium* subsp. *sepium, Mentha aquatica, Lythrum salicaria*

Table 42 *Scrophulario auriculatae-Alno glutinosae* sigmetum

Synrelevé n.	1	2	3	4	5	**6***	7	8	
Geographic area	Cap Corse	Cap Corse	Cap Corse	Cap Corse	Cap Corse	**Cap-Corse**	Cap Corse	Cap Corse	
Area (ha)	1.7	33	9.6	2.9	3.2	**1.2**	1.7	5.5	
Cover (%)	100	90	80	100	95	**100**	100	80	
Aspect	E	E	E	E	E	**W**	S-SW	-	
Average altitude (m)	110	80	90	100	160	**64**	129	150	
Slope (in °)	5	5	5	5	5	**5**	5	-	
Syntaxonomic richness	3	4	4	3	4	**2**	2	4	Σ
Characteristic syntaxa of progressive dynamic									
Scrophulario auriculatae-Alnetum glutinosae	/5	/;3	;2	O2	/3	**/5**	O5	…2	**V**
Scrophulario auriculatae-Alnetum glutinosae ficetosum caricae						**/2**			**I**
Carici microcarpae-Salicetum atrocinereae					/2				**I**
Cirsio cretici-Dorycnietum recti	/;1							O3	**III**
Cypero longi-Oenanthetum crocatae								O2	**I**
Communities with *Ranunculus lanuginosus*		/2	o2						**III**
Characteristic syntaxa of regressive dynamic									
Arundo donacis-Convolvuletum sepium	o2	/2	o3	O2	/2				**IV**
Pruno spinosae-Rubion ulmifolii communities with *Rubus ulmifolius* and *Prunus spinosa*				O3	/2		o2	O3	**III**
Pruno spinosae-Rubion ulmifolii communities with *Pteridium aquilinum*		/2	o2						**III**

order of 1 m^2. From a catenal point of view, they are part of the alluvial complex of low altitude, in which they are in contact with the series to eupatorium of Corsica and alder glutinous.This geopermastery comprises three HICs: (3150-1) "Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*—type vegetation", (3260-1;3260-2) "Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation".

1 geopermasynrelevé

Average syntaxonomic richness: 4 permasigmataxa by geopermasynrelevés.

Corsican tempori-hygrophilous geropermaseries on alluvium substrate [*Dittricho viscosae-Salici purpureae* geopermasigmetum] [*holotypus*: rel. 1—Table 44**]**

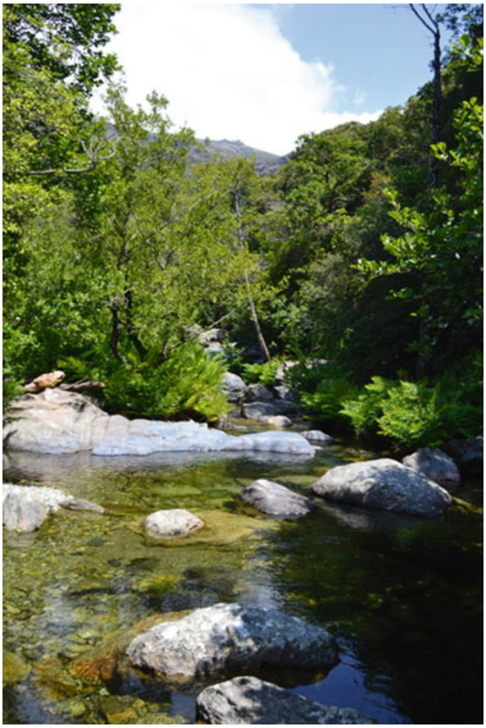

Fig. 45 *Scrophulario auriculatae-Alno glutinosae* sigmetum

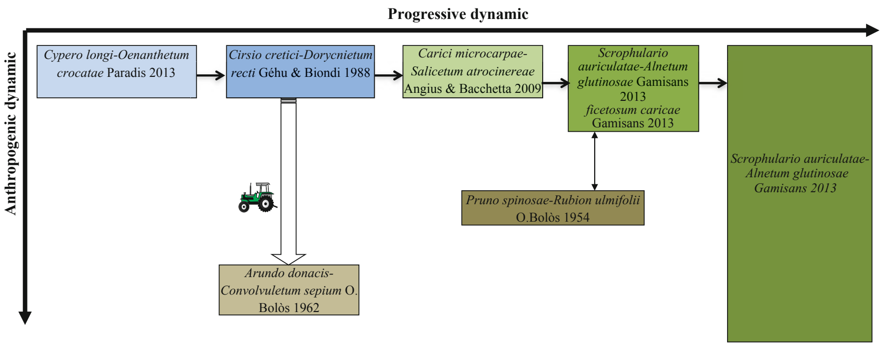

Fig. 46 *Scrophulario auriculatae-Alno glutinosae* sigmetum

These mesotrophic acidophilous permaseries are observed on banks of pebbles and damp sands [41] or on low-lying alluvial deposits [35]. They occupy small areas and in disparate ways. From a catenal point of view, these permaseries are part of the low-lying alluvial complex, in which they are in contact with *Eupatorio corsici-Alno glutniosae* sigmetum.

Table 43 Geopermaseries of running water

Geopermasynrelevé n.	**1***
Geographic area	**Cap Corse**
Area (ha)	**0.002**
Cover (%)	**15**
Permasigmataxa number	**3**
Nasturtio officinalis permasigmetum	**O/2**
Glycerio fluitantis permasigmetum	.+
Callitrichio obtusangulae permasigmetum	.+
Potamogeto denso-nodosi permasigmetum	.+

Table 44 *Dittricho viscosae-Salici purpureae* geopermasigmetum

Geopermasynrelevé n.	**1***
Geographic area	**Cap Corse**
Area (ha)	**1.3**
Cover (%)	**90**
Permasigmataxa number	**1**
Dittrichio viscosae-Salici purpureae permasigmetum	**O5**

This geopermaseries includes a HIC: (92A0) "*Salix alba* and *Populus alba* galleries".

1 geopermasynrelevé.

Average syntaxonomic richness: 1 permasigmataxa by geopermasynrelevés.

Corso-Sardinian temporihygrophilous geopermaseries of thermophilous riparian.
[*Rubo ulmifolii-Nerio oleandri* geopermasigmetum]
[*holotypus*: rel. 1 of Table 45**]**

This geopermaseries is located in the galleries bordering a few streams of Corsica. It develops along streams that can dry out in summer. In 2013, this geopermasia was recorded in Cap Corse (Luri Creek, Creek near Barcaggio, Farinole and Albo Marine). According to Paradis (2006), it would be frequent in other points of Corsica (St Florent in particular). This geopermaseries seems also to be present in Sardinia (Bacchetta et al. 2007, 2010).

Table 45 *Rubo ulmifolii-Nerio oleandri* geopermasigmetum

Geopermasynrelevé n.	**1***	2	3	
Geographic area	**Cap Corse**	Cap Corse	Cap Corse	
Area (ha)	**3**	2	1	
Cover (%)	**100**	100	90	
Permasigmataxa number	**3**	2	1	Σ
Rubo ulmifolii-Nerio oleandri permasigmetum	**O3**	O3	O4	**3**
Nerio oleandri-Vitico agni-casti permasigmetum	**O2**	o2		**2**
Rubo ulmifolii-Vitico agni-casti permasigmetum	**O2**			**1**

Fig. 47 *Rubo ulmifolii-Nerio oleandri* geopermasigmetum

This geopermaseries includes two HICs: (92D0-1) “Southern riparian galleries and thickets (*Nerio-Tamaricetea* and *Securinegion tinctoriae*)”.

3 geopermasynrelevés

Average syntaxonomic richness: 2 permasigmataxa by geopermasynrelevés (Fig. 47).

Geopermaseries of coastal ponds
[*Cresso creticae-Crypsido aculeatae* geopermasigmetum]
[*holotypus*: rel. 1—Table 46**]**

Table 46 *Cresso creticae-Crypsido aculeatae* geopermasigmetum

Geopermasynrelevé n.	**1***	2	
Geographic area	**Cap-Corse**	Cap-Corse	
Area (ha)	**1.61**	0.2	
Cover (%)	**80**	30	
Permasigmataxa number	**7**	7	∑
Cresso creticae-Crypsido aculeatae permasigmetum	**O2**	O2	**2**
Cresso creticae permasigmetum	**o1**	O2	**2**
Junco acuti permasigmetum	**o2**	O2	**2**
Tolypello glomeratae permasigmetum		.+	
Cladio marisci permasigmetum	**o2**		**1**
Phragmito australis permasigmetum	**O2**		**1**
Typho domingensis permasigmetum	**o+**		**1**
Limonio narbonensis-Junco gerardii permasigmetum	**o1**		**1**
Junco acuti-Schoeno nigricantis permasigmetum	**o1**		**1**
Ranunculo peltati permasigmetum	**o+**		**1**
Scirpo compacto-littoralis permasigmetum	**o+**		**1**
Permasigmetum with *Cotula coronopifolia*		O2	**1**
Chenopodio chenopodioidis-Crypsido aculeatae permasigmetum		o1	**1**
Polygono monspeliensis-Crypsido aculeatae permasigmetum		o2	**1**

This geopermaseries develops in depressions and coastal ponds dried out in summer. It develops within the inframediterranean level within sandy loam basins. Its distribution is still poorly known since it was only found north of Cap Corse behind the sandy cordon. Regular passage of livestock is the main degradation impact of this geopermaseries (Paradis and Tomasi 1991).

This geopermaseries includes a HIC: (1410) “Mediterranean salt meadows (*Juncetalia maritimi*)” and (3150-1) “Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*—type vegetation”.

2 geopermasynrelevés

Average syntaxonomic richness: 7 permasigmataxa by geopermasynrelevés (Fig. 48).

4 Mapping Results

Cap Corse (32,842.1 ha) is characterized by 28 serial and geoserial units: 12 vegetation series, 4 minoriseries, 12 geopermaseries and one non-plant unit (urbanized areas) (Table 47). The Cap Corse comprises three vegetation level (thermo-mediterranean, meso-mediterranean (lower and upper) and supra-mediterranean),

Fig. 48 *Cresso creticae-Crypsido aculeatae* geopermasigmetum

as well as coastal, riparian and swampy azonal units. The 28 serial units typified (excluding non-plant units) represent 36% of the sigmetal richness of Corsica.

The *Galio scabri-Querco ilicis* sigmetum variant with *Fraxinus ornus* constitues the main sigmetum of the plant landscape of Cap Corse, with 17040.9 ha, or 51.9% of the total area. Two other series characterize the landscape:

- (25) *Galio scabri-Querco ilicis* sigmetum variant with *Lathyrus venetus* occupies 5803.9 ha, Or 17.7% of the total area;
- (40) *Cardamino chelidoniae-Buxo sempervirentis* sigmetum occupies 3779.7 ha or 11.5% of the total area.

Urbanized areas (villages, hamlets) represent 745.3 ha, ie 2.3% of the total area and concentrate mainly on marine (Miomo, Erbalunga, Sisco, Pietracorbara, Santa Severa, Maccinaggio. . .).

Of the 20 coastal units listed on the Cap Corse 2 units are strictly endemics of Cap Corse *Crithmo maritimi-Limonio contortiramei* geopermasigmetum, frequent on the rocky coasts and *Crithmo maritimi-Limonio patrimoniense* geopermasigmetum, endemic of the region of Patrimonio.

Of all the sites surveyed, Cap Corse is the only site hosting the *Asperulo odorae-Taxo baccatae* sigmetum, a very localized series near Sant'Angelu.

Cap Corse has been the subject of several cartographic studies of plant groups (Molinier 1959, 1962), phytosociological (Paradis and Tomasi 1991) and habitats (Biotope 2006; Moneglia et al. 2012).

Biotope (2006) realized a typological and mapping inventorieson Natura 2000 site "FR9400568—Cap Corse nord and îles Finocchiarola, Giraglia, Capense".

Table 47 Typology, area and area percentage of vegetation series and geoseries of Cap Corse

Code	Sigmetum	Area (ha)	Percentage (%)
1	*Galio scabri-Querco illicis* sigmetum variant with *Fraxinus ornus var. ornus*	17075.6	50.6
2	*Galio scabri-Querco illicis* sigmetum variant with *Lathyrus venetus*	5803.9	17.2
3	*Cardamino chelidoniae-Buxo sempervirentis* sigmetum	3779.7	11.2
4	*Elymo corsici-Ptychoto saxifragae* geopermasigmetum	1171.5	3.5
5	*Stachyo glutinosae-Genisto corsicae* minorisigmetum	1016.9	3.0
6	*Genisto salzmanni-Alysso robertiani* minorisigmetum	888.8	2.6
7	Urban areas	745.3	2.2
8	*Scrophulario auriculatae-Alno glutinosae* sigmetum	671.5	2.0
9	*Ostryo carpinifoliae-Querco ilicis* sigmetum	648.1	1.9
10	*Saxifrago tridactylites-Sedo stellati* geopermasigmetum	432.2	1.3
11	*Oleo sylvestris-Junipero turbinatae* sigmetum	403.6	1.2
12	*Galio scabri-Querco suberis* sigmetum	331.3	1.0
13	*Ilici aquifoliae-Querco ilicis* sigmetum	235.7	0.7
14	*Crithmo maritimi-Limonio contortiramei* geopermasigmetum	166.8	0.5
15	*Apio graveolentis-Alno glutinosae* sigmetum	82.6	0.2
16	Geopermaserie of running water (*Glycerio fluitantis-Sparganion neglecti, Batrachion fluitantis*)	62.6	0.2
17	*Galio scabri-Querco illicis* sigmetum variant with *Quercus pubescens*	55.3	0.2
18	*Fraxino orni-Acero monspessulani* sigmetum	40.6	0.1
19	*Glaucio flavi-Crithmo maritimi* geopermasigmetum	33.7	0.1
20	*Euphorbio pithyusae-Helichryso italici* minorisigmetum	33.7	0.10
21	*Sileno corsicae-Ammophilo arundinaceae* geopermasigmetum	18.5	0.05
22	*Rubo ulmifolii-Nerio oleandri* geopermasigmetum	15.4	0.05
23	*Asperulo odorae-Taxo baccatae* sigmetum	9.2	0.03
24	*Cresso creticae-Crypsido aculeatae* geopermasigmetum	2.2	0.006
25	*Crithmo maritimi-Limonio patrimoniense* geopermasigmetum	1.9	0.006
26	*Notholanae marantae-Sileno paradoxae* geopermasigmetum	1.7	0.005
27	*Dittricho viscosae-Salici purpureae* geopermasigmetum	1.4	0.004
28	*Arrhenathero sardoi* geopermasigmetum	1.0	0.003
29	*Clematido cirrhosae-Pistacio lentisci* minorisigmetum variant with *Smilax aspera*	0.6	0.002
		33730.9	**100**

Biotope 2006 and Moneglia et al. 2012 carried out a synthesis on site "FR9400569 Crests of the Cap Corse, valley of Sisco".

These mappings present the advantage of visualizing the distribution of habitats, but their typology remains very broad from a phytosociological point of view, since the same polygon can comprise several plant associations belonging to several vegetation series. This is the case in the mapping of the "North Cap Corse" where polygons typified as "high maquis of the western Mediterranean" are included in both the *Oleo sylvestris-Junipero turbinatae* sigmetum and the *Galio scabri-Querco ilicis* sigmetum variant with *Fraxinus ornus* (Figs. 49 and 50).

4.1 Discussion

The use of the symphytosociological method has allowed to highlight the complexity of the Cap Corse landscape patterns through the recurring combination of fundamental structural elements: valley, slopes, crests. This method requires a good knowledge of the mechanisms that govern the progressive and/or regressive dynamic trajectory of vegetations. This approach contributes to a better understanding of the coenotic diversity and naturality of the Cap Corse landscape.

The vegetation series were and are always strongly influenced by anthropogenic actions, which results in a modification of the dynamic trajectories and a replacement of the original vegetations by secondary vegetations. This is the case of the Cape crests, which have suffered fire and pastoral pressure, thus eliminating the original floristic elements. In his study on the potential area of *Pinus nigra* subsp. *laricio* in Corsica, Thinon (1998) highlights with the charcoal the important presence of the *Pinus nigra* subsp. *laricio* and also the association of Pin laricio with the deciduous oaks in the region of Cap Corse. Today, only a few individuals of *Pinus nigra* subsp. *laricio* exist at Santa Lucia and instead a secondary plant succession is established.

102 associations were identified in Cap Corse, ie 30% of syntaxonomic richness of Corsica (345 plant communities identified in Corsica by Reymann et al. 2016). From a symphytosociological point of view, the syntaxonomic richness of the synrelevés remains low (≈4 syntaxa by synrelevé). This low syntaxonomic richness is explained by a relatively homogeneous plant landscape, especially on the meso-mediterranean level. The numerous fires have greatly rejuvenated and standardized the vegetation. Many meso-mediterranean slopes on the eastern coast are composed of a single syntaxon: *Pulicario odorae-Arbutetum unedonis*. The mediterranean slopes of the west coast are only composed of *Galio scabri-Quercetum ilicis*. In the alluvial plains the syntaxonomic richness is higher. The varied anthropic actions (pasture, cultivation, cutting) induces a complexity of the structural patterns of plant landscape: synrelevés are composed on average of 8 syntaxa.

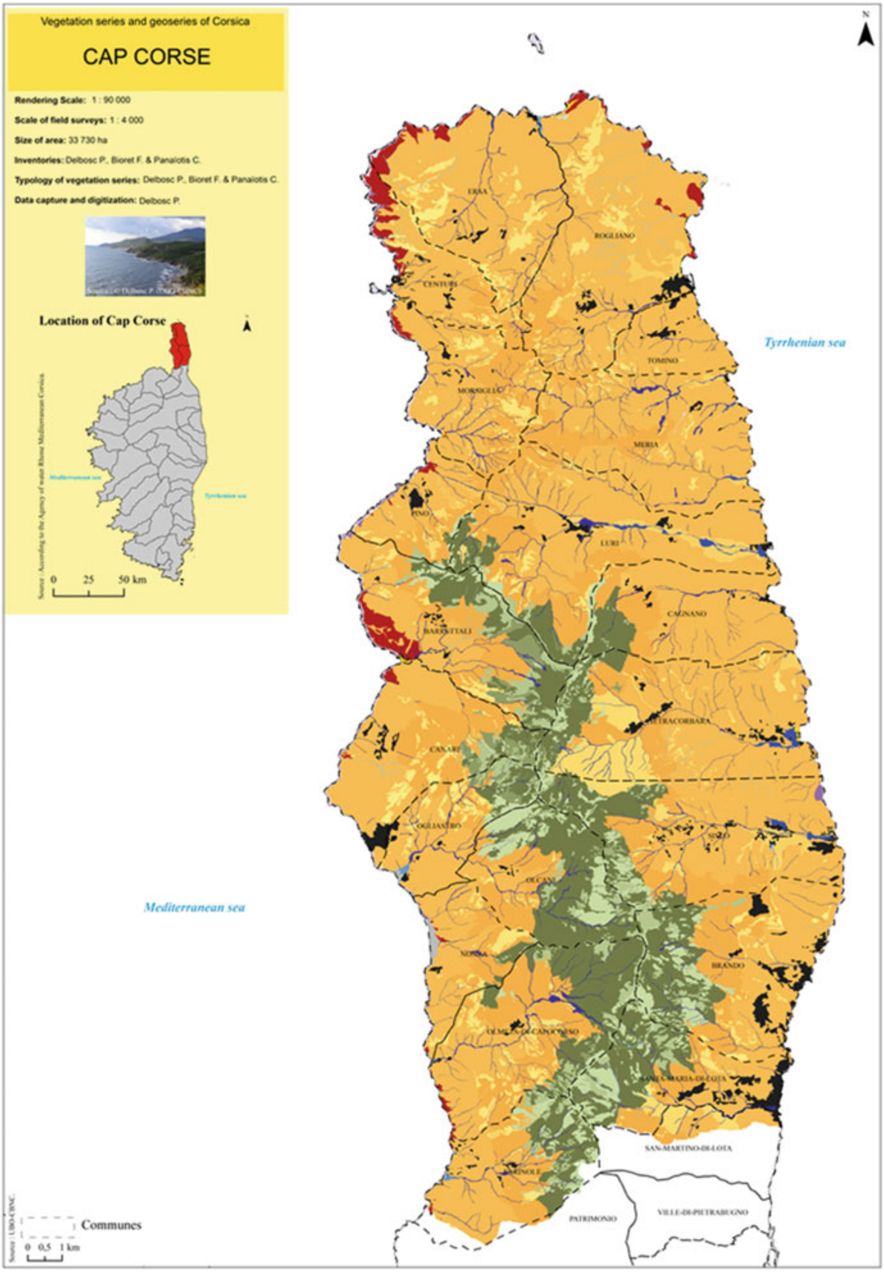

Fig. 49 Map of vegetation series and geoseries

Coastal units

Units of sandy beach

- *Sileno corsicae-Ammophilo arundinaceae* geopermasigmetum

Units of pebble beach

- *Glaucio flavi-Crithmo maritimi* geopermasigmetum

Units of rocky coast

- *Crithmo maritimi-Limonio contortiramei* geopermasigmetum
- *Crithmo maritimi-Limonio patrimoniense* geopermasigmetum
- *Euphorbio pithyusae-Helichryso italici* minorisigmetum
- *Clematido cirrhosae-Pistacio lentisci* minorisigmetum variant with *Smilax aspera*

Thermomediterranean level

- *Oleo sylvestris-Junipero turbinatae* sigmetum

Mesomediterranean level

- *Notholanae marantae-Sileno paradoxae* geopermasigmetum
- *Saxifrago tridactylites-Sedo stellati* geopermasigmetum
- *Stachyo glutinosae-Genisto corsicae* minorisigmetum
- *Ostryo carpinifoliae-Querco ilicis* sigmetum
- *Galio scabri-Querco suberis* sigmetum
- *Galio scabri-Querco ilicis* sigmetum variant with *Quercus pubescens*
- *Galio scabri-Querco illicis* sigmetum variant with *Fraxinus ornus var. ornus*
- *Galio scabri-Querco illicis* sigmetum variant with *Lathyrus venetus*

Supramediterranean level

- *Arrhenathero sardoi* geopermasigmetum
- *Elymo corsici-Ptychoto saxifragae* geopermasigmetum
- *Genisto salzmanni-Alysso robertiani* minorisigmetum
- *Fraxino orni-Acero monspessulani* sigmetum
- *Ilici aquifoliae-Querco ilicis* sigmetum
- *Asperulo odorae-Taxo baccatae* sigmetum
- *Cardamino chelidoniae-Buxo sempervirentis* sigmetum

Riparian units

- *Cresso creticae-Crypsido aculeatae* geopermasigmetum
- *Nasturtio officinalis* geopermasigmetum
- *Rubo ulmifolii-Nerio oleandri* geopermasigmetum
- *Dittricho viscosae-Salici purpureae* geopermasigmetum
- *Apio graveolentis-Alno glutinosae* sigmetum
- *Scrophulario auriculatae-Alno glutinosae* sigmetum

Other units

- Urban areas

Fig. 49 (continued)

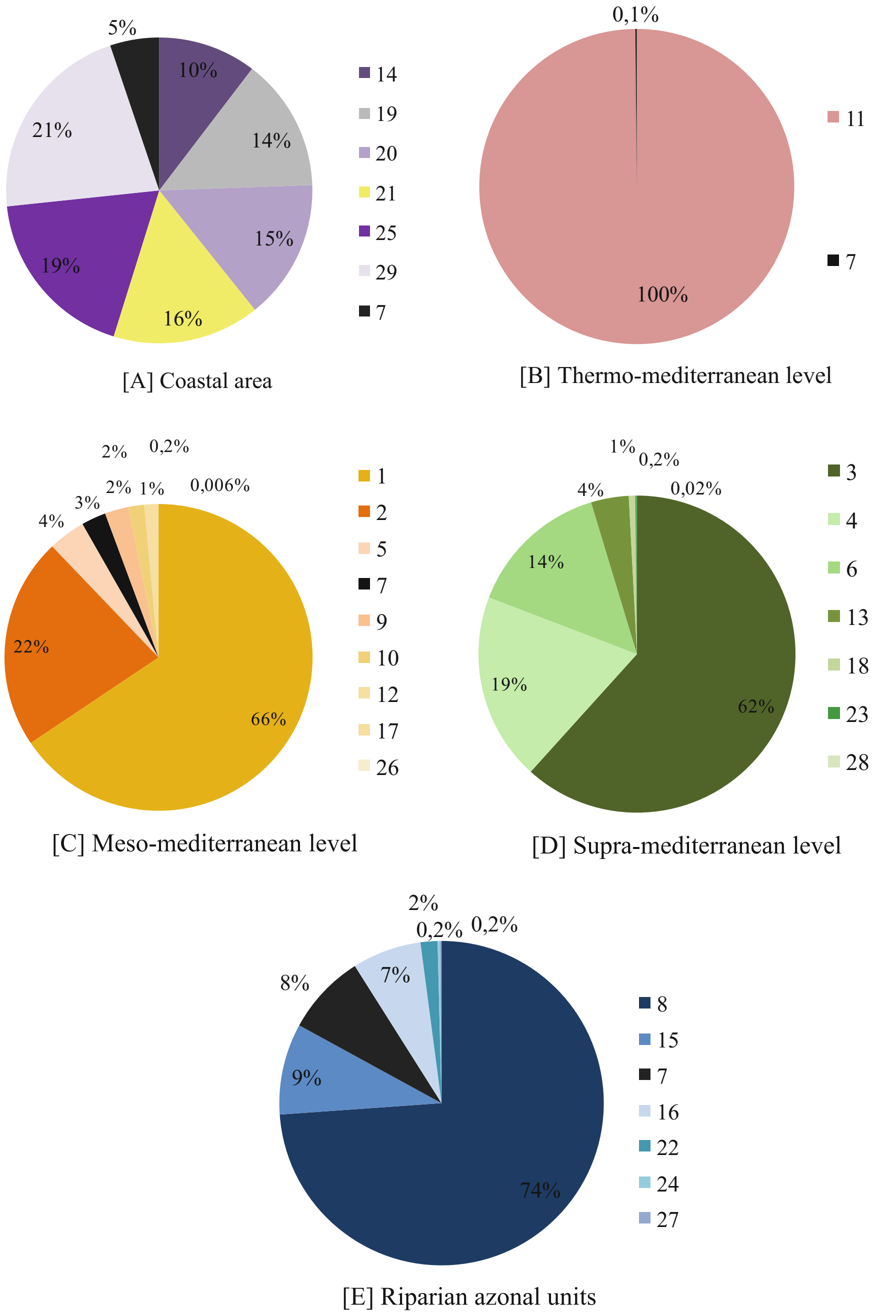

Fig. 50 Area diagram of vegetation series per vegetation level [A, B, C, D, E] 1—*Galio scabri-Querco illicis* sigmetum variant with *Fraxinus ornus* var. *ornus*; 2—*Galio scabri-Querco illicis* sigmetum variant with *Lathyrus venetus*; 3—*Cardamino chelidoniae-Buxo sempervirentis*

Mapping of the vegetation series based on a nested typological study of the plant landscape allows a multistratified analysis of the natural and semi-natural habitats. During the mapping work, several difficulties were encountered:

- difficulties in locating and interpreting vegetation on more or less accessible wooded slopes. Rare landmarks on undergrowth slopes, the location, interpretation and delimitation of individuals often difficult vegetation series are a potential source of error;
- difficulty or even impossibility of distinguishing the different forest groups by photo-interpretation: this is the case for the forests of *Pinus nigra* subsp. nigra. Some inaccessible areas have been photo-interpreted taking into account the adjacent vegetation;
- difficulty in mapping: certain series developing on steep or vertical slopes. The horizontal projection of this units colonizing vertical areas makes their individual mapping random. In this case, it is preferable to integrate these landscape units as associated vegetations to the adjacent units.

The upper limit of the coastal vegetation is sometimes difficult to fix along a decreasing halophilous gradient, as it sometimes appear more theoretical than real. In the case where the back-coastal zone is urbanized or exploited for livestock, a theoretical limit has been established. The width of the coastal zone, from the sea to the limit of the spray, extends on less than 50 m or sometimes on less than 10 m.

One of the difficulties for the geosymphytosociological study of coastal vegetation is in the dynamic approach of vegetation: the fundamental work is to differentiate the minoriseries of permanent vegetations. A scientific literature review supplemented by phytosociological surveys has made it possible to specify the floristic and dynamic apsects of communities. This is the case for *Euphorbio*

Fig. 50 (continued) sigmetum; 4—*Elymo corsici-Ptychoto saxifragae* geopermasigmetum; 5—*Stachyo glutinosae-Genisto corsicae* minorisigmetum; 6—*Genisto salzmanni-Alysso robertiani* minorisigmetum; 7—Urban areas; 8—*Scrophulario auriculatae-Alno glutinosae* sigmetum; 9—*Ostryo carpinifoliae-Querco ilicis* sigmetum; 10—*Saxifrago tridactylites-Sedo stellati* geopermasigmetum; 11—*Oleo sylvestris-Junipero turbinatae* sigmetum; 12—*Galio scabri-Querco suberis* sigmetum; 13—*Ilici aquifoliae-Querco ilicis* sigmetum; 14—*Crithmo maritimi-Limonio contortiramei* geopermasigmetum; 15—*Apio graveolentis-Alno glutinosae* sigmetum; 16—Geopermaseries of water courses (*Glycerio fluitantis-Sparganion neglecti, Batrachion fluitantis*); 17—*Galio scabri-Querco illicis* sigmetum variant with *Quercus pubescens*; 18—*Fraxino orni-Acero monspessulani* sigmetum; 19—*Glaucio flavi-Crithmo maritimi* geopermasigmetum; 20—*Euphorbio pithyusae-Helichryso italici* minorisigmetum; 21—*Sileno corsicae-Ammophilo arundinaceae* geopermasigmetum; 22—*Rubo ulmifolii-Nerio oleandri* geopermasigmetum; 23—*Asperulo odorae-Taxo baccatae* sigmetum; 24—*Cresso creticae-Crypsido aculeatae* geopermasigmetum; 25—*Crithmo maritimi-Limonio patrimoniense* geopermasigmetum; 26—*Notholanae marantae-Sileno paradoxae* geopermasigmetum; 27—*Dittricho viscosae-Salici purpureae* geopermasigmetum; 28—*Arrhenathero sardoi* geopermasigmetum; 29—*Clematido cirrhosae-Pistacio lentisci* minorisigmetum variant with *Smilax aspera* *pithyusae-Helichrysetum italici* and *Thymeleae hirsutae-Helichrysetum italici*. After being integrated as permaseries in the typology, these two associations are considererd as part of a minoriseries where they are preceded by a grassland with *Lotus cytisoides* and *Dactylis glomerata* subsp. *hispanicus* [*Loto cytisoidis-Dactyletum hispanicae*]. Due to ecological constraints (exposure to spray, wind, drought), the two phryganes dynamic can be blocked. However, in the most sheltered areas, these two sub-scrubland evolve towards higher thicket or towards *Clematido cirrhosae-Pistacietum lentisci*.

The correlation between the decline or total abandonment of agricultural practices in certain sectors since the twentieth century and the colonization of forest species demonstrate the speed of the process: in the absence of anthropogenic actions, a time of 50 years is sufficient to observe a return to forest systems. In the early stages of a series (lawn, sub-scrubland, thicket), the dynamic from one stage to another can be quite rapid (about 10 years) (Saïd et al. 2003). On the other hand, in the final stages of the series, the dynamic from thickets or bushes towards forests is much slower (Mesléard 1988; Barbero et al. 1990). Progressive dyamics depends not only on the time factor, but also on the soil, the presence of seeds and the vectors of dissemination (ornithochory, anemochory) (Fig. 51).

5 Conclusion

This phytosociological and symphytosociological approach allowed to define the dynamic links between the associations and to determine the vegetation series of Cap Corse. A symphytosociological typology, based on 376 synrelevés and geosynrelevés, allowed the description of 12 geopermaseries, 4 minoriseries and 12 series. Based on this typology, more than 32,000 ha of vegetation have been precisely mapped. This phytosociology dynamico-catenale work allowed to better take into account the vegetation in a landscape and management framework. Capicorsu appears as a particular biogeographical area of Corsica. The presence of an altitudinal gradient gives to this region an important phytocoenotic diversity which is home to many corsican endemic species.

Such a floristic and landscape richness deserves to be conserved as it is, even if the human impact is notable (fire, grazing, plantation), Fires remain the main factor of vegetation degradation. Combined with grazing, these factors induce a modification of the dynamic trajectories:

- by the development of several anthropophilous stages of which the head of series is the same; This is the case of the climatopilous series holm oak which includes several stages of degradation but which dynamic trajectory leads to *Galio scabri-Quercetum ilicis*;
- by total change of the dynamic trajectory from the herbaceous stage to the forest stage; This is the case in the supra-mediterranean level where the intensity and recurrence of fires is such that the original vegetation (*Pinus nigra* subsp. *laricio*

Fig. 51 West coast of Cap Corse

Fig. 52 Finocchiarola archipelago

series) is replaced by a secondary series (*Cardamino chelidoniae-Buxetum sempervirentis*);
- for several decades, the agricultural and pastoral in the Cap Corse favour the development of forest vegetation.

The typological results of this work will be integrated into the future catalog of the vegetation series and geoseries of Corsica (Fig. 52).

Typology and Mapping of Plant Landscape of Biguglia Pond: Application to Planning and Conservation Management

Pauline Delbosc, Frédéric Bioret, Sabrina Etourneau, Christophe Panaïotis, C. Piazza, and Paul Poli

1 Introduction

The Biguglia Pond shows a great diversity of natural habitats and a strong plant originality (Gamisans 2005, 2006; Géhu and Biondi 1994) and constitutes an ecotone between the marine system and the terrestrial systems.

Classified nature reserve since 1994, this pond has been subject of several plant inventories since 1992 (Gamisans and Piazza 1992; Gamisans 2005, 2006) to typify and map vegetations. During this work, each vegetation was analyzed dynamically between 1992 and 2006.

This study results from the application of the dynamico-catenal phytosociological methodology adopted within the framework CarHAB program, in order to better understand the dynamic trajectories of vegetation from 1992 to 2014. Typology of vegetation and vegetation series is based on an analysis of structural and textural, causality, phenomenological and historical descriptors. The analysis of all these elements constitutes a fundamental basis for an overall synthetic vision of the plant landscape.

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2 Area Study

2.1 Biogeographic and Bioclimatic

This Nature Reserve belongs to Mediterranean climate (Simi 1964; Bruno et al. 2001). The low level of relief (slopes less than 5° and the altitude less than 3 m) imply a significant exposure to winds and regimes of the autumn and spring rains.

Two vegetation levels, coastal and thermo-mediterranean are represented (Gamisans 1991). Given the remarkable coastline to the west, the « grau » to the northeast, as well as the rising of salt water in the pond, the coastline is particularly well marked. It is reflected by the presence of three major landscape entities: a lagoon, a sandy system (sandy beach and dune cordon) and a salt marsches.

The thermo-mediterranean level is also characterized by two landscape units: a mesophilous system marked mainly by cork oak scrub and marshy hygrophilous system with *Alnus glutinosa* (Fig. 1).

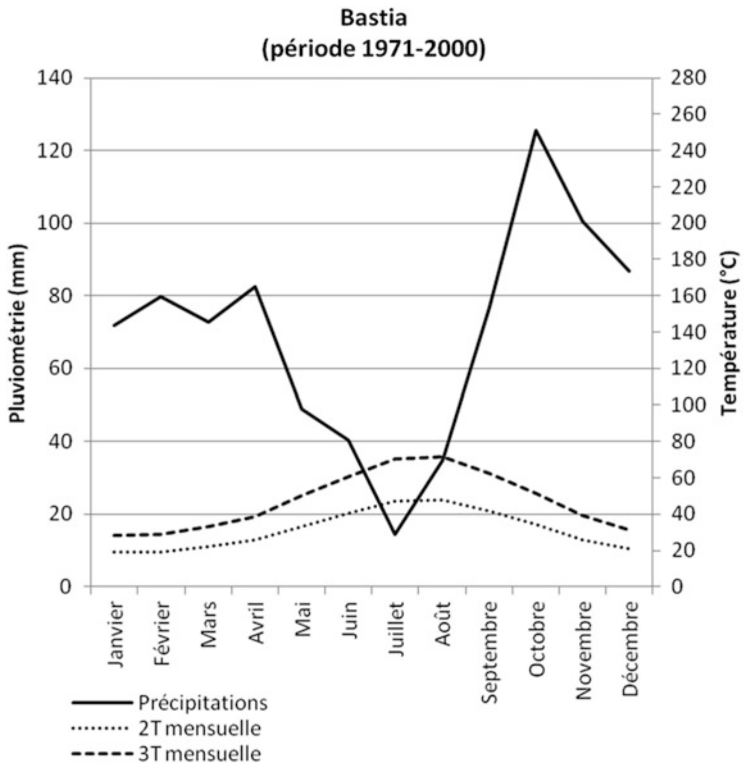

Fig. 1 Omrothermic diagram of Bastia meteorological station [From meteorological datas of Météo-France, Bruno et al. 2001]

2.2 Geomorphology, Geology and Soil

The pond of Biguglia, located in the North-West of Corsica, occupies 700 ha. It represents a lagoon of shallow depth (1 m on average), barred by a dune shoreline, but connected by a long and narrow channel.

The peculiarity of this pond lies in the cyclical and seasonal fluctuations of the saltwater intake by the sea and intake of fresh water by the Bevincu. It represents an ecotone between marine, brackish and freshwater environments. Salinity is higher in the northern part of the pond due to sea/pond relationships (B.C.E.O.M. 2006; Etourneau 2011 *in* Département de la Haute-Corse 2013).

The geological substratum of Reserve is composed exclusively of Quartenary soils with a dominance of sand and silt (Rossi and Rouire 1980). The presence of acidic sands conditions the development of particularly original plant communities for the pond Biguglia and more widely for Corsica. In general, the soils are strongly influenced by the presence of a temporary surface water (oxidizing phase in summer, reducing phase in winter) (Demartini and Favreau 2011b). In some areas they come closer to reductions, which reflect the presence of a more or less deep permanent sheet. The pond is mainly composed of hydromorphic soils whose evolution is mainly linked to an excess of water (Figs. 2, 3, 4, and 5).

2.3 Phytosociological Knowledge

Biguglia pond was subject of mapping analyzes of vegetation in 1970 by Fieschi, phytosociological investigations in 1992 by Gamisans and Piazza and then in 2005 by Gamisans (2005).

2.4 Human Impacts

The human impact on the edges of Biguglia pond is very important. This ancestral impact is certainly at least two millennia old. However, the landscape was recently most profoundly changed, especially with the digging, towards the end of the XIXth century, construction of major drainage canals that surround the largely western and southern shores. This drainage has certainly reduced the importance of freshwater wetlands that existed around the pond so that aquatic flora that were located there has now taken refuge mainly in the channels or streams.

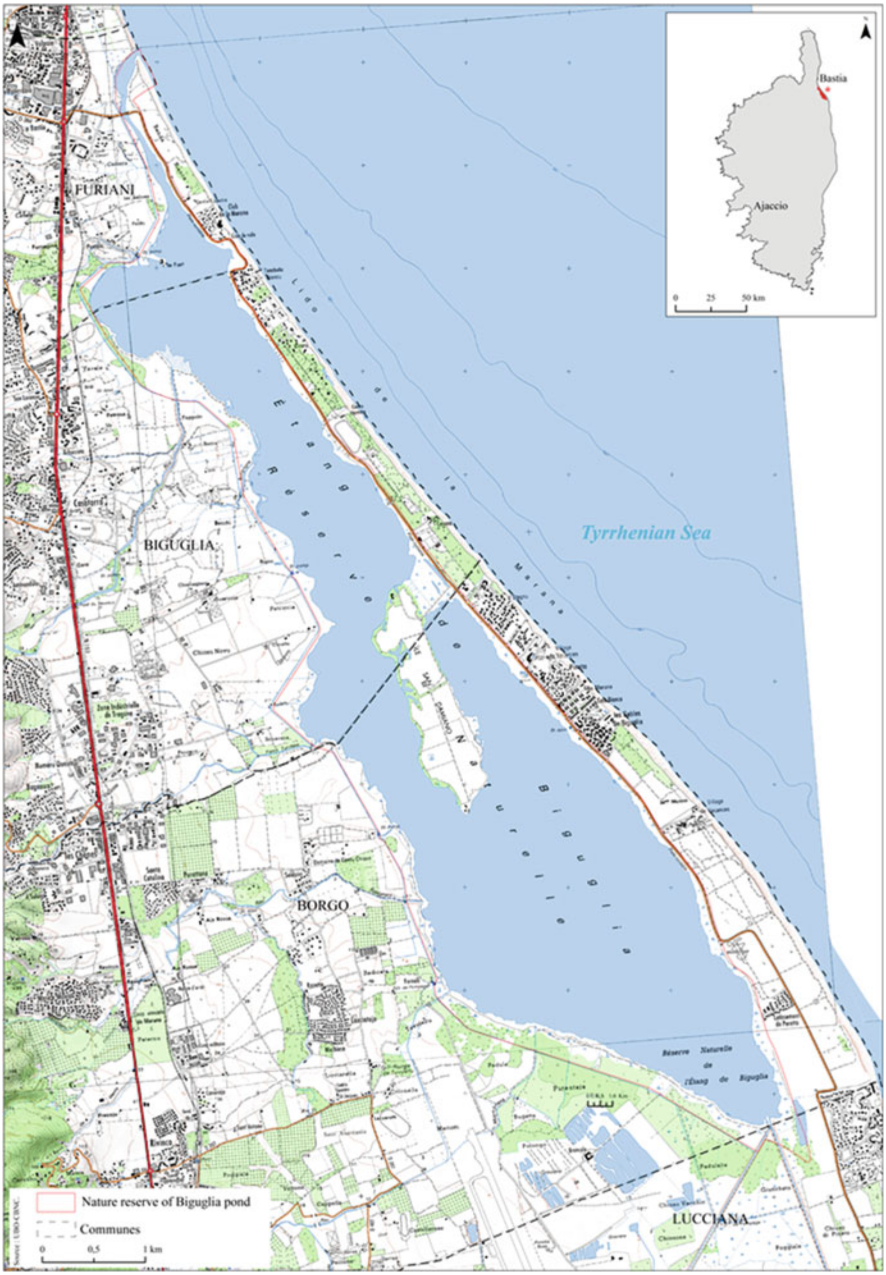

Fig. 2 Location and boundaries of Natural Reserve of Biguglia pond (Etourneau, 2011 *in* Département de la Haute-Corse, 2013)

Fig. 3 Vegetations of dune beach [1] and marshy vegetation of *Alnus glutinosa* [2]

Fig. 4 Grasslands grazed of agro-pastoral system of San Damiano peninsula [3] and salt marsches [4]

Fig. 5 Seagrasses on north of pond

2.5 Vegetation Dynamics

The change in vegetation between 1970 and 1991 has been noted by comparing vegetation maps of edges of pond realized in 1970 by J.-B. Fieschi with vegetation map of the same area developed by C. Piazza In 1991. This comparison reveals a number of phenomena. There was a progression of the banks towards the interior of the pond. This is particularly evident on the southern and western shores, where new reed beds have been set up to the detriment of open water, which marks a significant landfall of the edges of the pond, corresponding to a gradual filling of the latter by sediments brought by the various streams.

It seems that this phenomenon has accelerated during these two decades, in connection with certain clearing around the pond for the needs of agriculture and urbanization.

The comparison of two maps shows that the reed beds have been able to develop on open water. This certainly reflects a decline in soil salinity in certain areas, which is confirmed by the disappearance of some shrubby clumps during the two decades period and their substitution by less halophilous stands with a maritime rim or even some reed beds. This could be noted in particular at Tombolu Biancu, on the San Damiano peninsula and near the marine of the Bevincu. These phenomena undoubtedly depend on the time-varying exchanges between the pond and the sea, which, combined with the constant supply of fresh water by the streams, have led to a slight and local decrease in the salinity of certain soils.

Another spectacular phenomenon highlighted by comparison of two maps is the large decrease of the areas occupied by the alder-trees, about 50% in 20 years. These forests have been largely cut or burned to allow pasture for cattle and sheep. They continued to serve wood resources in 1991 (cuts observed between July and October). Their regression is particularly marked in south of Padulalta. In 1970, the alder forest spread up to the south of Broncole pumping station, whereas since 1991, the first alders occur more than 500 m to the north of this station. Vegetation of *Juncus acutus* was then limited to the south of Broncole, towards the fishery. Their recent progression towards the north and their extension have certainly been facilitated by grazing: this specie constitutes a refusal, has progressed to the detriment of other consumed plants. These phenomena of retraction of the alder forest and the extension of *Juncus acutus* are noted on the whole west part of the pond near Padulalta.

On San Damianu peninsula, the former testimonies reveal that it was partially covered with cork oaks (some still exist). The map of 1970 shows the vineyard and the 1991 map indicates crops of wheat and barley. The reed beds with *Juncus maritimus* and *Spartina versicolor* vegetations have generally remained in place. However, the 1970 map indicates an important dune at the west (Tombolu Biancu road). This dune was sharply reduced in 1991. This area was also colonized by *Pinus pinaster* which had not been indicated in 1970. Another notable change concerns *Populus alba* woods which have clearly developed since 1970 between the road and pond, especially to the south of Tombolu Biancu.

2.6 Vegetation Dynamics Between 1991 and 2006

Gamisans (2006) has shown that the general physiognomy of plant communities has changed little since 1991. There has also been a slight increase of some banks towards the interior of the pond. This is the case on the southern and western shores where new reed beds have been installed to the detriment of open water.

The alder surfaces have decreased significantly less than in the previous period. It seems to have been no more cuts. On the other hand a few fires and especially the strong pressure of the cows have further eroded these alder trees. This pasture with a relatively large livestock load is also responsible for a slight further extension of *Juncus acutus* and nitrophilous vegetation.

On the east coast, the vegetation of pond has remained unchanged since 1991. However, the road has been extended towards the pond and plant formations, in particular the tall humid grassland of the landing areas, On this side, lost several meters in width or even completely disappeared. The construction of a car park in Tombolu Biancu reduced the dune side of the pond to a thin edging, invaded by the *Carpobrotus* spp. where the psammophilous flora is on the way to strong regression (disappearance of the *Ammophila arundinacea*, rarefaction of *Calystegia soldanella*). Fortunately, the rehabilitation of the right bank of the grau by the Conservatoire du Littoral, and the laying of cranes, has made it possible to protect more effectively the dune systems of this sector.

Exotic plant species developed largely from the development of various environments (constructions, clearing, parking, tracks, crops).

Some of these plants are turning into real pests. Such is the case of *Cortaderia selloana*, the plumet of the pampa, a beautiful grass native to South America, cultivated in gardens and which for about two decades is becoming invasive.

3 Method

Before the establishment of dynamic catenal phytosociological method in 1981 (Géhu and Rivas-Martínez 1981), vegetation series were apprehended from vegetation mappings (Dupias et al. 1965), each of which is attached to a potentiality (Deductive approach).

The mapping of vegetation series established by Blasi (2010), Bacchetta et al. (2010) and Pinto-Gomes and Paiva Ferreira (2005) are based on a deductive approach whose principle consists in crossing the maps of ecological descriptors with the maps of the ecosystems to reveal the tessellary envelopes and the plant potentialities that are under them. This approach, which has been widely used since the 2000s with the improvement of GIS techniques, is particularly interesting for characterizing plant landscapes from vegetation to vegetation geoseries.

The approach used to delineate and spatialize vegetation and the vegetation series of the Biguglia pond was strongly inspired by the approach of Blasi et al. (2005). The combination of abiotic and phytosociological parameters is essential to have a view of the different levels of the landscape and to understand the spatio-temporal dynamics between the plant communities. The delimitation of the vegetation series from the devegetation maps also makes it possible to better visualize the repetitive and homogeneous combinations in the studied landscape (Béguin 2003) and, secondly, to obtain synslevés sous SIG with remarkable precision (Biondi et al. 2011).

The work of mapping the vegetation series, using the deductive approach, is based on five essential steps:

- characterization of phytosociological units: typology based on the Corsican vegetation Prodrome (Reymann et al. 2016);
- mapping: collection of field data;
- digitization and data processing: integration of data within a geographical information base that allows their visualization and their use;
- validation of data.
- restitution: restitution of all mapping informations analyzed within maps, descriptive notices...;

3.1 Phytosociological Characterization

The approach follows the sigmatistic phytosociological method of Braun-Blanquet (1928, 1968). This approach consists of recognizing and describing plant communities and then formalizing them from a nomenclatural point of view according to a synsystem (Guinochet 1973; Géhu and Rivas-Martínez 1981). Beyond this descriptive aspect, the other objective of the method is to specify the determinism of these vegetations (de Foucault 1986) and to explain the causality by various factors of the environment.

A sampling plan was developed as part of the synsystematic and dynamico-catenal study of the Biguglia pond. The objective of this plan was to ensure the sampling of the entire Nature Reserve by taking into account:

- the distribution of all vegetation units;
- the variability of ecological conditions.

To do this, the sampling was carried out with respect to four ecological factors discriminating: geology, geomorphology, pedology and bioclimatology. The set contributed to the definition of homogeneous ecological sectors.

At the same time, transects are carried out, corresponding to transverse profiles. Along these transects, it is a question of identifying the succession of individuals of associations homologous to a change in the floristic cortege and of defining the distribution and disposition of the plant communities according to an ecological gradient.

The combination of these two methods makes it possible to identify on the ground the spatial boundaries of the homogeneous ecological entities from the point of view of the physical factors: substrate, rocks, exposure, slope...

3.2 Dynamics Tendencies

The dynamic tendencies, elaborated by Faliński (1986, 1998), constitute an alternative approach to dynamic vegetation maps (Faliński and Pedrotti 1990). They correspond to temporal and spatial variation of vegetation. Their analysis requires several cartographic datasets to establish the dynamic processes that occur within the vegetation. Their principle is based on an analytical cartographic approach to fundamental ecological processes: fluctuation, primary and secondary succession, regression, degeneration and regeneration (Fig. 6).

These dynamic processes include six major types of ecological processes (Faliński and Pedrotti 1990; Pedrotti 2004, 2013):

- **fluctuation:** the process representing the set of small changes that concerns part of the phytocenosis without modifying the type of phytocenosis. Depending on the nature of the fluctuation, two sub-categories are distinguished: natural fluctuations resulting from natural ecological processes (windthrow, dead trees. . .) and anthropogenic fluctuations due to anthropogenic pressures (mowed or grazed grassland);
- **degeneration**: process leading to structural and floristic changes in the plant association without changing the type of phytocenosis. The degeneration process induces a reduction of the tree stratum and the shrub stratum. The herbaceous stratum is marked by the arrival of ruderal or nitrophilous species linked to anthropogenic factors (forest cutting, grazing, etc.);

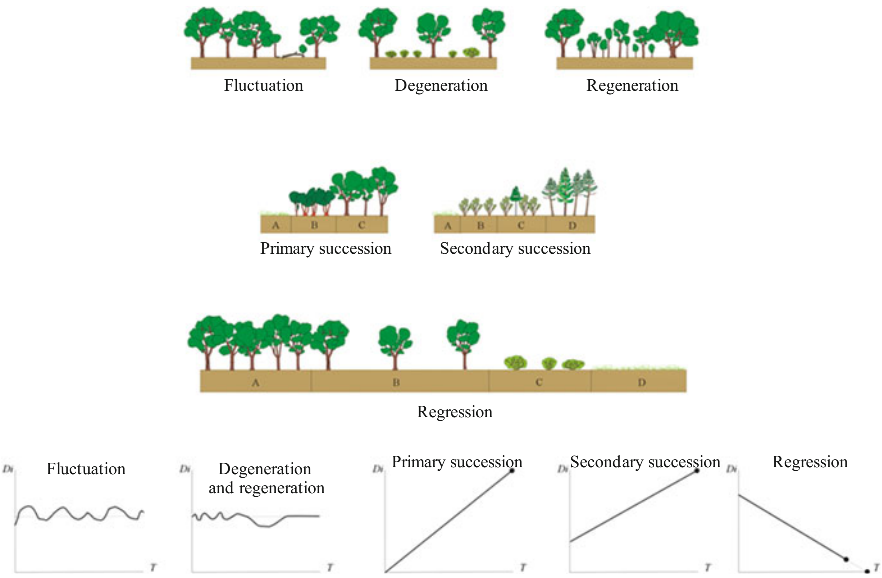

Fig. 6 Dynamic tendencies in vegetation: T = time: Di: dynamic index; A, b, c, d: phase of dynamic processes or dynamic stages (From Faliński 1986 and Pedrotti 2013)

- **regeneration**: process opposed to degeneration, without modification of the type of phytocœnose. The closing of a clearing or the recolonization of forests after the repeated passage of fire, are examples of regeneration, the latter reflecting a return to the initial state and more generally the phenomenon of resilience;
- **succession**: process of ex-novo reconstruction of plant associations over several years, culminating in a mature stage in equilibrium with climate and soil (climax stable stage). In the case of the primary succession, vegetation development begins on a mineral substrate devoid of organic matter; The secondary succession intervenes on the sectors where vegetation is already in place, generally following an abandonment of the anthropic activities (grazing, fire, cuts…). In this second case, the degradation is too great for the dynamic trajectory to differ from that before the changes in the primary succession;
- **regression**: process of progressive simplification of the plant association under the effect of anthropogenic exogenous actions. In the most extreme cases, the regression process can lead to the virtual or complete disappearance of the association. Regression may begin with an initial phase of degeneration;
- **seasonal rhythm**: is a process corresponding to a cyclical variation according to the seasons. An example of a cyclical process is that which occurs within temporary pools.

The mapping data of previous vegetation are those of Gamisans and Piazza (1992) and Gamisans (2006). The current vegetation map (Delbosc et al. 2015b) was used to apply the dynamic trends model. Each mapped unit corresponds to a plant association individual. The latter therefore represents a homogeneous unit from the ecological, structural, floristic and dynamic points of view. The delimitation of the units of the dynamic trends is therefore based on the division of the current vegetations. The names of the units take into account three pieces of information:

- numeric code;
- name of the plant association (name of the syntaxa in Latin);
- dynamic unit in which the individual of plant association is inscribed.

Graphical semiology is based on a symbolic designation of the different dynamic trends (hatching, dotted lines, dashed lines…) which aims to give the information of the taxonomic unit, the community type and the dynamic unit (Faliński and Pedrotti 1990). This method is, as in classical vegetation mapping, problematic because it limits the reading of the map. In the context of our study, it is proposed to revise the semiological typology of dynamic trends as follows:

- fluctuation: gradient of light green;
- degeneration: gradient of orange;
- regeneration: gradation of red;
- primary succession: gradient of dark green;
- secondary succession: gradient of violet;
- regression: brown gradient;
- seasonal rhythm: blue-gray gradient.

The structuring of the legend follows that established by Faliński and Pedrotti (1990): the typological positions have been classified according to the type of dynamic process (fluctuation, degeneration, regression...).

3.3 Symphytosociological and Geosymphytosociological Characterization

Biondi et al. (2011) showed the difficulty of achieving the synrelevés according to the inductive approach. The authors have demonstrated a remarkable accuracy in synrelevates from crosses of a vegetation map and ecological maps (geology, pedology, insolation and geomorphology). In view of the area of the two sites, a test was carried out on the Biguglia pond. The synrelevés were carried out under GIS using the deductive approach of Biondi et al. (2011). To create the synthesized in GIS, the method proceeded in several steps:

- delimitation of homogeneous ecological units: all ecological data not being available, bioclimatic maps, geological maps and topographical maps were collected;
- manual selection of polygons developing in the same homogeneous ecological unit; for each group of polygons of the same ecological envelope, a synthetic code has been assigned;
- extraction of the synrelevated matrix including the synthetic code, the names of the plant associations and their areas;
- calculation of the relative frequency of the plant associations within the synrelevés;
- transposition of the relative frequency of plant associations in the abundance-dominance code of Braun-Blanquet (1928).

3.4 Map of Vegetation Series and Geoseries

The acquisition of the map data took place in several phases:

- bibliographic synthesis to identify all ecological and phytosociological information;
- photo-interpretation to analyze physiognomic types;
- phytosociological pre-typology and structuring of the mapping base;
- filed survey to collect data;
- digitization of all the information gathered in the field;
- restitution of phytosociological maps, physiognomy of vegetation and vegetation series and geoseries.

The work is carried out under the ArcGIS 10® software, the projections used correspond to the "RGF93_Lambert_93" and each unit of vegetation is represented by a surface object, itself representing an individual of plant association.

The mapping supports used are multiple (CORINE Land Cover, BD Orthophotography 2011, BD Infrared orthophotography 2011, Scan 25 IGN 2011, Geology (BRGM 1:50,000), BD Topo IGN 2011).

The sequence of events leading to the final mapping representation is punctuated by steps to promote approximations. The elements of the field have been transferred to the background art with the greatest possible precision, in order to optimize the transcription of the data on a computer medium. The rigor given to field mapping is essential to ensure the best possible restitution of reality. The scale used here for field surveys and digitization is the 1:1500. The ecological configuration of the site requires a fine approach for two reasons:

- the scale is linked to the choice of mapped objects (plant associations);
- complete vision of the spatial structuring of vegetation in a given territory;
- Biguglia is designated as a Natura 2000 site. A fine scale makes it possible to better visualize conservation issues and appears adapted to answer questions of management and management of small areas (<1000 ha).

The 1:1500 scale of the field and digitization used in the development of the mapping of the vegetation makes it possible to represent mosaics and complexes of vegetation. For each polygon, it is the dominant vegetation from a surface point of view which has been preserved to name it.

The methodology adopted was based on the national methodology "Mapping of natural habitats and plant species applied to terrestrial sites in the Natura 2000 network" (Clair et al. 2005) developed by the National Museum of Natural History and the Federation of National Botanical Conservatories (Table 1).

In order to facilitate the management of the geographical data associated with the vegetations, these are contained in a single layer of geographic information constituted by polygons.

The latter have strictly topological relations, the contours of the neighboring polygons being perfectly contiguous.

It was chosen to structure the legend according to the physiognomy and ecology of the mapped vegetation, from the vegetation to the forest vegetation. The organization was carried out according to the types of vegetation systems:

- coastal system (halophilous and subhalophilous vegetations of sandy systems, salt meadows, brackish reed beds);
- Mesohygrophilous to mesohygrophilous system (amphibian vegetation, reed beds, mesohygrophilous grass vegetation and hygrophilous hemlines, thicket and hygromic to meso-hygrophilous swamp forests, mesohyrophrophilous forests);
- mesophilous system (scrub and mesophilous to mesoxerophilous forests);
- agro-pastoral system (lawns, meadows and nitrophilous hems);
- other (plantations, non-vegetable anthropogenic units).

Table 1 Structuring and filling standards of the attribute table for the vegetation map of Biguglia pond

Field	Notice	Type of field
OBJECTID	polygon ID number	Whole number
CODE_VEG	Vegetation code established in the vegetation typologies (Delbosc 2015).	Whole number
ASSO_VEG	Latin name of the syntaxon	Text
CODE_PVF	Code of the Vegetation Prodrome of France according to Bardat *et al*. (2004)	Text
LIB_PVF	Exact label according to the Vegetation Prodrome of France	Text
CODE_NAT20	"Code of the elementary habitat according to the habitat catalogs"	Text
LIB_NAT200	Exact label according to habitat catalogs	Text
HAB_NAT200	Type of habitat (priority habitat, community habitat, habitat not covered by the Directive).	Text
CODE_CB	Code with the highest precision	Text
LIB_CB	Exact label	Text
CODE_EUNIS	Code with the highest precision	Text
LIB_EUNIS	Exact label	Text
FORM_VEG	Character and appearance of a vegetation type according to Ellenberg & Mueller Dombois (1967)	Text
NOM_SERIE	Exact title of the series according to vegetation series prodrome (Delbosc et al., In prep.)	Text
TYPE_SERIE	Serie types according to Rivas-Martínez (2005)	Text
SIGMETUM	Latin name of sigmassociation or geosigmassociation	Text
SUPERFICIE	Area of polygon	Whole number
AUTEUR	Observer and author of digitization	Text
ANNEE	Year entry	Text

A numerical code (1 to n) has been assigned to each phytosociological unit. For the Biguglia pond, each type of vegetation (forests, tall humid grasslands, reed beds...) is represented by a color (Table 2).

For the mapping of habitats of Community interest, the semiotic principles establish as following:

- coastal habitats: this category has been re-declined according to vegetation systems. The semiology follows that established for vegetation series (orange gradient for sandy and sandy gravel systems, purple gradient for rocky coasts, gray for pebble beaches and red for salt vases);
- wet habitats: represented by blue gradients. Swamp habitats are blue-green and riparian or freshwater habitats are light to dark blue;

Table 2 Graphic semiology

Vegetation system	Vegetation types	Colour gradient
Coastal system	Halophilous and subhalophilous vegetation of psammophilous system	
	Vegetations of salt meadows	
	Brackish reedbeds	
Mesohygrophilous to hygrophilous system	Amphibious vegetation	
	Non-brackish rosettes	
	Mesohygrophilous grasslands and hygrophilous hems	
	Hyrophrophilous and mesohygrophilous forests and thickets	
	Mesohygrophilous forests	
Agropastoral system	Maquis and mesophilous to mesoxerophilous forests	
	Nitrophilous lawns, meadows and hems	
Other	Plantations	
	Non-vegetable anthropogenic units	

- agro-pastoral habitats are represented by pink colors;
- forest habitats are represented in gradients of green;
- rocky habitats are represented in gradients of violet.

4 Results

4.1 Systemic Approach

The first step of this work is focused on the recognition and evaluation of the vegetation and habitat systems of the Biguglia pond so as to quickly position the stakes in terms of global conservation and development of territory.

A vegetation system refers to the system of spatial organization of the vegetation according to Solon (1983 *in* Géhu 2006). A system must have some properties:

- reflect the structure of vegetation;
- understand natural ecological complexes, spatio-functional;
- allow delimitation of real and typological units;
- allow the use of these units not only in a formal description of the vegetation, but also for the mapping of vegetation and the regionalization of the territory;
- be comparable, in rank and size, with the units of the complex typology of physical geography and regionalization of the territory.

A sequence of vegetation is a succession of vegetation juxtaposed in space (Géhu 2006).

4.1.1 The Lagoon System

In this work, the lagoon vegetation has not been the subject of phytosociological or cartographic inventories. Nevertheless, using a bibliographic element (Gamisans 1991; Gamisans and Piazza 1992; Gamisans 2005, 2006), a typology of vegetation was established for this lagoon system.

This system is governed by a salinity gradient. To the north of the pond, near the grau, the marine influence very marked favor the implantation of herbariums to *Ruppia maritima* [*Ruppietum maritimae* (Hocquette 1927) *corr.* Iversen 1934].

Further back in the pond, the *Zostera noltii* herbarium is located on pond thin sedimentary [*Zosteretum noltii* Pignatti 1953] (Fig. 7).

Inside the pond are seagrass beds of *Potamogeton pectinatus* and *Najas marina* (Etourneau, 2011 *in* Département de Haute-Corse, 2013). The seagrass beds of the *Potametum pectinati* Carstensen ex Hibig 1971 colonize the mesotrophic waters on silty and clayey substrates and support summer exudation. The vegetation belonging to the *Najadetum marinae* Oberdorfer *ex* Fukarek 1961, grows within a mesotrophic to meso-eutrophic waters plan, on substrates more or less silted.

4.1.2 Sandy Shoreline System

To the north of the pond, the coastal site of Banda Bianca, facing east, is exposed to winds and spray. The halophilous gradient involves a vegetation sequence from the first very exposed belt marked by aerial vegetation of *Salsola kali* subsp. *tragus* and *Cakile maritima* subsp. *maritima* [*Salsolo kali-Cakiletum maritimae* Costa and Mans. 1981 corr. Rivas Mart. et al. 1992] to the last zonation characterized by a coastal thicket to *Pistacia lentiscus* and *Smilax aspera* [*Clematido cirrhosae-Pistacietum lentisci* Gamisans and Muracciole 1984 *corr.* Géhu and Biondi 1994] (Fig. 8).

Behind the halo-anemogenous band grows a vegetation of *Eryngium maritimum* and *Elytrigia juncea* subsp. j*uncea* [*Eryngio maritimi-Elymetum farcti* Géhu 1986]. A mesohaline fringe then comes a grouping with *Echinophora spinosa* and *Elymus juncea* subsp. *juncea* [*Echinophoro spinosae-Elymetum* farcti Géhu 1988]. This vegetation is often interspersed with the *Ononidetum variegatae* Piazza and Paradis 2002. To the oligohaline vegetation succeeds an anemomorphosed thicket of *Clematido cirrhosae-Pistacietum lentisci smilacetosum asperae*.

Behind this dune beach, it is a brackish mesohygrophilous embryonic complex in which are developed vegetations of *Spartino versicolori-Juncetum maritimi* O. Bolòs 1962.

In the south of the pond, near the Poretta airport, the same sequence of vegetation is expressed, except for the littoral thicket of *Pistacia lentiscus* and *Smilax aspera* which is replaced by thickets with *Cistus salviifolius* and *Halimium halimifolium* subsp. *halimifolium* [*Cisto salviifolii-Halimietum halimifolii* Géhu and Biondi 1994]. Its presence is largely explained by a sandy-gravel substratum of this coastal area (Figs. 9 and 10).

Fig. 7 Seagrass lagoon of Biguglia

4.1.3 Marshes System

Placed in the regional Corsican context, the environments of salt marsches remain localized on the eastern part of the island because of the coastal geomorphology. Biguglia Pond is one of the island's most important salt marsches with Porto-Vecchio (Santa Giulia, Stabiacciu Delta) (Géhu and Biondi 1994).

Fig. 8 Vegetation sequence of the sandy Banda Bianca system

Fig. 9 *Cisto salviifolii-Halimietum halimifolii*

Most of the vegetations that make up this system are paucispecific or often monospecific [*Arthrocnemo glauci-Salicornietum emerici* (O. Bolòs 1962) Géhu and Géhu-Franck 1978; *Suaedo maritimae-Salicornietum patulae* (Brullo and Furnari 1976) Géhu and Géhu-Franck 1984]. Because of the activity of the grau, the salted and salt marsches meadows are punctual to the north of the pond and much more abundant at the tail of pond where water and sediments stagnate.

The vegetation sequence is punctualon the reserve: in the most heavily hygrophilous and salty areas, the vegetation of annual *Salicaornia* spp. grows (*Arthrocnemo glauci-Salicornietum emerici* (O. Bolòs 1962) Géhu and Géhu-Franck 1978). The

Fig. 10 Vegetation complexe of *Salicornion fruticosae*

Fig. 11 *Limonio narbonensis-Caricetum extensae*

latter are mixed with floristic elements of the *Puccinellio festuciformis-Juncetum maritimi* (Pignatti 1966). Géhu et al. 1984 when asphyxiated substrates are flooded almost permanently (Fig. 11).

At a slightly elevated topographic level, the association of *Puccinellio festuciformis-Sarcocornietumfruticosae* (Braun-Blanq. 1928), Géhu 1976, is expressed. This vegetation affects oligohaline substrates and moderately flooded. The limited association of *Limonio narbonensis-Caricetum extensae* Géhu and Biondi 1994 is localized in the sandy areas with the contacts of salted vases. They

Fig. 12 Pasture meadows (1) and thickets with *Rubus ulmiifolius* (2) of the peninsula of San Damiano [3] and without the Biguglia pond

are generally located on the edges of salty habitats and constitute a sort of transition towards the sandy coast.

Under the effect of fires and grazing, these two coastal systems (sandy and salty mud) are degraded. This sequence of vegetation is modified by the appearance of secondary groups such as *Juncus acutus* [*Juncetum acuti* Re. Molinier and Tallon 1969] or brackish meso-hygrophilous prairies with *Cotula coronopifolia* and *Polypogon monspeliensis* [*Polycarpion tetraphylli* Rivas-Mart. 1975].

4.1.4 Mesophilous and Meso-xerophilous System

This system appears fragmentarily on the drier outer limits of the Reserve. It is only on the San Damiano peninsula that this system expresses itself fully: It is characterized by prairial agropastoral facies. The exploitation of pastures in the past and the pasturage still present favors the mainly open meadow environments [1] (Fig. 12).

The San Damiano peninsula presents a concave geomorphology whose plateau includes a gentle slope towards the brackish banks of the pond. The grasslands can be attached to the association of *Lino biennis-Cynosuretum cristati* Tüxen and Oberdorfer 1958. These are mesophilous vegetations dominated by a grass carpet with *Gaudinia fragilis*, *Cynosurus cristatus* or *Lolium Perenne*. Regularly trampled, they present nitrophilous species of *Echio lycopsis-Galactitetum tomentosae* Re. Molinier 1937 or *Cichorietum intybi* Tüxen ex G. Sissingh 1969. Pastoral pressure decreasing, grasslands are picking and then replaced by nitrophilous Secondary studies of *Pruno spinosae-Rubion ulmifolii* O. Bolòs 1954 [2].

The plateau of the peninsula also has topographic depressions, flooded at least part of the year, and favorable to wet vegetation. Mesohygrophilous meadows of the *Lino biennis-Festucetum arundinaceae* Dubuis and Simmoneau ex B. Foucault 1989 are often imbricated with the *Trifolgus fragiferi-Cynodontetum dactylonis* Braun-Blanq. and O. Bolòs 1958, indicating a eutrophication of the environment.

4.1.5 Edaphohygrophilous System

The non-brackish hygrophilous system is located on the western part of the pond. It is characterized by a complex of hygrophilous and meso-hygrophilous vegetation from the structural and textural point of view. It is possible to observe a mosaic between the tall humid grassland [*Cirsio cretici-Dorycnietum recti* Géhu and Biondi 1988], thickets [*Salicion cinereae* T. Müll. and Görs 1958] and forests of *Alnus glutinosa* [*Angelico sylvestris-Alnetum glutinosae* Gamisans 2013; *Sparganio neglecti-Alnetum glutinosae* Gamisans 2013].

The tall humid grassland is marked by numerous eutrophic and mesotrophic species such as *Dorycnium rectum*, *Cirsium creticum* subsp. *triumfetti*, *Althaea officinalis*, *Calystegia sepium* subsp. *Sepium*, *Mentha aquatica*, *Lythrum salicaria*. This vegetation is entangled with the reed beds, more or less high, with *Phragmites australis* subsp. *australis* [*Phragmitetum australis* Schmale 1939 *calystegietosum sepii* Gamisans 1992]. More localized, vegetations of shallow and mesotrophic pond edges to Iris pseudacorus L. [*Iridetum pseudacori* Eggler 1933] develop at the hinge of reed beds with phragmites.

Over the entire pond, reed beds are colonized by moist thickets of *Pruno spinosae-Rubion ulmifolii* O. Bolòs 1954, which constitute a transition phase towards the *Salix atrocinerea* Brot. [*Salicion cinereae* T. Müll and Görs 1958]. These are riparian vegetation in areas of stagnant water, low topographic levels, extensively flooded and developing on slightly acid soil. They remain very sporadic on the pond, leaving room for the alder trees of the *Angelico sylvestris-Alnetum glutinosae* Gamisans 2013 (Figs. 13 and 14).

Sparganio neglecti-Alnetum glutinosae Gamisans 2013, is very localized on the west bank of the pond, differentiates from the *Angelico sylvestris-Alnetum glutinosae* Gamisans 2013 by the mesotrophic acid substrates, soaked a good part of the year.

Fig. 13 Complex of edaphohygrophilous vegetation from the tall humid grassland in the foreground, from thickets to *Rubus ulmiifolius* in the background to the top seed with *Alnus glutinosa*

Fig. 14 *Angelico sylvestris-Alnetum glutinosae*

This vegetation complex, situated catenally, is juxtaposed with the canals of the pond. These are dominated by communities of floating pleustophytes in the stagnant and sunny eutrophic waters of *Lemna gibba* and *Lemna minor* [*Lemnion minoris* Tüxen ex O. Bolòs and Masclans 1955]. Where the topographic level is elevated, the drier soil permits the installation of thermophilous maquis to *Pulicaria odora* and *Arbutus unedo* [*Pulicario odoratae-Arbutetum unedonis* Allier and Lacoste 1980] and fragments of *Quercus suber* forest (Fig. 15).

4.2 Flora

The phytosociological surveys and inventories allow to identify 225 taxa on the natural reserve of the pond of Biguglia. Three of them have protection status, and only *Kosteletzkya pentacarpos* is protected according to European HFFD. The sampling is not floristic but phytosociological, it is very likely that the species observed by Jacques Gamisans in 2006 and not recorded in 2014 are present on the pond Biguglia.

4.3 Phytosociologic Typology

109 phytosociological relevés were carried out during the 2014 field campaign. After analysis and using the Corsican Vegetation Prodrome (CVP), it is possible to propose the syntaxonomic schema presented in Appendix.

Fig. 15 Catenal composition with alder vegetation series and *Lemnion minoris*

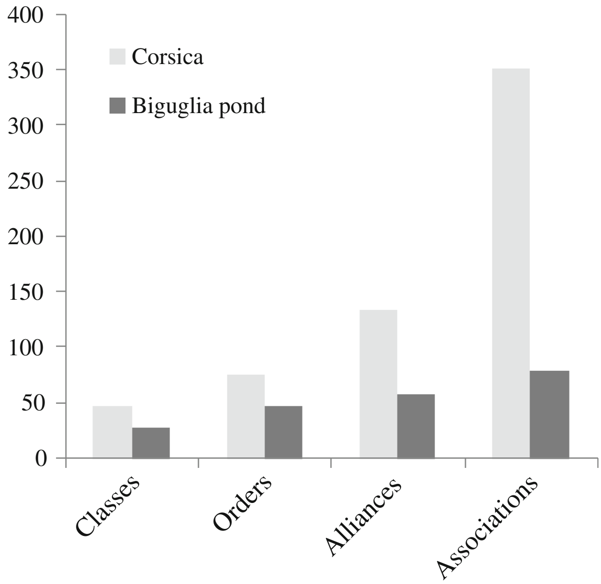

Fig. 16 Comparison of the number of class, order, alliance and phytosociological association of the Natural Reserve of Biguglia with Corsica

Compared to this phytosociological reference in Corsica (Reymann et al. 2016), the Biguglia pond Nature Reserve presents a great phytosociological diversity at all hierarchical levels (Fig. 16):

- 60% of classes;
- 61% of orders;

- 43% of alliances;
- 22% of associations.

4.4 *Map of Vegetations*

4.4.1 Phytosociological Mapping of the Natural and Semi-natural Vegetations of the Biguglia Pond

This mapping has a total of 70 units:

- 66 phytosociological units with 6 alliances, 1 sub-alliance, 46 associations, 9 sub-associations and 3 groups; They are classified into 12 types of vegetation whose surface percentages are shown in Fig. 17.
- 5 non-vegetated units (canal, open water, trail, bare sand, urbanized areas) (Fig. 18, Table 3).

4.4.2 Physiognomic Mapping of Vegetations of Biguglia Pond

24 physiognomic units are represented. The lagoon, the reed beds, the sansouïres, the thickets and the forests are the major units of the plant landscape (Figs. 19 and 20; Table 4).

4.4.3 Mapping of Natural and Semi-natural Habitats of Community Interest

The interest of the site under the FFHD is assessed through the surface area and the relative percentage of habitats of Community interest and priority (Fig. 21; Table 5): almost 60% of the surface of the site is occupied by HCIs, With the exception of coastal lagoons (seagrass beds...) not mapped.

Among the HCI (Fig. 21), coastal and agro-pastoral habitats are the two major entities of the landscape: pioneer vegetation with *Salicornia* spp. And other annual species of muddy and sandy areas (73.9 ha or 10.5% of the surface of the site), vegetation of Mediterranean salt meadows (*Juncetalia maritimi*) (66.39 ha or 9.44% of area).

The wet Mediterranean meadows of the *Agrostio stoloniferae-Scirpoidion holoschoeni* and the riparian galleries of *Tamarix africana* are very represented on the site, with a respective area of 61.1 ha and 42.2 ha.

The site's interest under the FFHD l'appellation de cette directive européenne is assessed through the area and the relative percentage of habitats of Community and priority interest. Table 6 shows a significant proportion of habitats of Community interest (57.9% of the area). It is necessary to recall that coastal lagoons (seagrass beds...), priority habitats, are part of the plant units typologically counted but not mapped (Fig. 22).

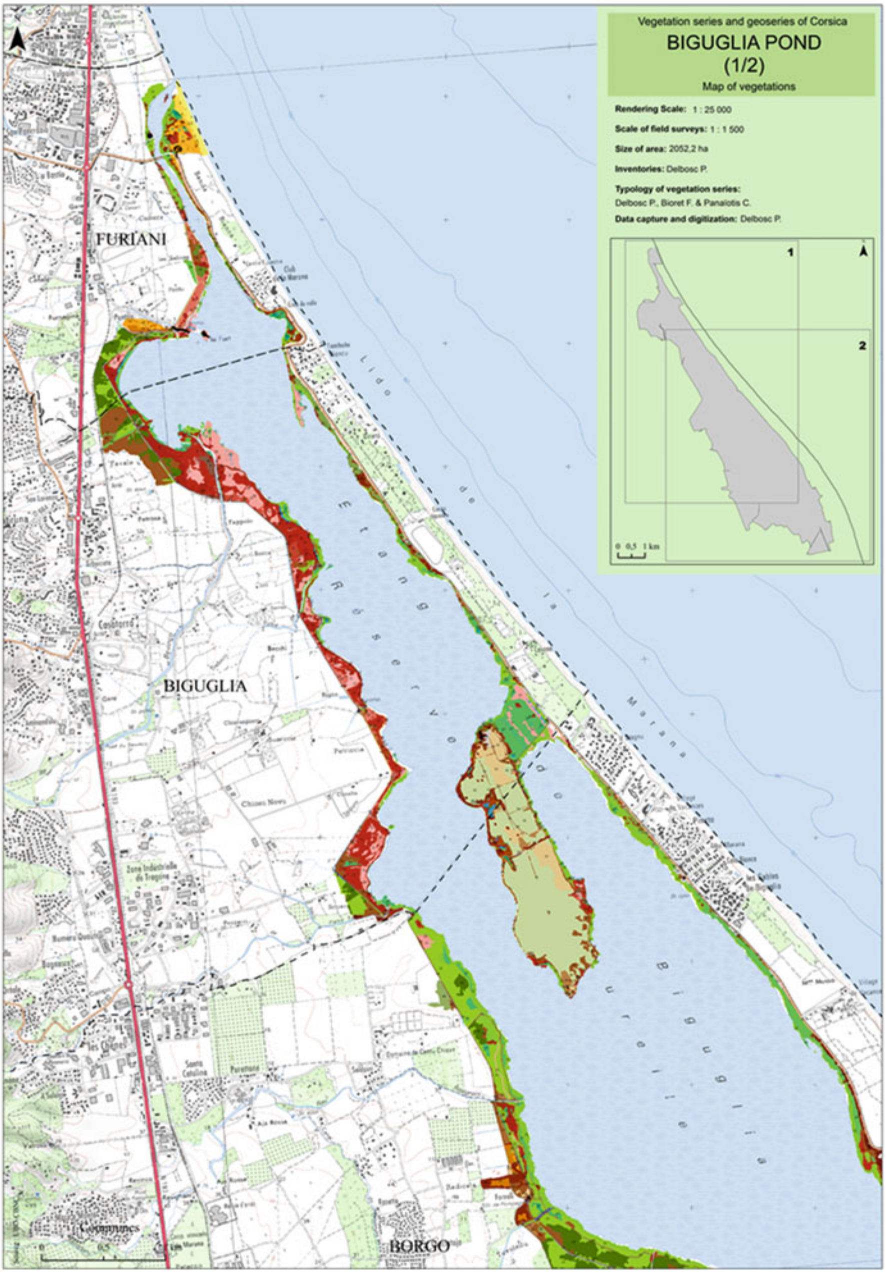

Fig. 17 (**a**) Phytosociological mapping of the natural and semi-natural vegetation of the Biguglia pond. (**b)** Phytosociological mapping of the natural and semi-natural vegetation of the Biguglia pond. (**c**) Phytosociological mapping of the natural and semi-natural vegetation of the Biguglia pond

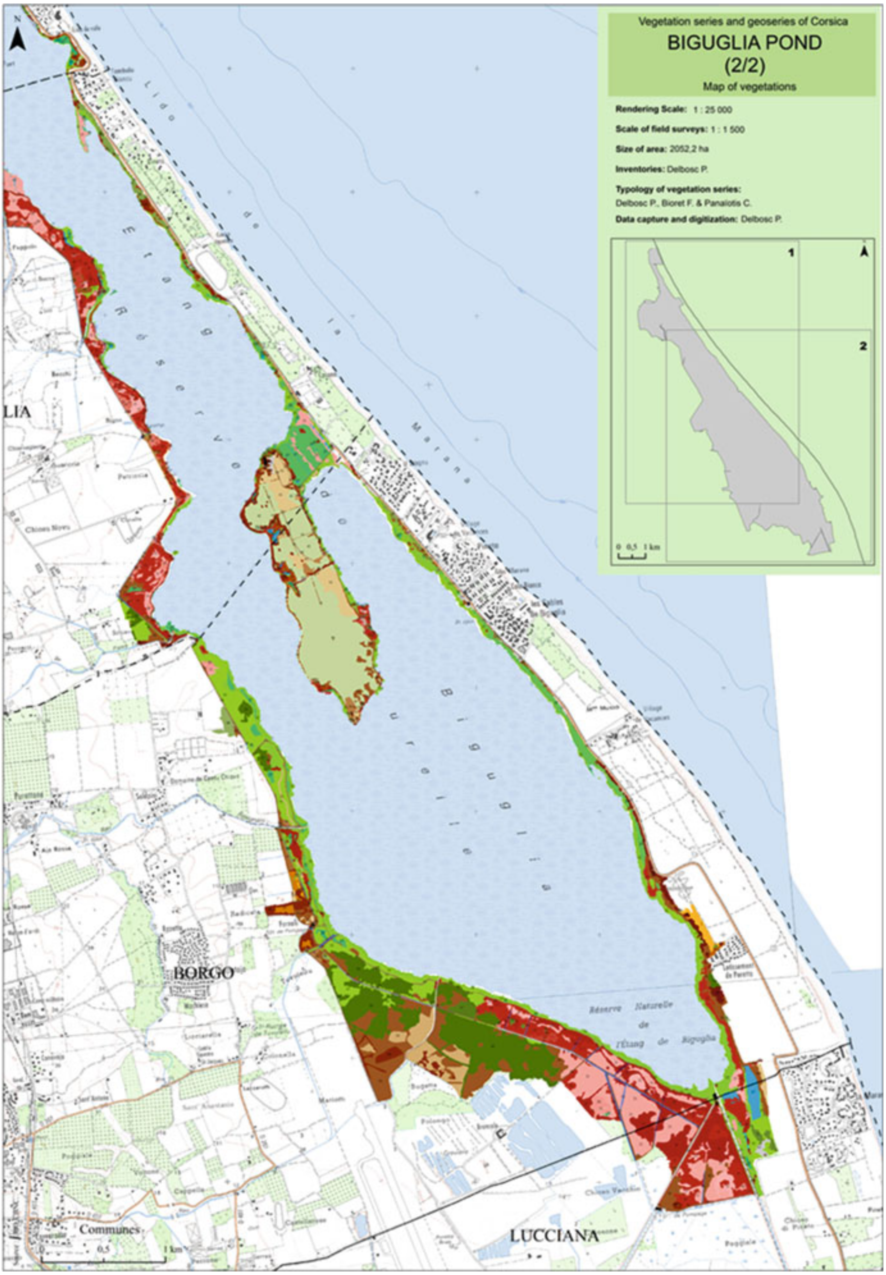

Fig. 17 (continued)

Fig. 17 (continued)

4.4.4 Mapping of Dynamic Tendencies

Figure 23 highlights several facts:

- vegetation on sandy beaches (3) is affected by a dynamic trend of "natural fluctuation" type. Some parts of the dune are not vegetated (bare sand), it is the first littoral fringe on which *Salsolo kali-Cakiletum maritimae* develops and which is currently non-vegetalized (wind erosion and site frequentation);
- vegetation in salted vats (11) are characterized by dynamic trends of anthropogenic origin, such as "anthropic fluctuation, regression or secondary succession";
- mesophilous to mesoxerophilous vegetation (24) are marked by dynamic trends linked to anthropogenic influence (anthropogenic fluctuation, regression, degeneration and secondary succession). In the most unserved areas of livestock trampling, dynamic trends are regeneration or natural fluctuations;

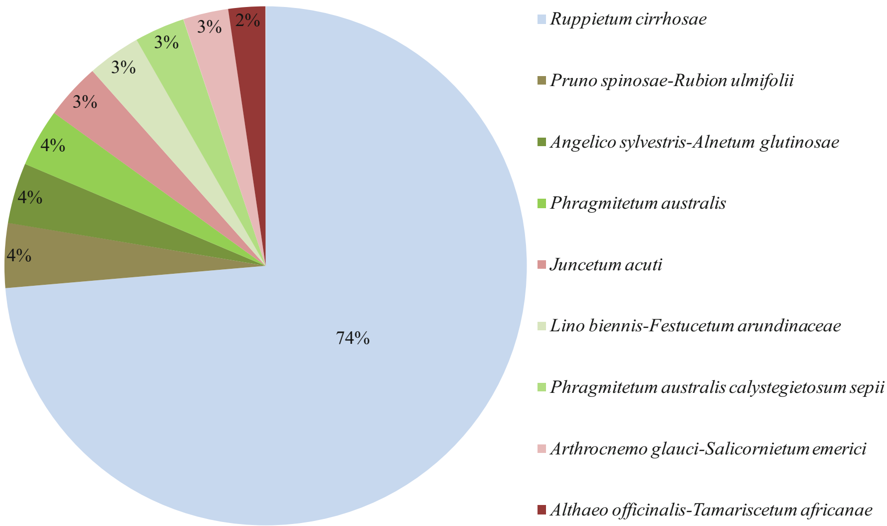

Fig. 18 Representation of area percentage of main plant associations of Biguglia

- edaphohygrophilous vegetations (64, 65, 67, 73, 76, 78) are affected by dynamic trends of the natural fluctuation type.

Table 7 and Fig. 24 show that the Biguglia pond is characterized by six dynamic trends (regeneration, natural fluctuation, anthropogenic fluctuation, degeneration, regression, secondary succession) and two “other” positions (open water and urban areas). The main dynamic trends that dominate are regeneration, natural and anthropogenic fluctuations:

- regeneration (172.8 ha): this dynamic trend concerns vegetation of recolonization after abandoning anthropogenic activities; It characterizes the closure of the environments by the development of thickets of *Pruno spinosae-Rubion ulmifolii*, tall humid grassland of the *Cirsio cretici-Dorycnietum recti* or pre-forest of *Fraxino angustifoliae-Ulmenion minoris*;
- natural fluctuation (238.2 ha): this type of trend occurs among the seeds like the Angelico sylvestris-Alnetum glutinosae and the *Sparganio neglecti-Alnetum glutinosae*. At this level of the dynamic trajectory, it is an intrasyntaxonomic dynamics that is established (tree fall in particular). This dynamic trend is also seen in the vegetation of salt marsches such as *Arthrocnemo glauci-Salicornietum emerici, Scirpetum compacto-littoralis, Inulo crithmoidis-Tamaricetum africanae*. In this case, it is the ecological factors and more particularly the geodynamics (fluctuation of the water level) which determine the intra-syntaxonomic fluctuations;
- anthropogenic fluctuation (133.6 ha): these trend is influenced by anthropic actions: trampling by livestock, mowing, frequentation. The *Lino biennis-Festucetum arundinaceae* is subjected to mowing which tends to modify it structurally but without modification of its floristic retinue. Other vegetations

Table 3 Typology, surface area and percentage of the plant associations of the Biguglia pond

Plant communities	Area (in ha)	Area percent (in %)
Ruppietum cirrhosae	1359.1	66.2
Pruno spinosae-Rubion ulmifolii	74.4	3.6
Angelico sylvestris-Alnetum glutinosae	69.6	3.4
Phragmitetum australis	66.6	3.2
Juncetum acuti	64.1	3.1
Lino biennis-Festucetum arundinaceae	61.1	3.0
Phragmitetum australis calystegietosum sepii	57.3	2.8
Arthrocnemo glauci-Salicornietum emerici	51.6	2.5
Althaeo officinalis-Tamariscetum africanae	42.3	2.1
Path	20.7	1.0
Suaedo maritimae-Salicornietum patulae	15.7	0.8
Pulicario odoratae-Arbutetum unedonis quercetosum suberis	15.3	0.7
Trifolio fragiferi-Cynodontion dactylonis	15.2	0.7
Echio lycopsis-Galactitetum tomentosae	14.3	0.7
Inulo crithmoidis-Phragmitetum australis	11.2	0.5
Scirpetum compacto-littoralis	9.6	0.5
Kosteletzkyo pentacarpos-Phragmitetum australis	8.8	0.4
Inulo crithmoidis-Tamaricetum africanae	7.9	0.4
Cisto salviifolii-Halimietum halimifolii	7.0	0.3
Populetum albae	6.9	0.3
Free water	5.9	0.3
Puccinellio festuciformis-Sarcocornietum fruticosae	5.0	0.2
Centaurio acutiflori-Hordeetum gussoniani	5.0	0.2
Galio scabri-Quercetum suberis	4.7	0.2
Arundini donacis-Convolvuletum sepium	4.0	0.2
Polygono monspeliensis-Crypsidetum aculeata	4.0	0.2
Wood of *Eucalyptus* spp.	4.0	0.2
Onopordetum illyrici	3.5	0.2
Pulicario odoratae-Arbutetum unedonis myrtetosum communis	3.3	0.2
Fraxino angustifoliae-Ulmenion minoris	3.2	0.2
Pulicario odoratae-Arbutetum unedonis	3.0	0.1
Water channel	2.2	0.1
Salicion cinereae	2.2	0.1
Salsolo kali-Cakiletum maritimae	2.0	0.1
Sparganio neglecti-Alnetum glutinosae	2.0	0.1
Cicendion filiformis-Solenopsion laurentiae	1.7	0.1
Hordeetum leporini	1.6	0.1
Bolboschoenetum maritimi	1.5	0.1
Urban areas	1.5	0.1
Centaurio acutiflori-Hordeetum gussoniani polypogonetosum monspeliensis	1.4	0.1
Silybo mariani-Urticetum piluliferae	1.1	0.1
Lemnetum minoris	1.0	0.1
Helichryso italici-Cistetum cretici	0.9	0.05
Spartino versicolori-Juncetum maritimi	0.9	0.05
Ononidetum variegatae	0.9	0.04
Puccinellio festuciformis-Juncetum maritimi	0.8	0.04
Pulicario odoratae-Arbutetum unedonis pinetosum hamiltonii	0.7	0.04
Eupatorio corsici-Alnetum glutinosae	0.7	0.03
Juncetum acuti elymetosum	0.6	0.03
Echinophoro spinosae-Elymetum farcti	0.5	0.02
Eryngio maritimi-Elymetum farcti	0.5	0.02
Pulicario odoratae-Arbutetum unedonis facies with *Cytisus villosus*	0.4	0.02
Potametum pectinati	0.4	0.02
Echio plantaginei-Galactition tomentosae	0.4	0.02
Urtico dioicae-Sambucetum ebuli	0.3	0.02
Sileno corsicae-Elymetum farcti otanthetosum maritimi	0.2	0.01
Cirsio cretici-Dorycnietum recti	0.2	0.01
Helichryso italici-Cistetum cretici calicotometosum spinosae	0.2	0.01
Scirpetum tabaernaemontani	0.2	0.009
Polycarpion tetraphylli	0.2	0.007
Catapodio marini-Parapholidetum incurvae	0.1	0.006
Sileno nicaeensis-Vulpietum fasciculatae	0.1	0.004
Vegetation at *Plantago lagopus*	0.1	0.004
Clematido cirrhosae-Pistacietum lentisci	0.1	0.004
Sparganio erecti-Sagittarietum sagittifoliae	0.04	0.002
Junco acuti-Schoenetum nigricantis	0.03	0.001
Wood of *Acacia delbatea*	0.02	0.001
Nasturtietum officinalis	0.02	0.0009
Typhetum latifoliae	0.01	0.0006
Eleocharitetum palustris	0.01	0.0005
Bare sand	0.01	0.0004
	2052.21	**100**

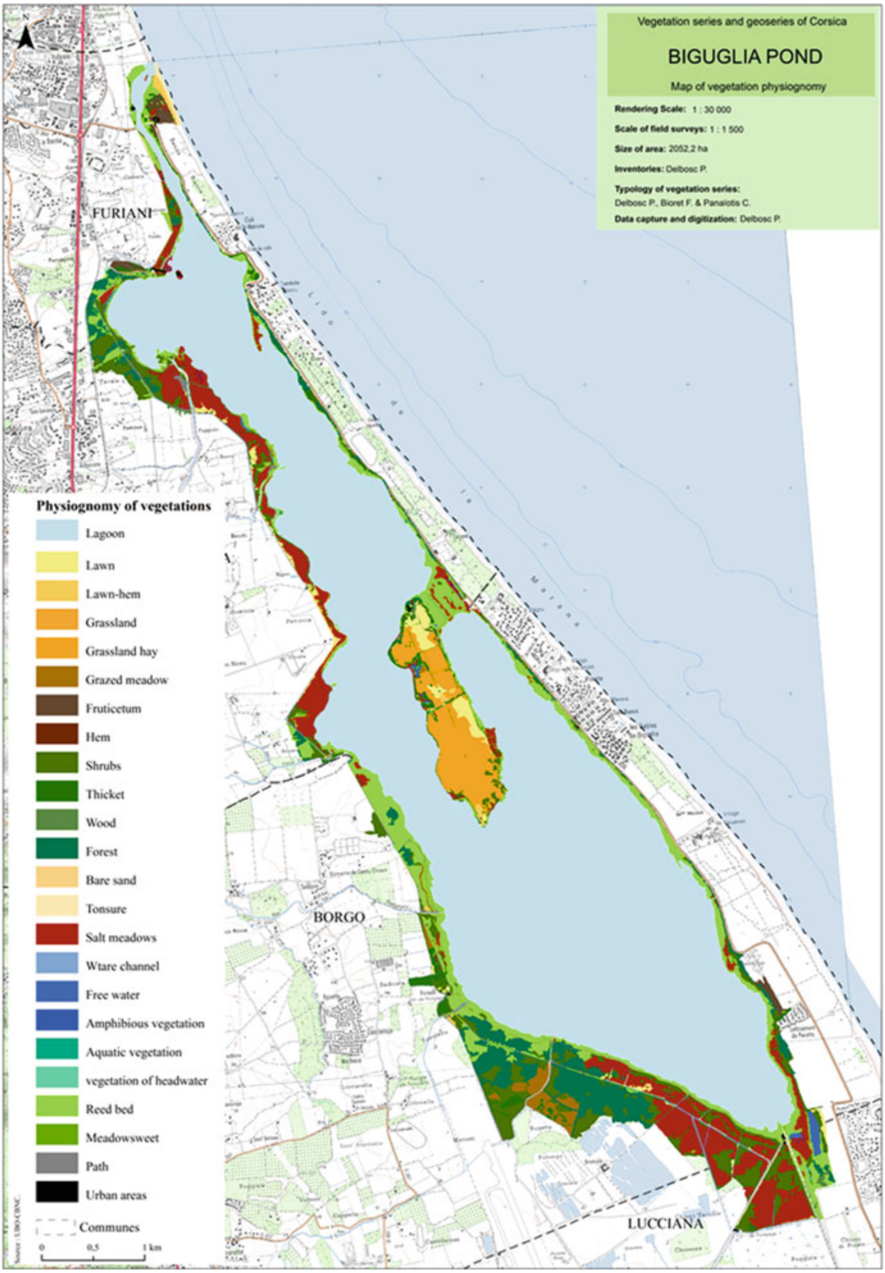

Fig. 19 Physiognomic mapping of vegetations of Biguglia Pond

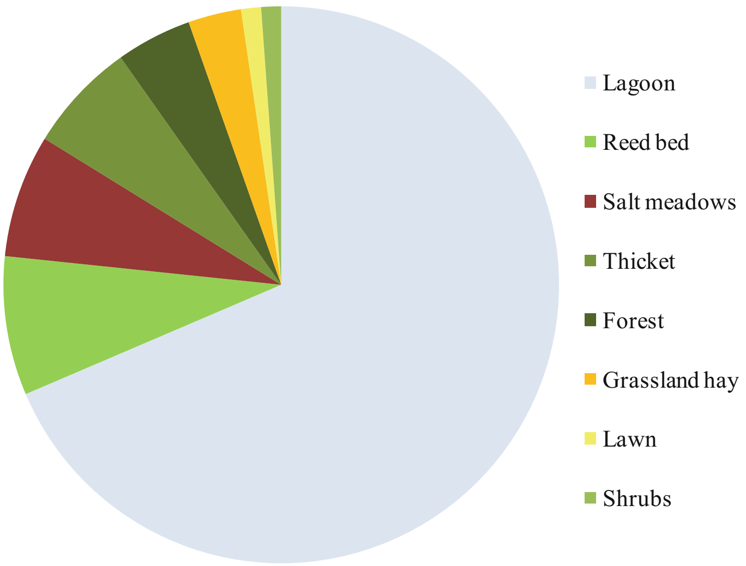

Fig. 20 Representation of area percentage of main physiognomic types of Biguglia pond

Table 4 Typology, surface area and percentage of the physionomic vegetation of the Biguglia pond

Physiognomy of vegetations	Area (in ha)	Percent area (in %)
Lagoon	1359.1	66.2
Reed bed	160.2	7.8
Salt meadows	141.8	6.9
Thicket	127.0	6.2
Forest	87.1	4.2
Grassland hay	61.1	3.0
Lawn	23.0	1.1
Shrubs	22.8	1.1
Path	20.7	1.0
Grazed meadow	16.3	0.8
Fruticetum	8.2	0.4
Lawn-hem	7.4	0.4
Free water	5.9	0.3
Wood	4.0	0.2
Water channel	2.2	0.1
Tonsure	2.0	0.1
Urban areas	1.5	0.1
Aquatic vegetation	1.4	0.1
Meadowsweet	0.2	0.01
Grassland	0.2	0.01
Hem	0.1	0.004
Amphibious vegetation	0.04	0.002
Vegetation of headwater	0.02	0.001
Bare sand	0.01	0.0004
	2052.21	**100**

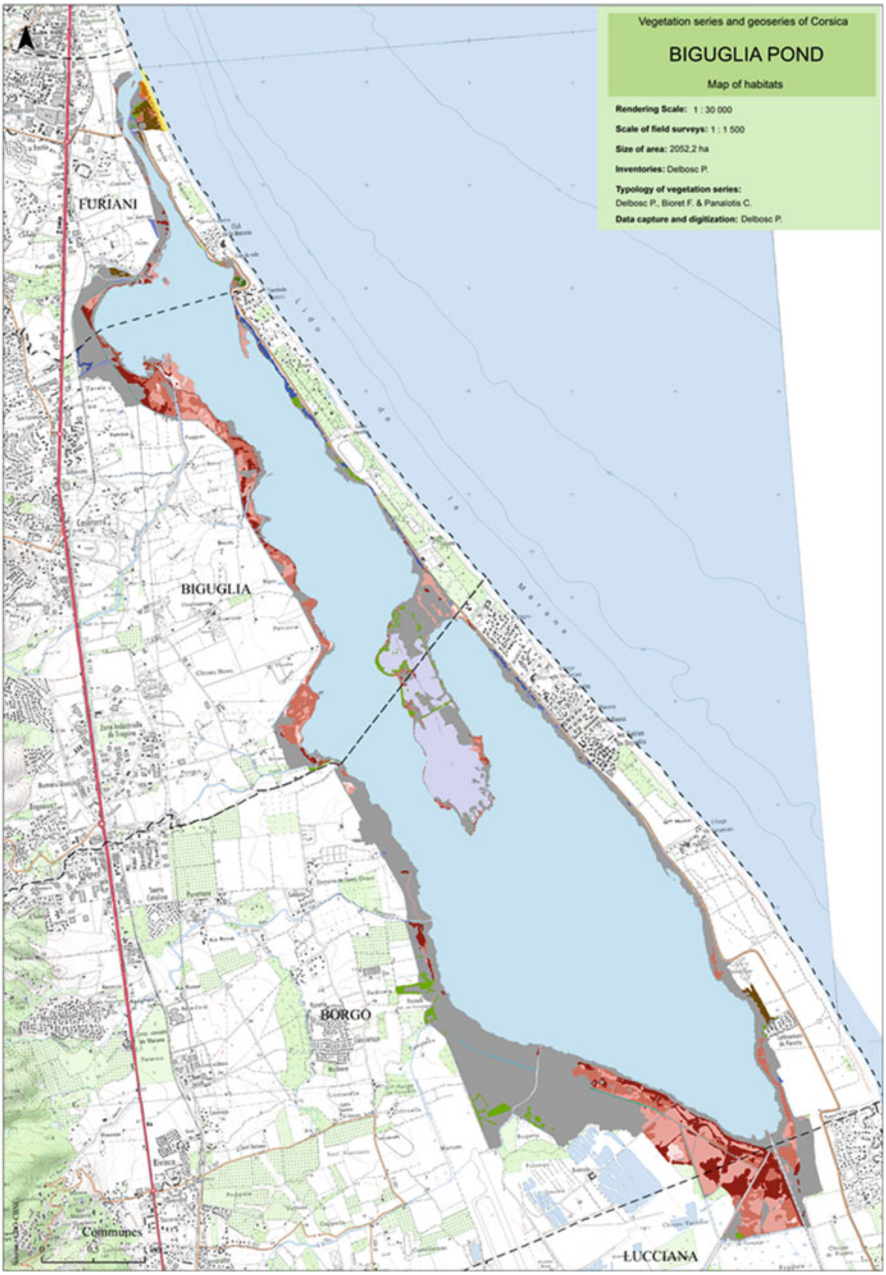

Fig. 21 (**a**) Mapping of habitats of Biguglia Pond. (**b**) Mapping of habitats of Biguglia Pond

Coastal habitats

- 1150-2 - Coastal lagoons
- 1210 - Annual vegetation of drift lines
- 9320-3 - *Olea* and *Ceratonia* forests
- 2110 - Embryonic shifting dunes
- 2230 - Malcolmietalia dune grasslands
- 2260-1 - *Cisto-Lanvantuletalia* dune sclerophyllous scrubs
- 1420 - Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornietea fruticosi*)
- 1310 - Salicornia and other annuals colonising mud and sand
- 1410 - Mediterranean salt meadows (*Juncetalia maritimi*)
- 92D0-1 - Southern riparian galleries and thickets (*Nerio- Tamaricetea* and *Securinegion tinctoriae*)
- 92D0-3 - Southern riparian galleries and thickets at *Tamaris*

Amphibious habitats

- 3150 - Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*
- 3150-3 - Natural eutrophic lakes

Edaphohygrophilous habitats

- 6420 - Mediterranean tall humid herb grasslands of the *Molinio-Holoschoenion*
- 6430-4 - Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels
- 92A0 - Salix alba and Populus alba galleries
- 92A0-4 - Riparian forests of the Mediterranean at *Alnus glutinosa* and *Alnus cordata*

Mesophilous and mesoxerophilous habitats

- 9330-3 - *Quercus suber* forests
- 9540-1.5 - Mediterranean pine forests with endemic Mesogean pines

Habitats not covered by the Directive

Fig. 21 (continued)

Table 5 Typology, surface area and percentage of habitats of the Biguglia pond

Natura 2000 code	Designation Natura 2000	Type of Habitat	Area (in h)	Percent area (in %)
1150-2	Coastal lagoons	Priority habitat	1359.1	66.2
-	Habitats not covered by the Directive	-	396.0	19.3
1310	Salicornia and other annuals colonising mud and sand	Habitat of Community Interest	73.9	3.5
1410	Mediterranean salt meadows (*Juncetalia maritimi*)	Habitat of Community Interest	66.4	3.2
6420	Mediterranean tall humid herb grasslands of the *Molinio-*	Habitat of Community Interest	61.1	3.0
92D0-3	Southern riparian galleries and thickets at *Tamaris*	Habitat of Community Interest	42.3	2.1
9330-3	*Quercus suber* forests	Habitat of Community Interest	15.3	0.7
92D0-1	Southern riparian galleries and thickets (*Nerio-Tamaricetea* and *Securinegion tinctoriae*)	Habitat of Community Interest	7.9	0.4
2260-1	*Cisto-Lavanduletalia* dune sclerophyllous scrubs	Habitat of Community Interest	7.0	0.3
92A0	*Salix alba* and *Populus alba* galleries	Habitat of Community Interest	6.9	0.3
1420	Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornietea fruticosi*)	Habitat of Community Interest	5.0	0.2
6430-4	Hydrophilous tall herb fringe communities of plains and the montane to alpine levels	Habitat of Community Interest	4.0	0.2
1210	Annual vegetation of drift lines	Habitat of Community Interest	2.0	0.1
2110	Embryonic shifting dunes	Habitat of Community Interest	1.2	0.1
3150-3	Natural eutrophic lakes with *Magnopotamion* of *Hydrocharition*	Habitat of Community Interest	1.0	0.1
2230	*Malcolmietalia* dune grasslands	Habitat of Community Interest	1.0	0.05
9540-1.5	Mediterranean pine forests with endemic Mesogean pines	Habitat of Community Interest	0.7	0.04
92A0-4	Riparian forests of the mediterranean at *Alnus glutinosa* and *Alnus*	Habitat of Community Interest	0.7	0.03
3150	Natural eutrophic lakes	Habitat of Community Interest	0.4	0.02
9320-3	*Olea* and *Ceratonia* forests	Habitat of Community Interest	0.1	0.004
			2052.21	**100**

Table 6 Surface assessment of habitat types of Biguglia

Type of Habitat	Area (in h)	Percent area (in %)
Priority habitat	1359.1	66.2
Habitat of Community Interest	297.1	14.5
Habitats not covered by the Directive	396.0	19.3
	2052.21	**100.0**

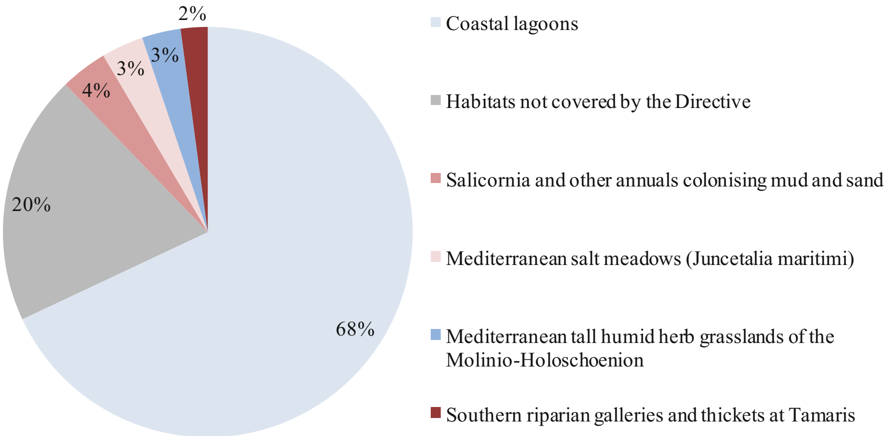

Fig. 22 Surface assessment of main habitat types of Biguglia

such as the *Galio scabri-Quercetum suberis* show anthropogenic fluctuations by the regular passage of the cattle: the association remains the same but the undergrowth is modified by the arrival of nitrophilous species. This phenomenon also concerns haliped vegetation such as *Suaedo maritimae-Salicornietum patulae* or *Althaeo officinalis-Tamariscetum africanae*.

Secondary dynamical trends (degeneration, regression and secondary succession) occupy lesser surfaces but mainly concern the geopermasia of the salted vases (*Arthrocnemo glauci-Salicornio emerici* geopermasigmetum) characterized by these dynamic trends:

- degeneration: vegetation with *Salicornia* spp. Are colonized by the *Juncetum acuti*. The trampling of livestock combined with the lack of appetite of *Juncus acutus* subsp. *acutus* involves increased colonization of the species on parts of the pond (tail and northwestern part of the pond). In areas where colonization of *Juncus acutus* subsp. *acutus* is too important, the floristic elements of the halophilous vegetation tend to disappear, the dynamic tendency then becomes regression;
- regression: this dynamic trend represents a regressive dynamic of natural vegetation towards semi-natural vegetation linked to agricultural use. These include *Echio plantaginei-Galactition tomentosae, Centaurio acutiflori-Hordeetum*

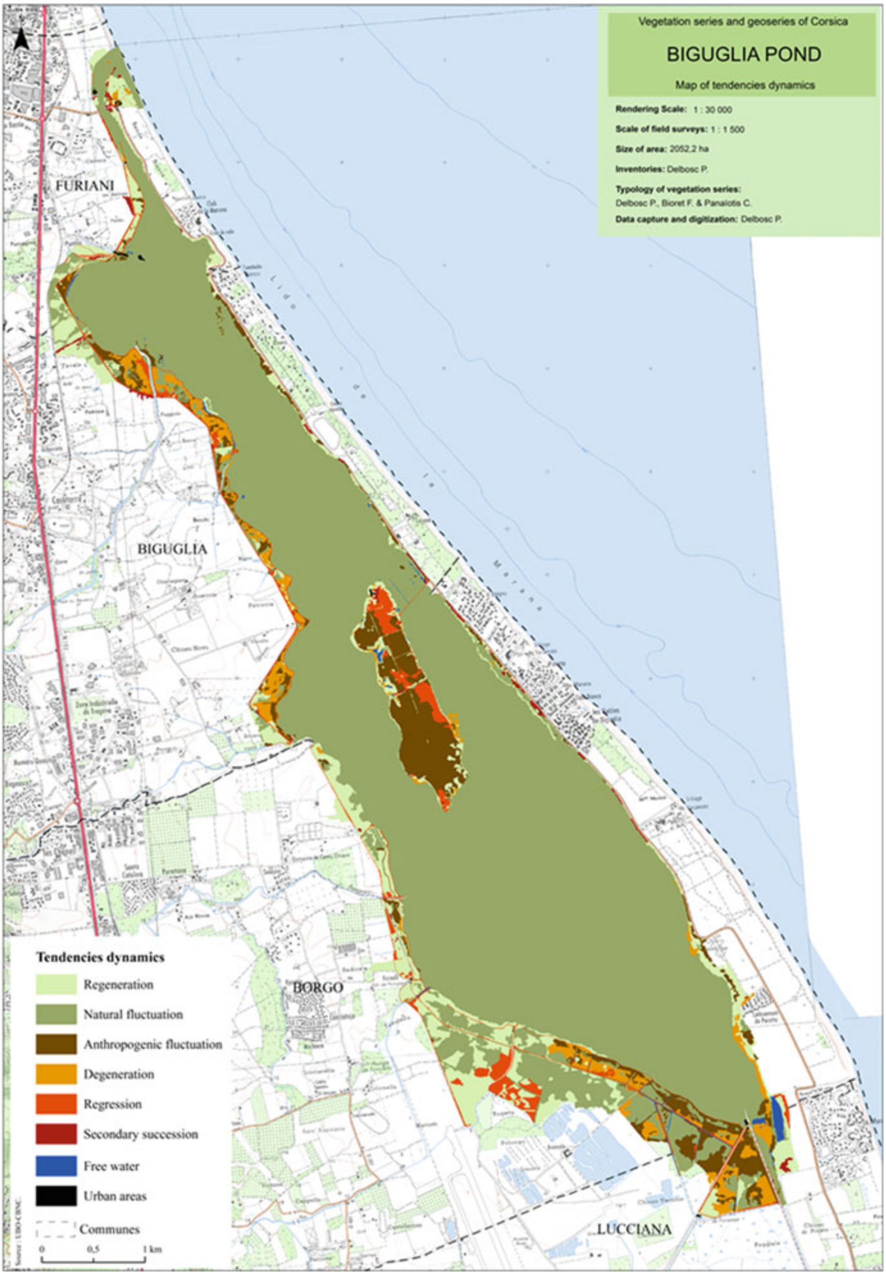

Fig. 23 Mapping of dynamic tendencies of Biguglia pond

Table 7 Surface assessment of dynamic tendencies types of Biguglia

Tendencies dynamics	Area (in ha)	Percent area (in %)
Degeneration	67.5	3.3
Free water	8.0	0.4
Anthropogenic fluctuation	133.6	6.5
Natural fluctuation	1597.3	77.8
Regeneration	172.8	8.4
Regression	63.4	3.1
Secondary succession	8.2	0.4
Urban areas	1.5	0.1
	2052.21	**100**

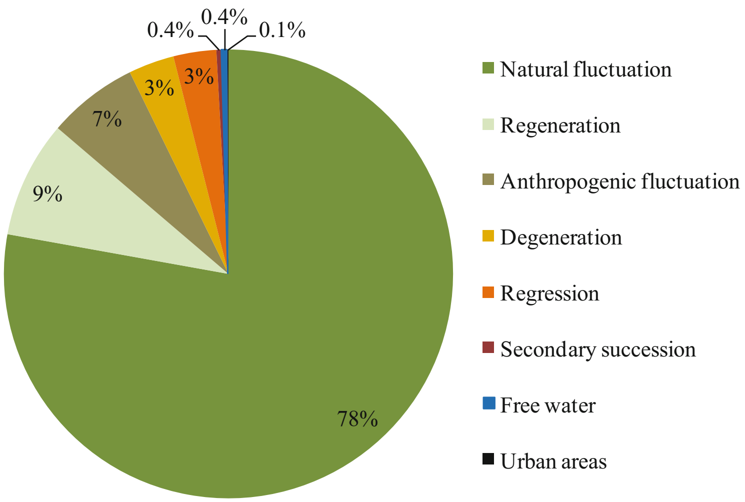

Fig. 24 Surface of dynamic tendencies types of Biguglia

gussoniani, Hordeetum leporini or *Onopordetum illyrici*. These low-lying vegetations, showing the bare soil in places, are favored by the trampling of the cattle. The floristic procession is not very diversified, with species adapted to compaction and trampling. When anthropogenic pressure is too high, the substrate becomes essentially mineral (path and sand bare for psammophilous systems);

- secondary succession: it characterizes invasive exotic vegetation (grouping with *Cotula coronopifolia*, grouping with *Acacia dealbata* and grouping with *Arundo donax*). This dynamic trend occupies smaller areas, but in view of the previous data (Gamisans and Piazza 1992, Gamisans 2006), groups of invasive exotic species tend to develop. The *Cotula coronopifolia* community occurs frequently in vegetation complexes, while the *Arundo donax* group develops along the watercourses and replaces the reed beds of the primary succession with *Phragmites australis* subsp. *australis*.

4.4.5 Diachronic Analysis of Vegetations (Global Approach)

The changes of field and observers and the typological evolution of the vegetations constitute a bias in the diachronic analysis. In 1992, the approach adopted by Gamisans and Piazza consisted of a physiognomic and floristic analysis of the vegetation of the pond. It was in 2005 and then in 2006 that Jacques Gamisans developed a true phytosociological typology. We will therefore deal here with the diachronic analysis in a global way (Gamisans 2005, 2006).

It seems pertinent to analyze the different vegetation dynamics by vegetation system: this makes it possible to better understand the changes taking place, each of which has singular ecological characteristics.

For the lagoon system, the main pitfall is the lack of phytosociological and cartographic data on vegetation to evaluate area changes. Considering the ecological conditions (salinity and its fluctuations, sedimentation, variable water level), these vegetations are considered as permanent vegetation or permaseries.

For the coastal system (sandy and sansouïres), the halophilous gradient implies a blocked dynamic for the most exposed vegetation or a truncated dynamic at two or three stages for the most sheltered communities (*Clematido cirrhosae-Pistacietum lentisci* Gamisans and Muracciole 1984, Géhu and Biondi 1994; *Cisto salviifolii-Halimietum halimifolii* Géhu and Biondi 1994). In addition to the ecological aspect, the dynamic trajectories of these vegetations are strongly influenced by anthropogenic actions.

The sandy coastline is subject to high human frequentation, at least on the first aeronautical zonation. The presence of a site of the Conservatoire du Littoral and the Department of Upper Corsica limited this impact.

On the western shore and at the tail of the pond several salt meadows were burned. This significant impact, which has existed for a long time, contributed significantly to the degradation of the original vegetation (Fig. 25).

Fig. 25 Vegetation of *Juncus acutus* subsp. *acutus* and halophilous thicket of *Tamarix africana* after fire

This degradation has favored the implantation and extension of ruderal and even exotic species and vegetation (*Cotula coronopifolia*). In addition to anthropogenic impacts, the natural drying out of salted marsches induces colonization by the *Juncus acutus* [*Juncetum acuti* Molinier and Tallon 1969] vegetation, which is of lesser patrimonial interest than *Salicornietalia fruticosae* Braun-Blanq. 1933].

Several halonitrophilous species have been recorded in phytosociological surveys of salted meadows: *Tripolium pannonicum*, *Polypogon monspeliensis*, *Beta vulgaris* subsp. *maritima*, *Atriplex prostrata* are the most abundant.

The brackish reed beds with *Bolboschoenus maritimus* and *Scirpus littoralis* seem to have remained stable even if on the east bank of the pond, the reed beds of *Phragmites australis* subsp. *australis* to colonize them. Saline fluctuations could be an explanatory factor for these floristic variations. The same is true for the reed beds in *Kosteletzkya pentacarpos* [*Kosteletzkyo pentacarpos-Phragmitetum australis* Gamisans 1992] and the various groups with *Phragmites australis* subsp. *Australis* [*Inulo crithmoidis-Phragmitetum australis* Gamisans 1992; *Phragmitetum australis* Schmale 1939] whose occupied areas remain stable. Only a few slight surface variations have been observed and can be explained by salinity fluctuations and variations in water level.

Brackish thickets in *Tamarix africana* [*Althaeo officinalis-Tamariscetum africanae* Gamisans 1992] have declined since 2006 due to fire practices. Some thickets undergo the regular passage of the cattle and constitute a zone of repository for the animals. The vegetation of undergrowth is modified and does not show a nitrophilous herbaceous stratum.

For the mesophilous and hygrophilous systems, the dynamics correspond to a complete plant succession from the lawn or prairial stages to the head of series. In these systems, the series present a progressive dynamic but also a regressive dynamic mainly related to fires and grazing. In general, on these two Gamisans systems in 2006, there has been a growing tendency of ruderal vegetation development since 1991 (Fig. 26).

Edaphohygrophilous system Alder forests regressed in favor of the meso-hygrophilous thickets of *Pruno spinosae-Rubion ulmifolii* O. Bolòs 1954. The groupings with *Arundo donax* were spread on the banks of the canals. The main focus of expansion comes from the north of the pond at the level of the D32 departmental road.

The tall humid *Cirsio cretici-Dorycnietum recti* Géhu and Biondi 1988 remained in the northeast of the pond near Banda Bianca. Elsewhere, and especially on the western shore of the pond, the tall herb evolved towards reed. They are reeds with a nitrophilous tendency and belonging to the *Phragmitetum australis* Schmale 1939 *calystegietosum sepii* Gamisans 1992. The abundance of *Rubus ulmifolius* in these vegetations reflects a transition towards pre-forest vegetation. This facies with *Rubus ulmifolius* has expanded considerably since 2006. The gallery forests of *Populus alba* on the east bank have not evolved. The same applies to the afforestation with *Eucalyptus* spp. whose areas are the same as in 2006.

Fig. 26 Vegetation of *Arundo donax* near Fornoli

Mesophile to Meso-xerophilous System The thermo-mediterranean maquis to *Pistacia lentiscus*, *Myrtus communis* subsp. *communis* and *Quercus suber* maintains since 2006. Anthropogenic pressure from fires and cuts induces a temporary blockage of the dynamics in the maquis stage: the latter only very rarely reaches 4 m in height. The maintenance of the opening of these maquis prevents the colonization of the sciaphil species typical of the undergrowth of the tree formations of the *Quercetea ilicis* Braun-Blanq. In Braun-Blanq., Roussine and Nègre 1952. Similarly for the formations of *Quercus suber* which prick the prairial landscape on the San Damiano peninsula. On the east bank of the pond, the Quercus suber forest are influenced by human activities: the presence of *Pteridium aquilinum*, *Paspalum distichum* or *Hordeum murinum* subsp. *murinum* testifies to the embankments linked to the departmental road.

On the San Damiano peninsula, the grasslands are subjected to grazing, which results in the appearance of thicket-like vegetation or ruderal swards of *Galactites elegans* and *Echium plantagineum*. Even though these environments remain colonized by shrubby species such as *Rubus ulmifolius* and *Pteridium aquilinum*.

4.5 Typology and Mapping Vegetation Series and Geoseries

13 symphytosociological units are represented. The edaphohygrophilous series with *Alnus glutinosa* and *Angelica sylvestris*, halophilous geopermaseries of salt meadows, climatophilous series with cleavers and cork oak, and geopermasia of lakes and bodies of water are the 4 serial units typical of the plant landscape of the pond Biguglia (Fig. 4).

Ten new series have been identified on the Biguglia pond. Landscape surveys have been carried out in other areas of Corsica to confirm the existence of certain series whose data on the pond were too fragmentary. The surveys of the *Clematido cirrhosae-Pistacio lentisci* minorisigmetum variant with *Smilax aspera* and the *Galio scabri-Querco suberis* sigmetum are shown in Tables 10 and 21 of the Cap Corse monograph.

4.5.1 *Echinophoro spinosae-Ammophilo arundinaceae* geopermasigmetum

Geopermaseries of Dune Sandy Beaches, Dry-Subhumid Thermo-Mediterranean, of the East Coast of Corsica

This psammophilous, heliophilous and halophilous geopermaseries is endemic of Corsica. It is common on the east coas tof the island and is characterized by the *Echinophoro spinosae-Ammophiletum arundinaceae*. *Ammophila* vegetation constitution almost continuous fringe on all sites. Vegetation sequence is present over 20 m and is replaced by *Clematido cirrhosae-Pistacietum lentisci smilacetosum asperae*.

Sigmasystematic [holotypus: rel. 2—Table 8]

5 geopermasynrelevés.

Average syntaxonomic richness: 7.2 permasigmataxa by geopermasynrelevé.

Although frequent along the coastal zone of Corsica, dune geopermaseries appear ponctually. They are regularly subjected to human pressures: human use and trampling of sandy gravel sites have change the vegetation sequence and favor the development of secondary vegetation. Referring to the European Habitats Directive, this geopermaseries include many HCI:

Table 8 *Echinophoro spinosae-Ammophilo arundinaceae* geopermasigmetum

Géopermasynrelevé n.	**1***	2	3	4	11	
Geographic area	**Mucchiatana**	Prunete-Cannicia	Prunete-Cannicia	Prunete-Cannicia	Biguglia	
Area (ha)	**6.95**	1.43	5.4	4.3	2.05	
Cover (%)	**90**	95	80	90	90	
Number of permasigmataxa	**10**	9	6	5	6	∑
Characteristic permasigmataxa						
Echinophoro spinosae-Ammophilo arundinaceae permasigmetum	**.O1**	O2	O1	.r		**IV**
Permasigmataxa of sandy beach						
Salsolo kali-Cakilo maritimae permasigmetum	**O2**	O2	O2	O3	O3	**V**
Sporobolo arenarii permasigmetum	**.+**	.r	O1			**III**
Permasigmataxa of embryonic dunes						
Sporobolo pungentis-Elymo farcti permasigmetum		.+				**I**
Sileno corsicae-Elymo farcti permasigmetum					O2	**I**
Eryngio maritimi-Elymo farcti permasigmetum	**O1**	O2	O2	O2	O2	**V**
Eryngio maritimi-Elymo farcti permasigmetum variant with *Achillea maritima*	**O2**					**I**
Permasigmataxa of backshore dunes						
Pycnocomo rutifolii-Crucianello maritimae permasigmetum	**O3**	O2	O3	O2		**IV**
Echinophoro spinosae-Elymo farcti permasigmetum	**O2**					**I**
Echinophoro spinosae-Elymo farcti permasigmetum variant with *Achillea maritima*	**O2**	O3	O3	O2	O2	**IV**
Sileno nicaeensis-Vulpio fasciculatae permasigmetum	**O2**	.+			o1	**II**
Sileno gallicae-Bromo gussonei permasigmetum						
Cutandio maritimae permasigmetum	**o1**					**I**
Sileno sericeae-Vulpio fasciculatae permasigmetum						
Another permasigmataxa						
Permasigmetum with *Carpobrotus edulis*		O2				**I**
Ononido variegatae permasigmetum					O2	**I**

- (1210) annual vegetation foreshore (*Salsola kali-Cakiletum aegyptiacae*);
- (2110) embryonic dunes (*Sporoboletum arenarii, Sporobolo pungentis-Elymetum farcti, Echinophoro spinosae-Elymetum farcti, Sileno corsicae-Elymetum farcti, Eryngio maritimi-Elymetum farcti*);
- (2120) mobile dunes along the shoreline with *Ammophila arenaria* (white dunes) (*Echinophoro spinosae-Ammophiletum arundinaceae*);

4.5.2 *Arthrocnemo glauci-Salicornio emerici* geopermasigmetum

Corsican Geopermaseries, Dry-Subhumid Thermo-Mediterranean, Salty Meadows

Sigmaecology This geopermaseries develops around the ponds and lagoons of shorelines on flat areas with muddy substrates or even limestone-sand. The tidal phenomenon being almost non-existent in Corsica, it is rather a slight swing of the water level according to the seasons. In winter, sea water tends to cover all or part of the sansouïres. In summer, evapotranspiration is important and only vegetation at low levels can be soaked with water.

Ombrotype: lower dry (Saint-Florent area and Porto-Vecchio sector in Bonifacio) and lower subhumid (from Bastia to the site of Benedettu). Thermotype: thermo to inframediterranean.

Sigmachorology The geomorphological context of the coastal zone implies that this geopermaseries is mainly located on the eastern part of the island and in the Gulf of St-Florent on the western coast.

Sigmastructure (Fig. 27) This geopermaseries is structured by permanent halophytic salicorne vegetation. The lowest topographic levels are marked by more or less dense vegetation with annual *Salicornia* spp. On the raised parts, dense and highly covering hemicrytophytic vegetations develop.

Sigmasystematic [holotypus: rel. 14—Table 9]
37 geopermasynrelevés

Average syntaxonomic richness: 6.7 syntaxa by geopermasynrelevé.

This geopermaseries, halophilous and heliophilous, is characterized by the association of the *Arthrocnemo glauci-Salicornietum emerici* (O. Bolós 1962) Géhu and Géhu-Franck 1978. The vegetation sequence is expressed on variable surfaces from one to ten hectares. This geopermaseries is located in the lower contact of meso-hygrophilous maquis to myrtle (*Pulicario odorae-Arbutetum unedonis* Allier and Lacoste 1980 *myrtetosum communis* Paradis and Pozzo di Borgo 2005.)

The geosymphytosociological analysis shows that this geopermaseries presents some physiognomic and ecological variations:

- slikke (A) dominated by a syntaxonomic haliped procession (*Arthrocnemo glauci-Salicornietum emerici, Suaedo maritimae-Salicornietum patulae, Sarcocornietum deflexae and Puccinellio festuciformis-Sarcocornietum fruticosae*);
- the schorre (B) characterized by vegetation of salt meadows (*Puccinellio festuciformis-Juncetum maritimi, Limonio narbonensis-Pucinellietum festuciformis, Limonio narbonensis-Juncetum gerardii...*);
- a sub-brackish ecological variation (C) marked by the reed beds of *Scirpetum compacto-littoralis*. The latter grow on low saline soils. The originality of this variation makes it possible to link it to the variant in *Scirpetum compacto-littoralis*.

Bacchetta et al. (2007) described a Mediterranean subhalophilous and edaphohygrophilous geosigmetum of tamarisk (*Tamaricion africanae*). This series develops under rainy bioclimate with a variable thermotype of the lower thermo-mediterranean than the lower meso-mediterranean. It develops on moderately basic

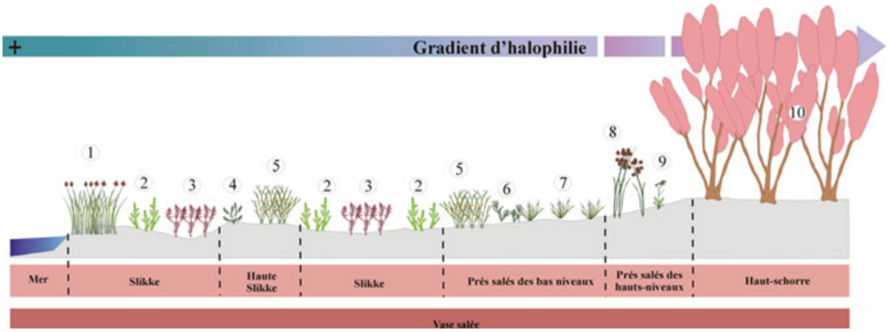

Fig. 27 Catenal structuration of the vegetation sequence of salt meadows. (1) *Scirpetum compacto-littoralis; (2) Sarcocornietum deflexae; (3) Arthrocnemo glauci-Salicornietum emerici; (4) Salsoletum sodae;* (5) *Puccinellio convolutae-Arthrocnemetum macrostachyi;* (6) *Suaedo maritimae-Salicornietum patulae;* (7) *Puccinellio festuciformis-Sarcocornietum fruticosae;* (8) *Puccinellio festuciformis-Juncetum maritimi;* (9) *Limonio narbonensis-Juncetum gerardii;* (10) *Althaeo officinalis-Tamariscetum africanae*

substrates. In view of this consideration and of the ecological similarities it would have been preferab le to isolate the *Tamarix* spp. and to attach them to this geosigmetum. In Corsica these tamarisks form an integral part of the system of salted vases, of which they terminate the catenal succession. The floristic procession composed of them includes a large number of species of mudflats (*Suaeda maritima, Salicornia patula, Scirpus maritimus, Sarcocornia fruticosa*. . .). For these reasons, tamarisks have been included in the geopermaseries of salted vases.

Conservation Issues The unique ecological conditions, the restricted range and the originality of the plant communities give this geopermaseries a high heritage value. This geopermaseries includes many HICs:

- (1310) *Salicornia* of the Mediterranean salt meadows (*Arthrocnemo glauci-Salicornietum emerici, Suaedo maritimae-Salicornietum patulae, Salsoletum sodae*);
- (1320) Vegetation with *Spartina versicolor* (*Spartino versicolori-Juncetum maritimi*);
- (1410-1) Mediterranean salt meadows of low levels (*Puccinellio festuciformis-Juncetum maritimi, Limonio narbonensis-Pucinellietum festuciformis*);
- (1410-2) Mediterranean high-salt meadows (*Limonio narbonensis-Juncetum gerardii, Limonio narbonensis-Caricetum extensae, Junco acuti-Schoenetum nigricantis*);
- (1420) Mediterranean halophilous forests (*Sarcocornietum deflexae, Puccinellio festuciformis-Sarcocornietum fruticosae, Puccinellio convolutae-Arthrocnemetum macrostachyi, Halimiono portulacoidis-Suaedetum verae*).

Threats are recurrent anthropogenic pressures on these vegetation systems. The frequency of fires allied to regular trampling of livestock favors the expression of vegetation of lesser interest to *Juncus acutus* subsp. *acutus* or even invasive alien species such as *Cotula coronopifolia*. The pollutant inputs from the streams that feed the ecosystem can also constitute a significant threat for this relatively fragile system.

Table 9 *Arthrocnemo glauci-Salicornio emerici* geopermasigmetum

	A											B									C						
Geopermasynrelevé n.	1	2	3	4	5	6	7	8	9	10	11	12	13	**14***	15	16	17	18	19	20	21	22	23	24	25	26	
Geographic area	Biguglia	Biguglia	Biguglia	Étang de Palo	Biguglia	Biguglia	Biguglia	Biguglia	Biguglia	Étang de Palo	Santa Giulia	Pinarellu	Palombaggia	**St-Florent**	Biguglia	Santa Giulia	Étang de Palo	Benedettu	Benedettu	Palombaggia	Biguglia	Biguglia	Crovani	Biguglia	Biguglia	Biguglia	
Area (ha)	6.34	9.26	3.46	5.3	10.7	2.49	16.2	3.7	10.9	11.3	3.4	3.95	1.5	**5.1**	29.2	7	4	3.7	0.24	3.8	10.1	11.9	1.6	4.8	0.6	4.61	
Cover (%)	100	100	100	100	100	100	100	100	100	100	70	100	70	**100**	100	100	40	100	100	80	95	95	95	95	100	100	
Permasigmataxonomic richness	7	5	4	4	3	7	6	6	6	6	6	10	11	16	13	9	7	11	11	11	3	2	2	3	3	2	∑
Characteristic permasigmataxon																											
Arthrocnemo glauci-Salicornio emerici permasigmetum	O2	O4	O5	O2	O5	O2	O3	O3	O2	O2	o3	O2	O2	**O1**	1	o1	o+	O2	O2								**III**
Permasigmataxa of the slikke																											
Arthrocnemo glauci-Salicornio ramosissimae permasigmetum	o1	o2																									
Suaedo maritimae-Salicornio patulae permasigmetum	O2	O2	.r			O2	O2	O2	O2			O3	O1	**O1**	O2			o1	o1	O1	O2						**III**
Salicornio patulae-Crypsido aculeatae permasigmetum										o2																	
Salsolo sodae permasigmetum														**o2**													**r**
Permasigmataxa of the high slikke																											
Spartino versicolori-Junco maritimi permasigmetum																		o1	o1						O3		+
Permasigmataxa of low salt meadows																											
Puccinellio festuciformis-Junco maritimi permasigmetum												o+	O1	**O2**	o1	o1	o+	o+	o+	o+							**II**
Limonio narbonensis-Pucinellio festuciformis permasigmetum												…+	O1	**…1**						O2							+
Permasigmataxa of mediterranean halophilic thickets																											
Sarcocornio deflexae permasigmetum												O3	O2	**O2**		.O2	o+			O1							**I**
Puccinellio festuciformis-Sarcocornio fruticosae permasigmetum				O2		O2	o1	o1	o1	O2	O3	O2	O3	**O2**	O2	.o2	/2			O2							**II**
Puccinellio festuciformis-Sarcocornio fruticosae permasigmetum variant with *Suaeda verae*														**o1**													
Puccinellio festuciformis-Sarcocornio fruticosae permasigmetum variant with *Juncus maritimus*												o1	o+	**.r**	o1	.+											
Puccinellio festuciformis-Halimiono portulacoides permasigmetum												o1						o2	.+								
Puccinellio convolutae-Arthrocnemo macrostachyi permasigmetum												O2	O2	**O4**						o1							+
Sarcocornio fruticosae permasigmetum																		O4	O4								**r**
Halimiono portulacoidis-Suaedo vera permasigmetum														**O1**													**r**
Permasigmataxa of mediterranean salt meats of high levels																											
Limonio narbonensis-Junco gerardii permasigmetum				O3						O3				**…1**				o1	o1	o1							**I**
Limonio narbonensis-Carico extensae permasigmetum													O+							…+							**r**
Junco acuti-Schoeno nigricantis permasigmetum																											
Permasigmataxa of the upper schorre																											
Althaeo officinalis-Tamarico africanae permasigmetum											O5	O2	O5	**O3**	O2	O2	O3			O2				O2	O1		**II**
Schoeno nigricantis-Plantagino crassifoliae permasigmetum										.r							o1										**r**
Elytrigio elongatae-Limbardio crithmoidis permasigmetum																O2											**r**
Bolboschoeno maritimi permasigmetum		O2				O2																				O2	+
Scirpo tabaernaemontani permasigmetum																											
Scirpo compacto-littoralis permasigmetum					O2									**O1**	o1	O1		O1	O2		O5	O3	o1	O2	O4	O4	**II**
Inulo crithmoidis-Tamarico africanae permasigmetum	O2	O2	O2	O3	O2	O2	O2	O4	O2	O3	O2		O2	**O2**	O3	O2	O2	O2	O2	O4							**III**
Brachish Permasigmataxa																											
Cladio marisci permasigmetum																											**r**
Scirpo compacti-Junco subulati permasigmetum											o2																+
Polygono monspeliensis-Crypsido aculeatae permasigmetum	O2														o1												+
Cicendion filiformis-Solenopsio laurentiae permasigmetum															o1												**r**
Chenopodio chenopodioidis-Crypsido aculeatae permasigmetum																											+
Permasigmataxa of regressive dynamic																											
Atriplici hastatae-Chenopodio chenopodioidis permasigmetum																											
Junco acuti permasigmetum	O3		O2			O4	O3		O5					**o1**	O2			O3	O3		O5	O4	O2	O4			**III**
Polycarpio tetraphylli permasigmetum															.r												+
Centaurio acutiflori-Hordeo gussoniani permasigmetum	O2					O2	o1	O2	o+						1												**II**
Centaurio acutiflori-Hordeo gussoniani permasigmetum variant with *Polypogonum monspeliensis*								O2																			**r**
Catapodio marini-Parapholiso incurvae permasigmetum											o1							.+	.+	…+							+

4.5.3 *Angelico sylvestris-Alno glutinosae* sigmetum

Corsican series with *Angelica sylvestris* and *Alnus glutinosa* of the neutral-alkaline marshy substrates.

Sigmaecology This series is frequent in hygrophilous and acidic marsh soils. It requires permanent flooding and may eventually be excavated during the summer.

Sigmachorology The *Angelico sylvestris-Alno glutinosae* sigmetum is located on the nature reserve of the Biguglia pond. It is present on the western shore of the pond where it is a major component of the landscape of the nature reserve.

Catenal Positioning It is located at the upper contact of the geo-perennial geopermaseries and is in the lower contact of the thermo-mediterranean climatic series of *Galio scabri-Querco suberis* sigmetum.

Sigmastructure
The head of series is a dense forest (7–10 m high) dominated by *Alnus glutinosa*. The shrub stratum is moderately dense, sometimes sparse and comprises mainly *Ficus carica, Rubus ulmiifolius, Vitis vinifera* subsp. *sylvestris.* The herbaceous stratum is composed of mesohyrgophilous species of *Alnetea glutinosae* (*Angelica sylvestris, Solanum dulcamara, Hydrocotyle vulgaris, Galium elongatum*, *Iris pseudacorus, Lysimachia vulgaris, Cirsium creticum* subsp. *triumfetti*. . .) (Table 10).

An anthropogenic stage with *Arundo donax* (*Arundo donacis-Convolvuletum sepium*) has also been recorded. It is a hygrophilous reed bed located on the edge of the *Alnus glutinosa*, which is sometimes intertwined with the reed beds of *Phragmites australis* subsp. *australis*.

Sigmasystematic diagnosis [holotypus: rel. 4—Table 11]
5 synrelevés.
Syntaxonomic richness: 3.6 syntaxa by synrelevé.

Conservation Issues In view of its distribution area limited to the Biguglia pond reserve, this endemic Corsican series has no remarkable habitats. It includes a protected species: *Vitis vinifera* subsp. *sylvestris* (Fig. 28).

Associated Vegetations No associated vegetation was observed.

Tout traduire en anglais dans le schéma ci-dessous.

Table 10 Bio-indicator species of *Angelico sylvestris-Alno glutinosae* sigmetum

Physiognomy of vegetations	Plant communities	Bioindicator species
Forest	*Angelico sylvestris-Alnetum glutinosae*	*Alnus glutinosa, Apium graveolens, Euphorbia hirsuta*
Mantle	*Salicion atrocinerea*	*Salix atrocinerea, Rubus ulmifolius,*
Reed bed	*Phragmitetum australis calystegietosum sepii*	*Phragmites australis* subsp. *australis, Calystegia sepium* subsp. *sepium*

Table 11 *Angelico sylvestris-Alno glutinosae* sigmetum

No. Synrelevé	1	2	3	**4***	5	
Geographic area	Biguglia	Biguglia	Biguglia	**Biguglia**	Biguglia	
Area (ha)	23.7	23.7	36.02	**5.2**	11.7	
Cover (%)	100	100	100	**100**	100	
Altitude average (m)	10	15	10	**10**	10	
Slope (in °)	-	-	-	-	-	
Aspect	-	-	-	-	-	
Syntaxnomic richness	3	3	6	5	4	∑
Syntaxa of progressive dynamic						
Angelico sylvestris-Alnetum glutinosae	O3	O3	O3	**O2**	O2	**V**
Salicion cinereae communities with *Salix atrocinerea*			o+	**o+**		**II**
Phragmitetum australis calystegietosum sepii	o1	O2	O2	**O3**	O5	**V**
Syntaxa of regressive dynamic						
Pruno spinosae-Rubion ulmifolii	O4	O3	O3	**O3**		**IV**
Urtico membranaceae-Smyrnietum olusatri			o1	**o2**	o2	
Arundo donacis-Convolvuletum sepium			.r		o+	**II**

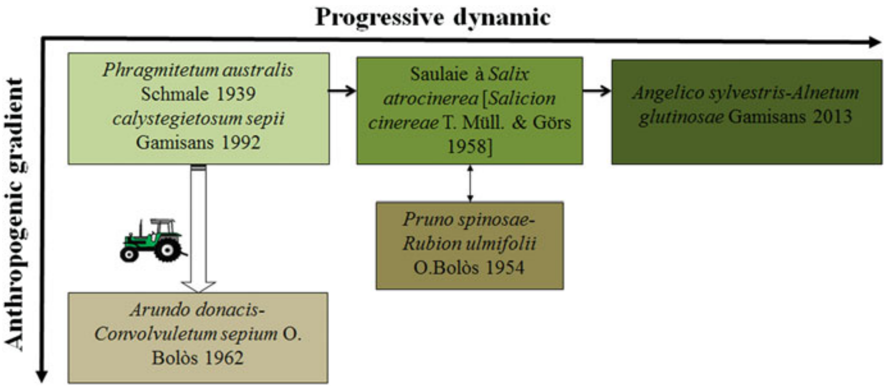

Fig. 28 *Angelico sylvestris-Alno glutinosae* sigmetum

4.5.4 *Sparganio neglecti-Alno glutinosae* sigmetum

Corsican series edaphohygrophilous swamp acidicline to neglected ribbon and alder glutinous.

Sigmaecology This series develops on hygrophilous and acidic marsh soils than the previous series. It requires permanent flooding and may possibly be cleared during the summer.

Sigmachorology The *Sparganio neglecti-Alno glutinosae* sigmetum is located southwest of the pond of the Natural Reserve of the Biguglia pond.

Catenal Positioning It is located at the upper contact of the geopermaseries of the sansouïres and is in the lower contact of the *Angelico sylvestris-Alno glutinosae* sigmetum.

Sigmastructure
The head of series is a dense forest (7–10 m high) dominated *by Alnus glutinosa*. The shrub stratum is poorly recovered and mainly comprises *Thelypteris palustris* and *Rubus ulmiifolius*. The herbaceous layer consists of hygrophilous species of *Alnetea glutinosae* (*Sparganium erectum* subsp. *neglectum*, *Hydrocotyle vulgaris*).

The stages of this series were not encountered during the surveys. It is highly probable that the dynamic stages of this series approximate those identified for the *Angelico sylvestris-Alno glutinosae* sigmetum.

Sigmasystematic Diagnosis [holotypus: rel. 1 of the Table 12]
1 synrelevé. Syntaxonomic richness: 1 syntaxon by synrelevé.

Conservation Issues This series doesn't present any particular remarkable species and habitats. Its area of distribution limited to the natural reserve of the pond of Biguglia gives the status of endemic series of Corsica.

Associated Vegetations No associated vegetation was observed.

4.5.5 *Fraxino angustifoliae-Ulmo minoris* sigmetum

Edapho-temporihygrophilous Series of the Acidiphilous Substrates
of the Thermo-mediterranean Stage with Elm

Sigmaecology This series develops on the acidiferous alluvial formations of the Eastern Plain, on the major beds of temporarily flooded alluvium. The soil is poorly developed, with a sandy-silty interstitial matrix.

Table 12 *Sparganio neglecti-Alno glutinosae* sigmetum

No. Synrelevé	1*
Geographic area	**Biguglia**
Area (ha)	**2.02**
Cover (%)	**100**
Altitude average (m)	**10**
Slope (in °)	-
Aspect	-
Syntaxnomic richness	**1**
Syntaxa of progressive dynamic	
Sparganio neglecti-Alnetum glutinosae	**O5**

Sigmachorology This ponctual series ~~punctuelle~~ in Corsica, is limited to the Eastern Plain. Its range seems to be limited to Corsica.

Catenal Positioning It is in the upper contact of the sansouïre geopermaseries and in the lower contact of the thermo-mediterranean climatic series of *Galio scabri-Querco suberis* sigmetum.

Sigmastructure
The head of series is a clear forest (8–10 m) dominated by *Ulmus minor*. The shrub stratum is not overlapping (15–30%) where *Ulmus minor*, *Cornus sanguinea* subsp. *sanguinea* and *Vitis vinifera*. The herbaceous stratum is marked by mesohygrophilous species such as *Circaea lutetiana*, *Carex remota*. The stages of this series were not encountered during the surveys.

Stanisci et al. (2004) identified a geosigmetum from the alluvial valleys of Ponza (Italy) which includes fragments of the suballiance to *Fraxino angustifoliae-Ulmenion minoris* Rivas-Martínez 1975. The latter is the seed of the few residual flaps of the mixed wet formations with *Fraxinus angustifolia* subsp. *oxycarpa, Ulmus minor, Populus nigra*. The lack of phytosociological material in Corsica, the presence of *Quercus pubescens* subsp. *virgiliana* (Ten.) Soó in the region of Ponza and its catenal context are all elements which make it possible to predict the existence of two serial entities or a possible possibility of serial synviraciance. Bacchetta et al. (2007, 2009, 2010) described a hygrophilous Sardinian geosigmetum of riparian vegetation (*Populenion albae, Fraxino angustifoliae-Ulmenion minoris, Salicion albae*) composed of *Fraxinus angustifolia* and *Ulmus minor* formations. These formations with *Ulmus minor* constitute relictual vegetations, and the post-war developments in the eastern Plain for the benefit of the agricultural estates have had to undermine these vegetations, hence its remarkable character.

Sigmasystematic Diagnosis [Holotypus: rel. 1—Table 13]
1 synrelevé.
Syntaxonomic richness: 2 syntaxa by synrelevé.

Conservation Issues This series does not present any particular remarkable species. The oak-ormaies are a HIC of the DHFF (92A0) "Oak-Mediterranean Ormaies".

Associated Vegetations No associated vegetation was observed.

4.5.6 *Eupatorio corsici-Alno glutinosae* sigmetum

Riparian edaphohygrophilous series with cervical *Eupatorium cannabinum* subsp. *corsicum* and *Alnus glutinosa* of fluviatile alluvial substrates [<600 m].

Sigmaecology This meso-eutrophic series, thermophilous, constitutes low-level ripisylves. It is located in the bottom of valleys with waters and fast flows, which can dry out during the summer period.

Table 13 *Fraxino angustifoliae-Ulmo minoris* sigmetum

No. Synrelevé	**1***
Geographic area	**Biguglia**
Area (ha)	**2.3**
Cover (%)	**100**
Altitude average (m)	**10**
Slope (in °)	**-**
Aspect	**-**
Syntaxnomic richness	**2**
Syntaxa of progressive dynamic	
Fraxino angustifoliae-Ulmenion minoris	**O5**
Syntaxa of regressive dynamic	
Pruno spinosae-Rubion ulmifolii	**O2**

Sigmachorology This series is located in the bottom of valley, from the entrance of the valley up to 700 m of altitude. In Corsica, this series is frequent along various Corsican rivers of low altitude.

Catenal Positionning At the bottom of the Asco Valley, this series is in contact with the swampy series of *Dryopteridi carthusianae-Alno glutinosae* sigmetum and the series of *Buxo sempervirentis- Querco illicis* sigmetum in the alluvial plains. When the series is located in contact with the meso-mediterranean slopes, it juxtaposes with the series of *Galio scabri-Querco illicis* sigmetum.

Sigmastructure The head of series is a linear forest dominated by *Alnus glutinosa*. The shrub stratum is fragmentary and is characterized by the presence of *Salix cinerea* and more punctually by *Fraxinus ornus* var. *ornus*. The herbaceous stratum, more or less dense, is dominated by *Hypericum hircinum* subsp. *hircinum*, *Eupatorium cannabinum* subsp. *corsicum, Carex microcarpa, Equisetum arvense, Osmunda regalis* and *Oenanthe crocata* (Table 14).

Sigmasystematic Diagnosis [Holotypus: rel. 2 of Table 15]

5 synrelevés.
Average syntaxonomic richness: 2 syntaxa by synrelevé (Fig. 29).

Conservation Issues The hydrogeomorphological context of the alluvial systems constitutes the predominant element in the organization and the arrangement of vegetations and more particularly of the tessellary space of the vegetation series. The major bed of the Asco river evolved in a few years and changed the river trajectory of the watercourse. Also the presence of urbanised areas near the Asco river encroaches on the tessellar space of the series. This series includes a habitat of Community interest (92A0-4) "aldergrass with glutinous alder and alder with stringed leaves". Public works related to road rehabilitation and the construction of

Table 14 Bioindicator species of *Eupatorio corsici-Alno glutinosae* sigmetum

Physiognomy of vegetations	Plant communities	Bioindicator species
Forest	*Eupatorio corsici-Alnetum glutinosae*	*Eupatorium cannabinum* subsp. *corsicum, Carex pendula, Equisetum arvense, Oenanthe crocata, Ficus carica*
Thicket	*Carici microcarpae-Salicetum atrocinereae*	*Salix atrocinerea, Rubus ulmifolius*
Tall humid grassland	Vegetation with *Hypericum hircinum* subsp. *hircinum* and *Carex microcarpa*	*Hypericum hircinum* subsp. *hircinum, Carex microcarpa, Euphorbia amygdaloides* subsp. *semiperfoliata, Mentha suaveolens* subsp. *suaveolens, Borrago pygmaea*

Table 15 *Eupatorio corsici-Alno glutinosae* sigmetum

No. Synrelevé	1	**2***	3	4	5	6	7	
Geographic area	Asco	**Asco**	Asco	Asco	Asco	Biguglia	Biguglia	
Area (ha)	1.2	**1**	4	52	0.2	1.2	1	
Cover (%)	90	**100**	100%	95	100	90	100	
Altitude average (m)	238	**250**	515	238	261	238	250	
Slope (in °)	-	**-**	10	-	-	-	-	
Aspect	-	**-**	S	-	-	-	-	
Syntaxonomic richness	3	**3**	3	3	1	1	1	∑
Syntaxa of progressive dynamic								
Eupatorio corsici-Alnetum glutinosae euonymetosum	/5	**/5**	/5	/5	O5	/5	/5	**V**
Populetum albae		**O2**		O2				**I**
Carici microcarpae-Salicetum atrocinereae caricetosum microcarpae	o1	**O2**	o2	/2				**IV**
Syntaxa of regressive dynamic								
Pruno spinosae-Rubion ulmifolii communities with *Rubus ulmifolius* and *Prunus spinosa*	o1	**O1**	/2	o1				**IV**

houses have resulted in the implantation of *Ailanthus altissima*, an invasive alien species, widely present in riparian areas and in marshy complexes.

Associated Vegetations This serie comprises two associated vegetations of the small streams of *Glycerio fluitantis-Sparganietum neglecti, Nasturtietum officinalis* or *Apietum crassipedis*.

4.5.7 *Phragmito australis* geopermasigmetum

Corsican geopermaseries of brackish and sub-brackish hydrophytic and brackish lakes and freshwater bodies.

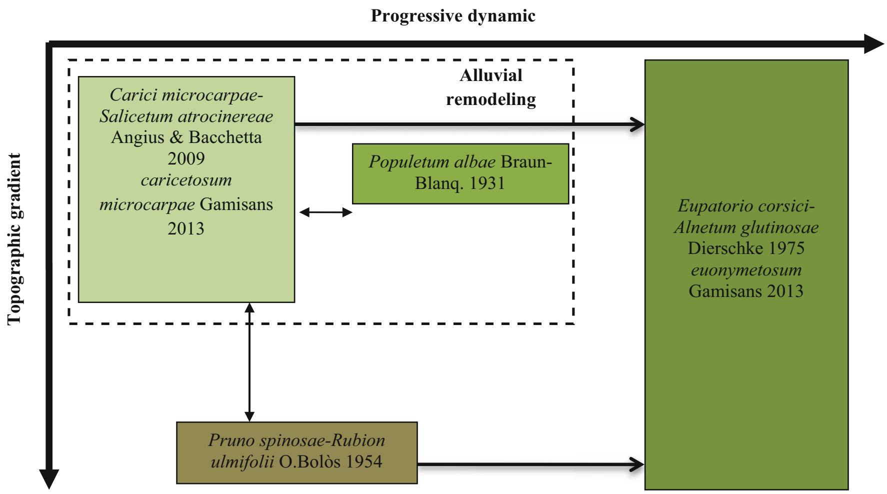

Fig. 29 *Eupatorio corsici-Alno glutinosae* sigmetum

Table 16 *Phragmito australis* geopermasigmetum

Geopermasynrelevé n.	**1***	2	3	4	5	**6**	
Geographic area	**Biguglia**	Biguglia	Biguglia	Biguglia	Biguglia	Biguglia	
Area (ha)	**0.5**	0.5	0.8	0.3	0.6	1	
Cover (%)	**100**	100	100	100	100	100	
Number of permasigmataxa	**2**	2	2	1	1	**1**	∑
Characteristic permasigmataxa							
Phragmito australis permasigmetum	**O4**	O5	O4	O5	O5	O5	**V**
Cladio marisci permasigmetum	**.+**	.+					**II**
Kosteletzkyo pentacarpos-Phragmito australis permasigmetum	**O2**		O3				**II**

[*Holotypus*: rel. 1—Table 16]
This geopermaseries is made up of vegetations of ponds and small rivers, flooded most of the time and able to exude in summer. Soils are acidic, sandy, and poor in nutrients. This geopermaseries is dominated by reed beds more or less high.

4.5.8 *Lemno minoris* geopermasigmetum

Geopermaseries of macrophytic and hydrophytic lakes and freshwater bodies.

[*Holotypus*: rel. 2—Table 17]
This geopermaseries develops in stagnant waters such as the ditches or the dead arms of small streams in shaded condition. It is composed of vegetation with the aspect of floating *Lemna* spp. sometimes very dense.

Table 17 *Lemno minoris* geopermasigmetum

Geopermasynrelevé n.	1	**2***	3	4	5	6	
Geographic area	Biguglia	**Biguglia**	Biguglia	Biguglia	Biguglia	Biguglia	
Area (ha)	0.1	**0.2**	0.2	0.3	0.2	0.2	
Cover (%)	50	**40**	70	50	40	60	
Number of permasigmataxa	3	**3**	2	2	2	1	∑
Characteristic permasigmataxa							
Lemno minoris permasigmetum	O2	**O2**	O4	O3	O2	O2	**V**
Lemno gibbae permasigmetum	O1	**O1**	.+				**III**
Potamogeto pectinati permasigmetum		**.+**		.+			**II**
Apio nodiflori-Sparganio neglecti permasigmetum					.r		**I**
Sparganio erecti-Sagittario sagittifoliae permasigmetum	.r						**I**

This geopermaseries includes a HIC: (3150.3) "Eutrophic water bodies with dominance of free macrophytes flying on the surface of the water".

4.5.9 *Nasturtio officinalis* geopermasigmetum

Geopermaseries corsican edaphohygrophilous from stagnant to low-level wetlands.

[*Holotypus*: rel. 1—Table 18]

These meso-eutrophic acidophilous permaseries are observed at low elevations in the meso-mediterranean stage along well-oxygenated and shallow streams. They are more rare in the supra-Mediterranean stage. These permaseries occupy small areas, of the order of 1 m^2. From a catenal point of view, they are part of the alluvial complex of low altitude, in which they are in contact with the series to eupatorium of Corsica and alder glutinous.

This geopermastery comprises three HICs: (3150-1) "Eutrophic water bodies with rooted vegetation with or without floating leaves", (3260-1) "Rivers (with *Ranunculus*) acid oligotrophs" and (3260-2) "Oligotrophic rivers Basic".

4.5.10 *Ruppio cirrhosae* geopermasigmetum

Geopermaseries corsican edaphohygrophilous of lagoons.

[*Holotypus*: rel. 1—Table 19]

Lagoon complex dominated by seagrass. As a result of climatic events (storms) which led to a freshwater entrance into the lagoon, the inventories of the landscapes carried out did not allow to identify all the herbariums potentially present (herbariums in *Najas marina*, *Potamogeton pectinatus*...). Further investigations will make it possible to complete the lists of permasigmetums which constitute the lagoon (Figs. 30 and 31, Table 20)

Table 18 *Nasturtio officinalis* geopermasigmetum

Geopermasynrelevé n.	**1***	2	3	
Geographic area	**Asco**	Cap Corse	Biguglia	
Area (ha)	**0.01**	0.002	0.01	
Cover (%)	**30**	15	95	
Number of permasigmataxa	**3**	3	2	∑
Characteristic permasigmataxa				
Nasturtio officinalis permasigmetum	**O/3**	O/2	o1	**3**
Glycerio fluitantis permasigmetum	**o2**	.+		**2**
Callitrichio obtusangulae permasigmetum	**.+**	.+		**2**
Potamogeto denso-nodosi permasigmetum		.+		
Permasigmetum with *Montia minor*			O/5	**1**
Apio crassipedis permasigmetum			o1	**1**
Ranunculo penicillati permasigmetum	**.+**			**1**

Table 19 *Ruppio cirrhosae* geopermasigmetum

Geopermasynrelevé n.	**1***	2	
Geographic area	**Biguglia**	Biguglia	
Area (ha)	**0.1**	0.2	
Cover (%)	**50**	40	
Number of permasigmataxa	**3**	3	∑
Characteristic permasigmataxa			
Ruppio cirrhosae permasigmetum	**O2**	O1	**2**
Zoostero noltii permasigmetum	**O1**	O2	**2**

4.6 *Assessment of the Conservation Status of Habitats of Community Interest*

The habitats of the DHFF that correspond to the vegetation studied (Fig. 32) are subject to conservatory management aimed at maintaining them in a good state of conservation or restoration by the manager (Department de Haute-Corse 2013). HICs represent 297.4 ha or 42.9% of the total area (Delbosc et al. 2017).

The dynamic tendencies approach can be integrated as a tool to help assess the state of conservation of HICs. The cartographic results of the dynamic tendencies were compared with the habitats of community interest (Fig. 33): the dynamic

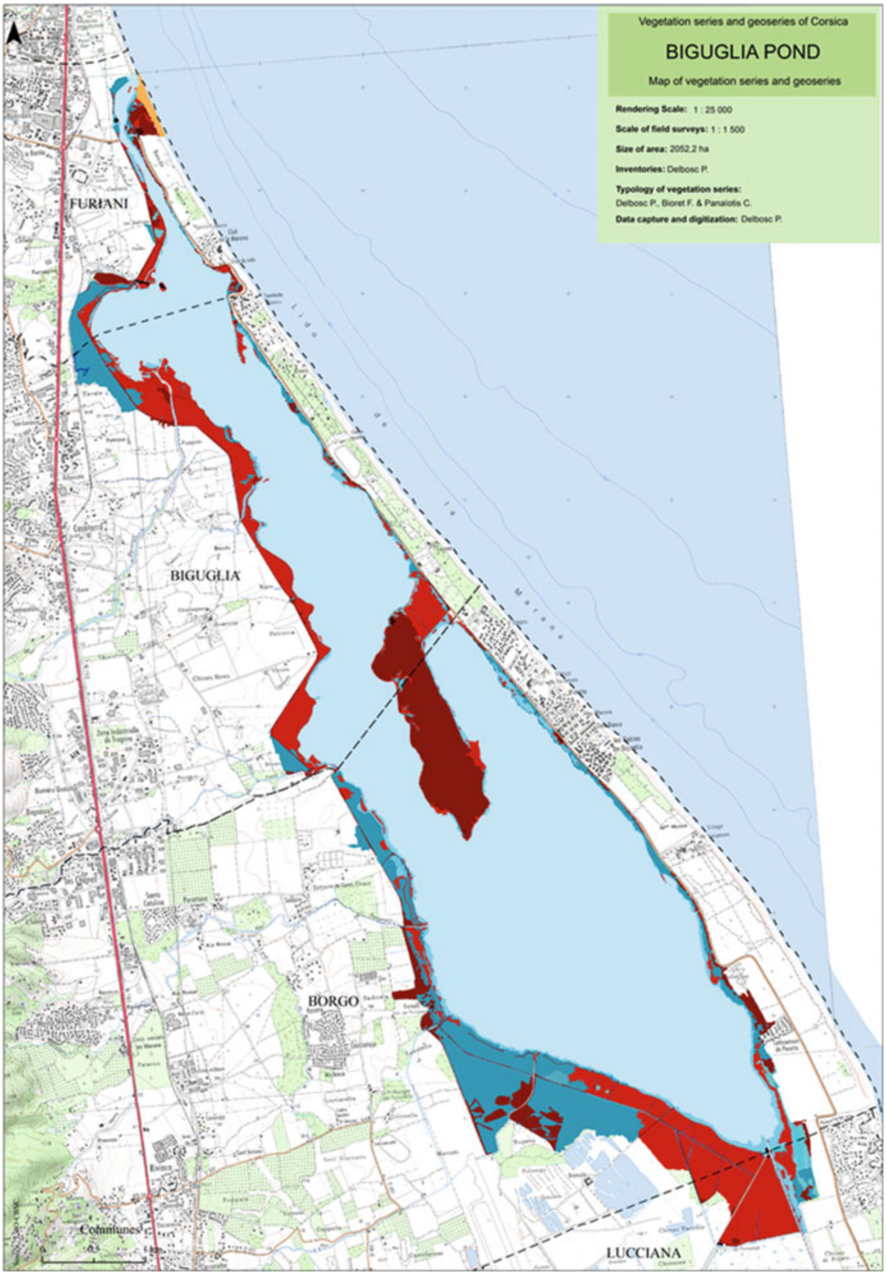

Fig. 30 (**a**) Mapping of vegetation series and geoseries. (**b**) Mapping of vegetation series and geoseries

Coastal azonal units of psammophilous systems

Echinophoro spinosae-Ammophilo arundinaceae geopermasigmetum

Coastal azonal units of salt meadow systems

Arthrocnemo glauci-Salicornio emerici geopermasigmetum

Thermomediterranean level

Galio scabri-Querco suberis sigmetum

Clematido cirrhosae-Pistacio lentisci minorisigmetum

Swampy azonal units

Angelico sylvestris-Alno glutinosae sigmetum

Spargnio neglecti-Alno glutinosae sigmetum

Fraxino angustifoliae-Ulmo minoris sigmetum

Riparian azonal units

Eupatorio corsici-Alno glutinosae sigmetum

Nasturtio officinalis geopermasigmetum

Lemno minoris geopermasigmetum

Phragmito australis geopermasigmetum

Units of mediterranean lagoons

Ruppio cirrhosae geopermasigmetum

Other units

Urban areas

Fig. 30 (continued)

tendencies of the degeneracy, regression and secondary succession type are mainly concentrated in the sectors where the HICs are concentrated, A and B in particular).

Figures 32 and 33 show that HICs are affected by dynamic trends related to anthropogenic actions (anthropogenic fluctuation, degeneration, regression and secondary succession). For a more detailed understanding of the dynamic tendencies of HICs, they should be analyzed for each habitat type (Figs. 32 and 33, Table 21).

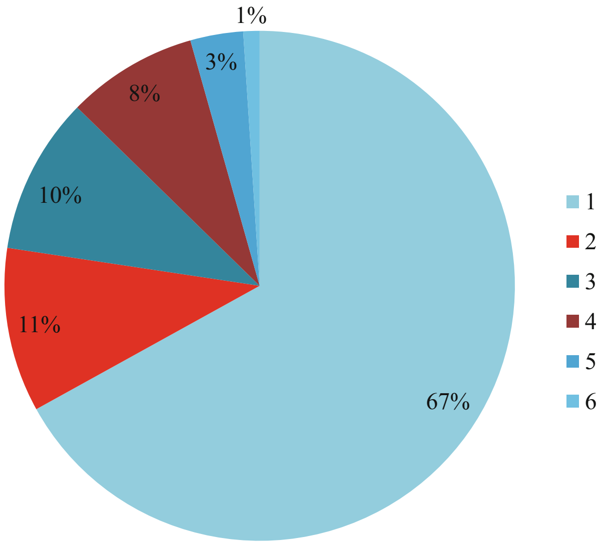

Fig. 31 Surface assessment of main vegetation series and geoseries; [1] *Ruppio cirrhosae* geopermasigmetum; [2] *Arthrocnemo glauci-Salicornio emerici* geopermasigmetum; [3] *Angelico sylvestris-Alno glutinosae* sigmetum; [4] *Galio scabri-Querco suberis* sigmetum; [5] *Phragmito australis* geopermasigmetum; [6] *Nasturtio officinalis* geopermasigmetum

Table 20 Typology, area and percent area of vegetation series and geoseries

Code	Sigmetum	Area (in ha)	Percent area (in %)
1	*Ruppio cirrhosae* geopermasigmetum	1359.1	66.2
2	*Arthrocnemo glauci-Salicornio emerici* geopermasigmetum	211.5	10.3
3	*Angelico sylvestris-Alno glutinosae* sigmetum	201.8	9.8
4	*Galio scabri-Querco suberis* sigmetum	168.5	8.2
5	*Phragmito australis* geopermasigmetum	67.9	3.3
6	*Nasturtio officinalis* geopermasigmetum	20.9	1.0
7	*Fraxino angustifoliae-Ulmo minoris* sigmetum	7.3	0.4
8	Free water	5.9	0.3
9	*Echinophoro spinosae-Ammophilo arundinaceae* geopermasigmetum	4.3	0.2
10	*Spargano neglecti-Alno glutinosae* sigmetum	2.0	0.10
11	Urban areas	1.5	0.07
12	*Lemno minoris* geopermasigmetum	0.9	0.04
13	*Eupatorio corsici-Alno glutinosae* sigmetum	0.7	0.03
14	*Clematido cirrhosae-Pistacio lentisci* minorisigmetum	0.1	0.004
		2052.2	**100**

The results show that, among all HICs, halophilous habitats are the most vulnerable to anthropogenic action. The habitat Mediterranean salt marsches (1410) presents various dynamic trends, but the phenomenon of degeneration dominates (64.7 ha on 66.4 ha of the total area of the habitat). Half of the areas occupied by the habitat "Mediterranean and Thermo-Atlantic halophilous forests" are characterized by a phenomenon of degeneration. The "hydrophilous megaphorbiae of planetary hem and montane to alpine levels" (6430-4) exhibit a dynamic tendency of "regression" type (Table 21).

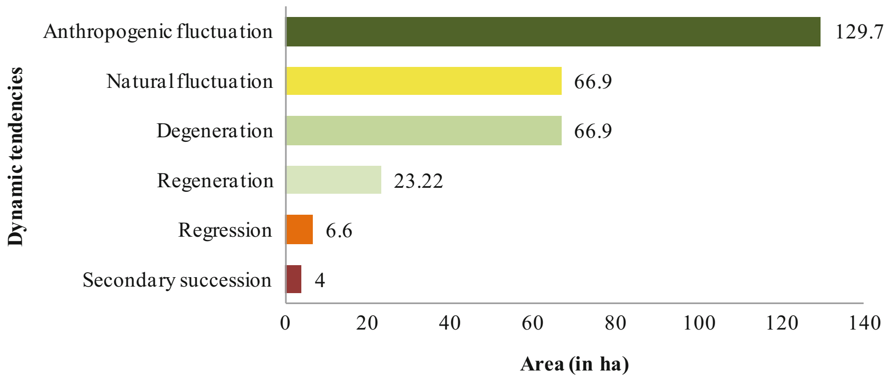

Fig. 32 Surface assessment of dynamic tendencies of HCI

4.6.1 Definition of Conservation Issues in Sectors

To define the conservation areas of the Biguglia pond, three important data have been taken into account:

- the crossing of 'dynamic trends' and 'habitats of Community interest' cartographic data;
- the crossing of "dynamic trends" cartographic data and non-Community habitats;
- anthropogenic pressures (grazing, fire, grinding, tree plucking...).

Two types of conservation sectors have been identified:

- Type 1 sectors are priority sectors for conservation;
- Type 2 sectors are secondary sectors of conservation issues but require phyto-ecological monitoring in the short term;
- Type 3 sectors are tertiary sectors for conservation but require less regular monitoring than previous ones.

Figure 34 shows the distribution of conservation sectors. From this result, three zones are distinguished (ZC1, ZC2 and ZC3) which correspond to the priority zones in terms of conservation or even restoration. ZC2 and ZC3 are affected by grazing and increased trampling of vegetation, which tends to modify their structural and physiognomic composition of vegetation. For ZC1, pastoral pressure remains similar to the previous two zones but is combined with fires that involve a regression of vegetation.

These results, compared with the serial units, make it possible to identify the serial units most vulnerable to anthropogenic pressure. These are the Corsican geopermaseries of the sal marsches (*Arthrocnemo glauci-Salicornio emerici* geopermasigmetum) and the climatophilous corso-sardinian series with cleavers and cork oak of the acidophilous substrates of the thermo-mediterranean stage (*Galio scabri-Querco suberis* sigmetum).

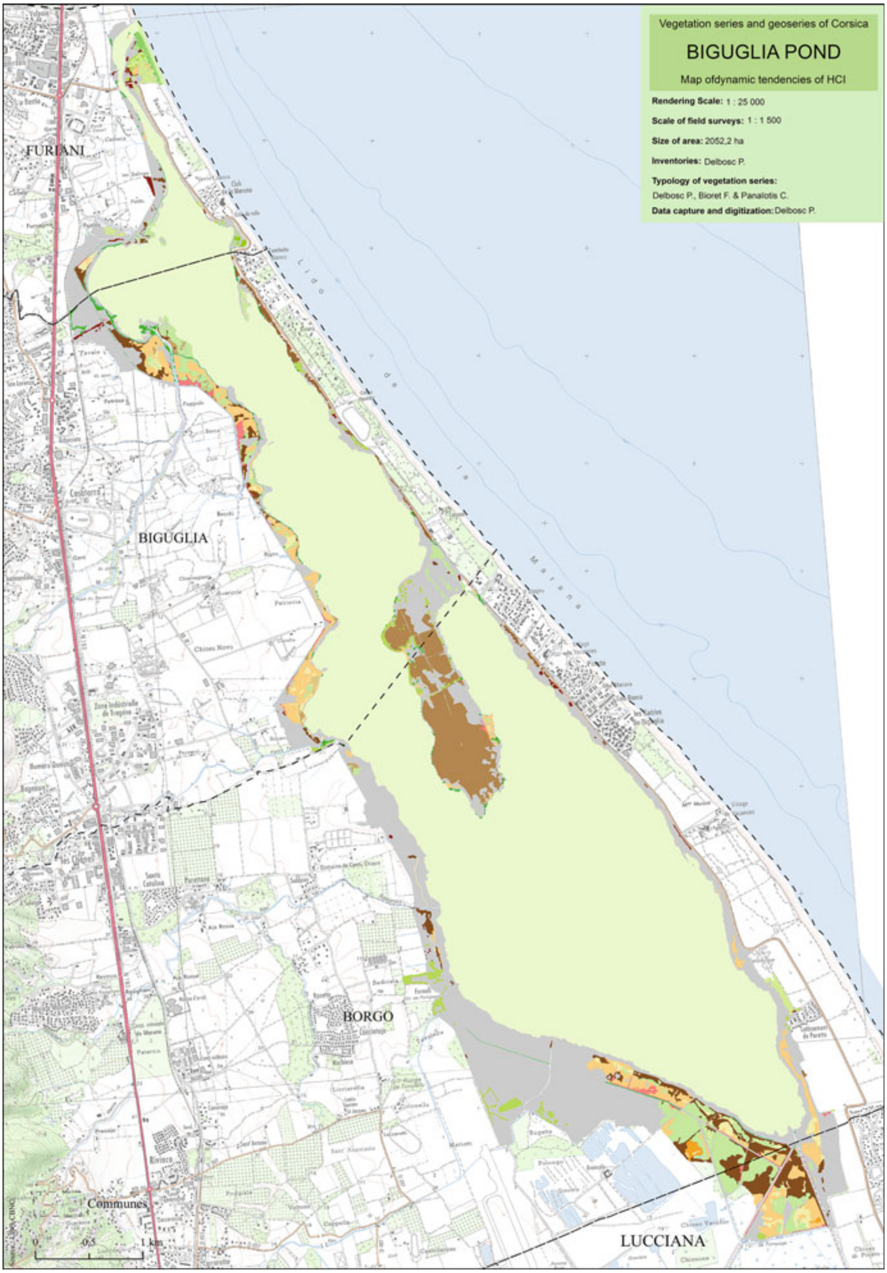

Fig. 33 (**a**) Map of dynamic trends of HCI. (**b**) Map of dynamic tendencies of HCI

Natural fluctuation

1150-2 - Coastal Lagoon

1210 - Annual vegetation of drift lines

1310 - *Salicornia* and other annuals colonising mud and sand

1410 - Mediterranean salt meadows (*Juncetalia maritimi*)

2110 - Embryonic shifting dunes

2230 - *Malcolmietalia* dune grasslands

3150 - Natural eutrophic lakes with *Magnopotamion* and *Hydrocharition*

3150-3 - Natural eutrophic lakes

92A0-4 - Riparian forests of the mediterranean at *Alnus glutinosa* and *Alnus cordata*

92D0-1 - Southern riparian galleries and thickets (*Nerio-Tamaricetea* and *Securinegion tinctoriae*)

9320-3 - *Olea* and *Ceratonia* forests

Regeneration

1410 - Mediterranean salt meadows (*Juncetalia maritimi*)

2260-1 - *Cisto-Lavanduletalia* dune sclerophyllous scrubs

9330-3 - *Quercus suber* forests

9540-1.5 - Mediterranean pine forests with endemic Mesogean pines

Anthropogenic fluctuation

1310 - *Salicornia* and other annuals colonising mud and sand

1410 - Mediterranean salt meadows (*Juncetalia maritimi*)

1420 - Mediterranean and thermo-atlantic halophilous scrubs (*Sarcocornietea fruticosi*)

6420 - Mediterranean tall humid herb grasslands of the *Molinio-Holoschoenion*

92A0 - *Salix alba* and *Populus alba* galleries

92D0-3 - Southern riparian galleries and thickets at *Tamaris*

Degeneration

1410 - Mediterranean salt meadows (*Juncetalia maritimi*)

1420 - Mediterranean and thermo-atlantic halophilous scrubs (*Sarcocornietea fruticosi*)

Regression

1310 - *Salicornia* and other annuals colonising mud and sand

6430-4 - Hydrophilous tall herb fringe communities of plains and the moutane to alpine levels

Habitats not covered by the Directive

Fig. 33 (continued)

Table 21 Dynamic tendencies of HCI

Natura 2000 code	Name of habitats	Dynamic tendencies	Area (in ha)
1150-2	Coastal lagoons	Natural fluctuation	1359.1
1210	Annual vegetation of drift lines	Natural fluctuation	2.0
1310	*Salicornia* and other annuals colonising mud and sand	Anthropogenic fluctuation	15.7
		Natural fluctuation	51.6
		Regression	6.6
1410	Mediterranean salt meadows (*Juncetalia maritimi*)	Regeneration	0.03
		Anthropogenic fluctuation	0.8
		Natural fluctuation	0.9
		Degeneration	64.7
1420	Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornietea fruticosi*)	Degeneration	2.3
		Anthropogenic fluctuation	2.9
2110	Embryonnic shifting dunes	Natural fluctuation	1.2
2230	Malcolmietalia dune grasslands	Natural fluctuation	1.0
2260-1	*Cisto-Lavanduletalia* dune sclerophyllous scrubs	Regeneration	7.1
3150	Natural eutrophic lakes with *Magnopotamion* and *Hydrocharition*	Natural fluctuation	0.4
3150-3	Natural eutrophic lakes	Natural fluctuation	1.0
6420	Mediterranean tall humid herb grasslands of the *Molinio-Holoschoenion*	Anthropogenic fluctuation	61.1
6430-4	Hydrophilous tall herb fringe communities of plains and the montane to alpine levels	Regression	4.0
92A0	*Salix alba* and *Populus alba* galleries	Anthropogenic fluctuation	6.9
92A0-4	Riparian forests of the mediterranean at *Alnus glutinosa* and *Alnus cordata*	Natural fluctuation	0.7
92D0-1	Southern riparian galleries and thickets (*Nerio-Tamaricetea* and *Securinegion tinctoriae*)	Natural fluctuation	7.9
92D0-3	Southern riparian galleries and thickets at Tamaris	Anthropogenic fluctuation	42.3
9320-3	*Olea* and *Ceratonia* forests	Natural fluctuation	0.1
9330-3	*Quercus suber* forests	Regeneration	15.3
9540-1.5	Mediterranean pine forests with endemic Mesogean pines	Regeneration	0.7
		Total	1656.5

4.6.2 Recommendations and Planning of Mangement Actions

The following management recommendations concern all the vegetation of Biguglia pond. They take into account vegetation, dynamic trends, anthropogenic pressures and their heritage value. They are divided into two parts:

- a component "conservation and ecological restoration of environments;
- a component "study and monitoring of vegetation".

Conservation and Ecological Restauration

Sheet 1.1: Preserving coastal environments with high conservation issues

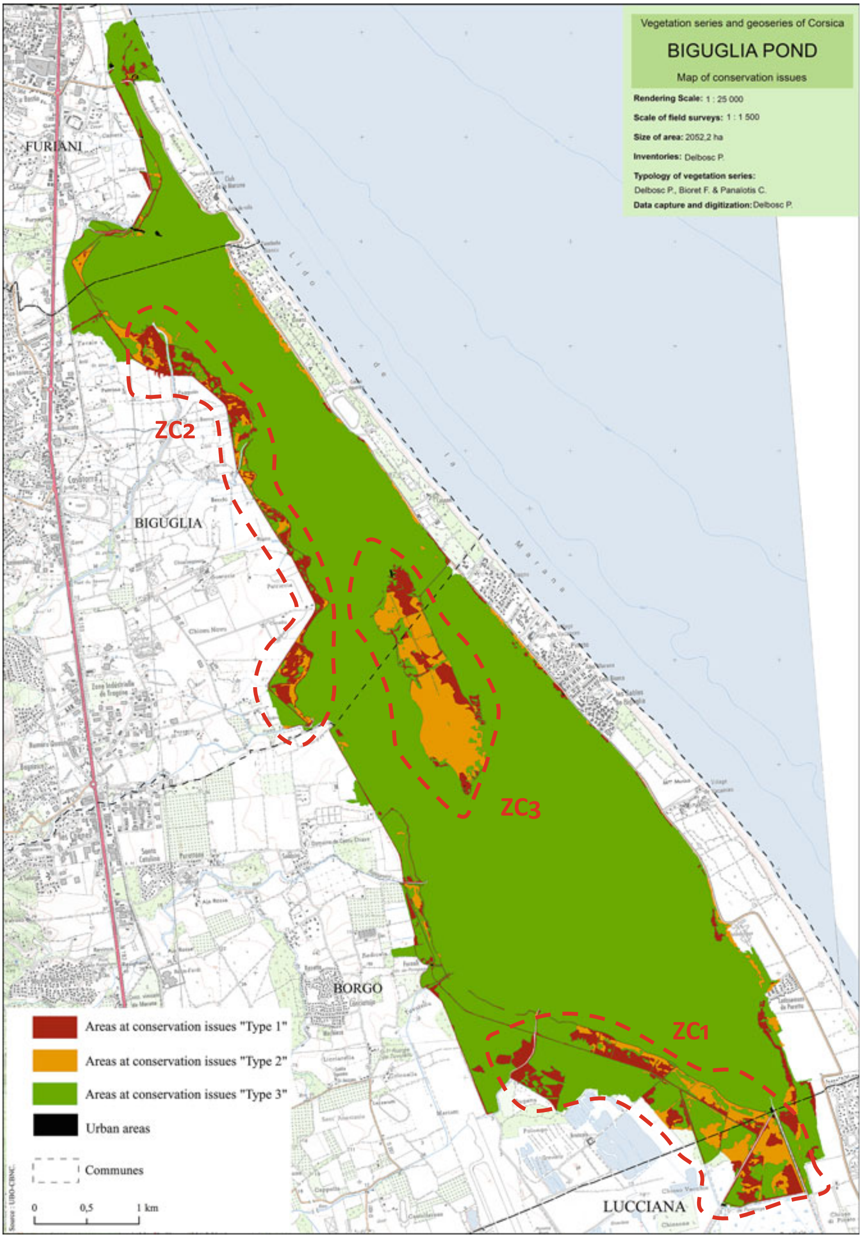

Fig. 34 Areas with conservation issues of Biguglia. ZC1: conservation area 1, ZC2: conservation zone 2; ZC3: conservation area 3

Objectives:

Maintain the priority vegetation systems in a good state of conservation;
Maintain the landscape quality of the site and the biological and genetic diversity of vegetation;
Protect vegetation systems from over-exploitation (trampling and fires).

Priority for implementation: ∗∗∗
Interest:

Three areas with conservation issues were highlighted. They are subject to severe degradation (trampling, fires) and present a geomorphological, floristic and syntaxonomic originality.

Objective evaluation indicator:

Monitoring the state of conservation of vegetation systems with high conservation issues (permanent plots)

Description of the action:

Develop a hierarchical list of coastal habitats according to criteria in consultation with the actors of the territory;
Fostering natural progressive dynamics;
Develop specific management plans that take into account the impact of attendance.

Implementation schedule: To be defined by sector.
Speakers: Nature Reserve of Biguglia Pond.
Location: All Biguglia Pond.

Sheet 1.2: Prevention of biological invasions

Objectives:

Prevent the introduction of invasive alien species and establish a management approach to the most problematic species, on a case-by-case basis, for each site, with the aim of maintaining genetic and vegetation-specific diversity.

Priority for implementation: ∗∗∗
Interest:

Plant communities of *Arundo donax* have spread to the shore of canals. The main focus of expansion comes from the north of the pond at the level of the D32 departmental road. On the western shore and at the tail of the pond several salt meadows were burned. This ancient impact has amply contributed to the degradation of the original vegetation. This degradation has favored the implantation and extension of exotic ruderal species and vegetation (*Cotula coronopifolia*). Some *Acacia dealbata* individuals were noted on the west bank between Rigno and Petriccia.

Objective evaluation indicators:

Surface treated,
Percentage of recovery,
Evolution of surfaces of anthropogenic dynamic trends (anthropogenic fluctuation, regression, degeneration, secondary succession).
Evolution of the recovery of remarkable vegetation.

Description of the action:

Prohibit plantations of exotic species, even those that are not considered invasive;
List (alert list) potentially threatening exotic species that may be recently introduced for horticultural purposes and have invasive behavior in other parts of the Indian Ocean;
Establish a system for the early detection of invasive species as well as those recently introduced (alert list);
Selective and manual elimination of exotic seedlings and off-site export of species uprooted based on advice from scientific experts.
Establishment of permanent monitoring to evaluate the effectiveness of control methods. This monitoring can possibly be achieved through the participation of school children, with scientific validation.

Implementation schedule: To be defined by sector.
Speakers: Nature Reserve of the pond Biguglia.
Location: Action to decline according to each site.

Sheet 1.3: Restoration and Continuous Control of IAS

Objectives:

Restore heritage vegetation and/or most threatened vegetation to maintain genetic and specific diversity.

Priority for implementation: ***
Interest:

The groupings of *Arundo donax* have spread on the banks of the canals. The main focus of expansion comes from the north of the pond at the level of the D32 departmental road. On the western shore and at the tail of the pond several salt meadows have burned. This long-standing impact has greatly contributed to the degradation of the original vegetation. This degradation has favored the implantation and extension of ruderal and even exotic species and vegetation (*Cotula coronopifolia*). Some individuals of *Acacia delbatea* were noted on the west bank between Rigno and Petriccia.

Objective evaluation indicators:

Surface treated,
Assessment of regeneration of native species,
Monitoring of reinforced species,

Conservation status of coastal habitats,
Presence of remarkable species (protected and endemic in particular).

Description of the action:

To prohibit the introduction of exotic species;
Integrate the control of invasive animal species (rats, cats, hares, mice, dog shrew);
Prioritize low-invasive areas by exotic species, and those with individuals of remarkable species;
Conduct ongoing control plans, allowing for program work in the medium and long term;
Establish monitoring of invasive alien species;
Take into account rare and threatened fauna in restoration operations;

Implementation schedule: To be defined according to the sites.
Speakers: Nature Reserve of the pond Biguglia.
Location: Zones with conservation stakes ZC1 and ZC2.

Studies and monitoring

Sheet 2: Monitoring the evolutionary dynamics of natural habitats

Objectives:

Monitor the evolution and conservation status of coastal natural and semi-natural habitats;
Monitor the impact of anthropogenic activities (trampling and fire);
Monitor the impact of management measures.

Priority for implementation: ***
Interest:

Knowledge of vegetation and their dynamics must be projected over several years in order to understand the spatio-temporal evolution of vegetation. Monitoring is essential to assess surface and syntactic fluctuations (presence and abundance of plant species and associations of remarkable character in particular). The continuity of this temporal monitoring makes it possible to apprehend the state of conservation of the habitats and to evaluate their risk of degradation or disappearance.

Objective evaluation indicator:

Number of plots monitored;
Monitoring of the state of conservation of habitats (presence of habitats, areas, densities).

Description of the action:

putting in place a monitoring system (plots, quadrats) on the habitats of high heritage value (endemic and indigenous) with prioritization according to the upstream plant and animal protection expertise;

develop a methodology for mapping and assessing the surface evolution of habitats;

Monitoring, analysis and synthesis of expertise in order to establish dynamic trajectories and dynamic vegetation trends and their state of conservation;

assess the impact of management measures on the surface evolution of vegetation.

Implementation schedule: To be defined by sites.
Speakers: Nature Reserve of the pond Biguglia.
Location: The entire Biguglia pond.

Discussion

Pauline Delbosc, Frédéric Bioret, and Christophe Panaïotis

Vegetation mapping is a useful tool for the spatialization of vegetation. It provides a large amount of information on the phytochemical diversity of a given territory but requires a consistent scientific knowledge. Compared to vegetation series maps, vegetation maps provide precision on the surfaces and spatial forms of the dynamic stages of the series.

Ideally, it would have been appropriate to follow the methodological process of Blasi et al. (2005), which consists in crossing the whole of the abiotic cartographic data with the phytosociological cartographic data, in order to define the vegetation series. This process is currently impossible in Corsica because of the heterogeneity of ecological cartographic data which does'nt allow an ecological classification of the homogeneous territory to be obtained, the scale and format of the data being different.

The ecological fund could also integrate vegetation mapping to refine the division of vegetation series. Tests could be carried out on the Biguglia pond in order to test an automatic segmentation on the coastal areas.

The choice of the scale may appear too precise (1:1500), but this precision is necessary to map a maximum number of vegetation units, especially lawn vegetation expressed on small areas. The choice of the scale depends on the study sites: the Haut-Vénacais massif and the Biguglia pond are two exceptional natural sites, both in terms of plant health and ecology. Their linkage, wholly or in part, to Natura 2000 sites involves a fine scale of surveys and seizures, with a view to using them for monitoring and management (Clair et al. 2005).

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The interest of vegetation mappings rests on obtaining a diversity of thematic maps (physiognomic map, Natura 2000 habitat map, vegetation map, vegetation layer map). This principle allows a complete and synthetic view of the phytochemical sets of a territory (Orsomando amd Pedrotti 1985; Pedrotti 2013). These maps are useful for assessing global changes in biodiversity (Biondi et al. 2007; Bioret et al. 2009).

Dynamic trends represent a pragmatic tool for translating the dynamic state of current vegetation (Faliński and Pedrotti 1990). The dynamic trends approach allowed to quantify and evaluate the dynamical processes of each vegetation in the Biguglia pond. They are a very time-consuming tool since the map of dynamic trends requires a map of vegetations. It also requires a temporal vision "past-present-future" and can be applied to well-known sites that have been the subject of descriptive or cartographic synthesis: the same vegetation may be affected by one or more types of dynamic trends, Anthropogenic influence. This is the case for areas occupied by *Pruno spinosae-Rubion ulmifoliiii* thickets which can be characterized by two types of dynamic trends: they are considered regressive forests or as thickets for recolonization after pasture abandonment.

The diagnosis of this dynamic state combined with the dynamic-catenal phytosociological approach allows to analyze finely the dynamic and structural properties of the vegetation. This diagnosis takes account of past and present uses, while integrating the plant potential. The approach of dynamic trends is complementary to the typological and cartographic work of vegetation series and geoseries which allows a finer analysis of the plant components of the sigmetal and geosigmmetric units. The mapping of dynamic trends reflects the dynamic patterns of small-scale vegetation.

It has been used for conservation management and restoration purposes on a site characterized mainly by blocked dynamic vegetation. This method makes it possible to highlight conservation areas, taking into account the dynamics of vegetation, the scarcity of plant associations at the scale of the site and on the scale of Corsica and the attachment of habitats to the repository EUNIS 28. This approach to vegetation dynamics is a tool for assessing the degree of conservation or degradation of the dynamic structure and the possibilities for restoration. The mapping of dynamic trends can be considered as an integrating indicator of floristic changes and intra-syntaxonomic spatio-temporal variations.

The dynamic trends allowed to consider the structural and textural changes of each dynamic stage of the vegetation series. In terms of conservatory management, this tool seems relevant to designate priority tessellar envelopes. Depending on the anthropogenic influence and depending on the type of vegetation series (permaseries, minoriseries or series), the priority of intervention will be different. In the first case, if the anthropogenic disturbance is not too intense, a progressive dynamics towards the forest can be established. In the second case, the resilience is more complex because it depends on several factors (complete replacement of the original vegetation, modification of the tessellar envelope…). The Biguglia pond is a very good example of this: the two serial units most vulnerable to anthropization are the geopermaseries of salted marsches and the climatophilous series with cleavers and cork oak.

The study of dynamic trends in the Biguglia pond with regard to the distribution of HICs showed that areas with a large number of habitats are subject to dynamic trends such as anthropogenic fluctuation, degeneration and regression. Dynamic trends can be viewed as an indicator of habitat conservation and response to anthropogenic pressures. The assessment of the state of conservation of habitats must incorporate a multi-criteria global analysis. Boteva et al. (2004) developed a method for assessing the state of conservation of habitats by mapping vegetation under GIS, taking into account the diversity, rarity, naturalness, threats and replaceability of vegetation.

Dynamic trend mapping is a tool for understanding the functionality of plant-wide vegetation series. The functionality corresponds to the responses of vegetation series individuals to the influence of different processes related to abiotic and biotic filters on a spatio-temporal scale. These responses result in a more or less moderate change in the structure and dynamics of the vegetation series.

Conclusion

Pauline Delbosc, Frédéric Bioret, and Christophe Panaïotis

The Nature Reserve of Biguglia Pond offers a unique landscape combining systemic diversity: lagoon system, sandy coastal system and salt meadows, mesophilous system and marshy edaphohygrophilous system. These systems are composed of different vegetations and habitats with limited geographical area in Corsica. Despite a strong degradation of vegetation by fire and grazing, the reading of vegetation sequences remains legible and there are still complete sequences from the littoral to the inland. It is a complex and very diverse site where aquatic vegetation overlaps and is closely intertwined with riparian vegetation.

The 2014 field campaign confirmed and introduced the typology set up by Gamisans in 2005:

- 80 plant associations have been identified, representing one fourth of the phytosociological richness of the Corsican territory.
- 4 sets of vegetation, 3 curtases and 9 geopermaseries were inventoried;
- 225 taxa were recorded in the phytosociological surveys. 3 of them have a protection status: and only *Kosteletzkya pentacarpos* is listed in Annex II of the European Habitats Directive.

A heritage assessment was carried out using Natural Habitats covered by the Habitats and Wildlife Habitats Directive:

- 40% of the habitats are of Community interest;
- 60% of the habitats do not fall under the Directive.

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Among the habitats of community interest, coastal and agro-pastoral habitats are the two major entities of the landscape. The cartographic works made it possible to spatialize all the plant data from the physionomic mapping of the vegetations to the mapping of the vegetation series through a phytosociological map.

General Conclusion

Pauline Delbosc, Frédéric Bioret, and Christophe Panaïotis

Mapping is a means of expression offering many resources, on various themes (vegetation, vegetation series and vegetation geoseries). It is also an original method of research by the simultaneous representation of qualitative and quantitative variables (Rey 1961; Dupias et al. 1965; Ozenda 1986). The principles of cartography require a multiplicity of techniques for structuring and hierarchizing spatial data, organizing legend and semiology in order to accurately transcribe the phenomena observed in the plant landscape (Pesaresi et al. 2007; Blasi 2010; Penas and Del Río 2012).

The set of typological and cartographic works presented in this article make it possible to establish a synthesis on two sites, Biguglia pond and Cap Corse, providing an overview on the genesis of a spatial organization model vegetation series and geoseries. Whether it is vegetation maps, vegetation series maps or ecological maps, the methodological choices are based on several parameters, the three fundamental of which are the scale, phenomena and type of vegetation sector map (mountain or coastline).

A second perspective concerns the patrimonial evaluation of the serial and geoserial units of vegetation. The complexity of the functioning and the anthropic influences exerted on each of the series and geoseries could be the object of a more precise study. Some sectors could be selected according to their ecological and anthropic originalities in order to carry out follow-ups on a finer scale (vegetation). The aim is to better understand the anthropogenic impacts and the spatio-temporal scales of plant succession according to the degree of disturbance. It may be wise to

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perform synrelevates and geosynrelevates on the whole of these same sectors in order to characterize disturbance gradients.

In the longer term, in order to meet the objectives of the CarHAB program, a project of an ecological network of Corsica could be created. The objective of this project would be to monitor, conserve and manage Natura 2000 sites within a regional network as it was developed in the Marche region by Biondi et al. (2007). The general approach would be based on the structuring of a typological and cartographic database of phytocenetic data (flora, vegetation and vegetation series), zoocoenotic data, and abiotic data (geology, pedology, geomorphology and climate). The availability of all these data would make it possible to better understand regional biodiversity and to plan monitoring and management choices.

Appendix: Synsystematic Scheme of Cap Corse and Biguglia Pond

***ADIANTETEA CAPILLI-VENERIS* Braun-Blanq. *in* Braun-Blanq., Roussine & Nègre 1952**

Adiantetalia capilli-veneris Braun-Blanq. *ex* Horvatić 1939
  Adiantion capilli-veneris Braun-Blanq. *ex* Horvatić 1939
    Crithmo maritimi-Adiantetum capillus-veneris Géhu, Biondi & Géhu-Franck 1988
    Communities with *Adiantum capillus veneris*
    Communities with *Soleirolia soleirolii*

AGROSTIETEA STOLONIFERAE Oberd. 1983

Deschampsietalia cespitosae Horvatic 1958
  Ranunculo ophioglossifolii-Oenanthion fistulosae B. Foucault *in* B. Foucault & Catteau 2012
    Eleocharitetum palustris (Sennikov 1919) Savic 1926

Holoschoenetalia vulgaris Braun-Blanq. *ex* Tchou 1948
  Agrostio stoloniferae-Scirpoidion holoschoeni B. Foucault *in* B. Foucault & Catteau 2012
  Oenantho crocatae-Scirpoidetum holoschoeni Delbosc & Bioret *ass. nov. hoc loco*
  Fuirenetum pubescentis Paradis 2009
  Dittrichio viscosae-Juncetum acuti Paradis, O'Deye-Guizien & Piazza 2013
  Trifolio fragiferi-Cynodontion dactylonis Braun-Blanq. & O. Bolòs 1958
    Trifolio fragiferi-Cynodontetum dactylonis Braun-Blanq. & O. Bolòs 1958

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Potentillo anserinae-Polygonetalia avicularis Tüxen 1947
Alopecurion utriculati Zeidler 1954
Lino biennis-Festucetum arundinaceae Dubuis & Simmoneau *ex* B. Foucault 2012

ALNETEA GLUTINOSAE Braun-Blanq. & Tüxen ex V. Westh., Dijk & Passchier 1946
Salicetalia auritae Doing *ex* V. Westh. *in* V. Westh. & den Held 1969
Salicion cinereae T. Müll. & Görs 1958
Thelypterido palustris-Salicetum cinerae Paradis, O'Deye-Guizien & Piazza 2013

Alnetalia glutinosae Tüxen 1937
Alnion glutinosae Malcuit 1929
Angelico sylvestris-Alnetum glutinosae Gamisans 2013
Apio graveolentis-Alnetum glutinosae Gamisans 2014

Sphagno-Alnion glutinosae (Doing-Kraft *in* Maas 1959) H. Passarge & Hofmann 1968
Sparganio neglecti-Alnetum glutinosae Gamisans 2013

ANOGRAMMO LEPTOPHYLLAE-POLYPODIETEA CAMBRICI Rivas Mart. 1975
Anomodonto viticulosi-Polypodietalia cambrici O. Bolòs & Vives *in* O. Bolòs 1957
Polypodion serrati Braun-Blanq. *in* Braun-Blanq., Roussine & Nègre 1952
Communities with *Polypodium cambricum*
Umbilico rupestris-Sedetum andegavense Delbosc & Bioret *ass. nov. hoc loco*

Selaginello denticulatae-Anogrammion leptophyllae Rivas Mart., Fern. Gonz. & Loidi 1999
Communities with *Selaginella denticulata* (Paradis & Pozzo di Borgo 2005)

ARRHENATHERETEA ELATIORIS Braun-Blanq. 1949
Arrhenatheretalia elatioris Tüxen 1931
Brachypodio rupestris-Centaureion nemoralis Braun-Blanq. 1967
Communities with *Arrhenatherum elatius* subsp. *elatius*

Trifolio repentis-Phleetalia pratensis H. Passarge 1969
Cynosurion cristati Tüxen 1947
Lino biennis-Cynosuretum cristati Tüxen & Oberdorfer 1958
Lolio perennis-Cynosuretum cristati Braun-Blanq. & De Leeuw 1936

Plantaginetalia majoris Tüxen *ex* von Rochow 1951
Lolio perennis-Plantaginion majoris G. Sissingh 1969
Cichorietum intybi Tüxen *ex* G. Sissingh 1969

ARTEMISIETEA VULGARIS W. Lohmeyer, Preising & Tüxen ex von Rochow 1951

Artemisietalia vulgaris Tüxen 1947 *nom. nud.*

Sambucenion ebuli O. Bolòs & Vigo *in* Rivas Mart., Báscones, T. E. Diáz, Fern. Gonz. & Loidi 1991

Urtico dioicae-Sambucetum ebuli Braun-Blanq. (1936) 1952

Onopordetaliaacanthii Braun-Blanq. & Tüxen *ex* Klika *in* Klika & Hadač 1944

Onopordion acanthii Braun-Blanq.*in* Braun-Blanq., Gajewski, Wraber & Walas 1936

Onopordetum illyrici Braun-Blanq. 1931

Carthametalia lanati Brullo *in* Brullo & Marcenò 1985

Silybo mariani-Urticion piluliferae G. Sissingh *ex* Braun-Blanq. & O. Bolòs 1958

Urtico membranaceae-Smyrnietum olusatri (A. & O. Bolòs) O. Bolòs & Re. Molinier 1958

Silybo mariani-Urticetum piluliferae Braun-Blanq. (1931) 1936

ASPLENIETEA TRICHOMANIS (Braun-Blanq. in H. Meier & Braun-Blanq. 1934) Oberd. 1977

Asplenietalia glandulosi Braun-Blanq. & H. Meier *in* H. Meier & Braun-Blanq. 1934

Brassicion insularis Gamisans 1991*nom. nud.*

Ruto graveolenti-Brassicetum insularis (Litard. 1928) Gamisans 1991

Cheilanthetalia maranto-maderensis Sáenz de Rivas & Rivas Mart. 1979

Phagnalo saxatilis-Cheilanthion maderensis Loisel 1970 *corr.* Sáenz de Rivas & Rivas Mart. 1979

Diantho siculi-Asplenietum billotii Gamisans & Muracciole 1984

Umbilico rupestris-Asplenietum obovati (Biondi et al. 1993) Géhu & Biondi 1994

Asplenietum marini Gamisans & Paradis 1992

Sedo albi-Notholaenetum marantae Delbosc & Bioret *ass. nov. hoc loco*

Androsacetalia vandellii Braun-Blanq. *in* H. Meier & Braun-Blanq. 1934 *corr.* Braun-Blanq. 1948

Potentillion crassinerviae Gamisans 1968

Armerio leucocephalae-Potentilletum crassinerviae Ro. Molinier 1959

Sedo brevifolii-Dianthetum godroniani Litard. 1928

CAKILETEA MARITIMAETüxen & Preising in Tüxen 1950

Euphorbietalia peplis Tüxen 1950

Euphorbion peplis Tüxen 1950

Salsolo kali-Cakiletum maritimae Costa & Mans. 1981 *corr*. Rivas Mart. *et al.* 1992

typicum Costa & Mans. 1981
xanthietosum italici Géhu *et al*. 1984
atriplicetosum prostratae Géhu & Biondi 1994

Salsolo kali-Euphorbietum peplis Géhu *et al.* 1984
Atriplicetum hastato-tornabeni O. Bolòs 1962

CARDAMINETEA HIRSUTAE Géhu 1999
Geranio purpurei-Cardaminetalia hirsutae Brullo *in* Brullo & Marcenò 1985
Valantio muralis-Galion muralis Brullo *in* Brullo & Marcenò 1985
Communities with *Cardamine hirsuta* and *Fumaria capreolata*

CARICI CARYOPHYLLAE-GENISTETEA LOBELII J. C. Klein 1972
Carlinetalia macrocephalae Gamisans 1975
Anthyllidion hermanniae J. C. Klein 1972
Genisto salzmannii-Alyssetum robertiani Ro. Molinier 1959
Thymo herba-baronae-Genistetum lobelioidis Gamisans 1989
genistetosum lobelioidis Gamisans 1989
allietosum schoenoprasi Gamisans 1989

Caricion caryophylleae Gamisans 1975
Communities with *Trifolium campestre* and *Carex caryophyllea*
Anthoxantho odorati-Brachypodietum pinnati Gamisans 1989

CHARETEA FRAGILIS F. Fukarek 1961
Charetalia hispidae Krausch *ex* W. Krause 1997
Charion vulgaris (W. Krause *ex* W. Krause & Lang 1977) W. Krause 1981
Tolypelletum glomeratae Corill. 1957
typicum Corill. 1957
althenietosum filiformis (Corill.) Felzines & Lambert 2012
charetosum hispidae (Corill.) Felzines & Lambert 2012

CISTO LADANIFERI-LAVANDULETEA STOECHADIS Braun-Blanq. in Braun-Blanq., Re. Molinier & He. Wagner 1940
Lavanduletalia stoechadis Braun-Blanq. *in* Braun-Blanq., Re. Molinier & He. Wagner 1940
Cistion ladaniferi Braun-Blanq. *in* Braun-Blanq., Re. Molinier & He. Wagner 1940
Helichryso italici-Cistetum cretici Allier & Lacoste 1980
genistetosum corsicae Paradis & Pozzo di Borgo 2005
calicotometosum spinosae Paradis & Pozzo di Borgo 2005
juniperetosum turbinatae Paradis, Piazza & Pozzo di Borgo 2006

Teucrion mari Gamisans & Murraciole 1984
Stachyo glutinosae-Genistetum corsicae Gamisans & Muracciole 1984
teucrietosum mari Gamisans & Muracciole 1984
rosmarinetosum officinalis Gamisans & Muracciole 1984
daucetosum hispanicae Gamisans & Muracciole 1984
santolinetosum corsicae Angiolini & Dominicis 2000

Genisto corsicae-Cistetum salvifolii Paradis *et al.*2014
Notholaeno marantae-Silenetum paradoxae Gamisans 2000

Stauracantho genistoidis-Halimietalia commutati Rivas Mart., Lousã, T. E. Díaz, Fernández-González & J. C. Costa 1990
Stauracantho genistoidis-Halimion halimifolii Rivas Mart. 1979
Cisto salviifolii-Halimietum halimifolii Géhu & Biondi 1994
typicum Géhu & Biondi 1994
helichrysetosum microphylli Paradis, Lorenzoni, Piazza & Quilichini 1999

CRATAEGO MONOGYNAE-PRUNETEA SPINOSAE Tüxen 1962
Prunetalia spinosae Tüxen 1952
Pruno spinosae-Rubion ulmifolii O. Bolòs 1954
Rubo ulmiifolii-Ericetum arboreae Aurière & Reymann 2016
typicum Aurière & Reymann 2016
ericetosum scopariae Aurière & Reymann 2016

CRITHMO MARITIMI-STATICETEA Braun-Blanq.in Braun-Blanq., Roussine & Nègre 1952
Crithmo maritimi-Staticetalia Molin. 1934
Crithmo maritimi-Limonion articulati Paradis, Panaïotis, Piazza & Pozzo di Borgo 2013
Crithmo maritimi-Limonietum articulati (Malcuit 1931 *corr*. Géhu & Biondi 1994) Paradis, Panaïotis, Piazza & Pozzo di Borgo 2013
typicum Géhu & Biondi 1994
halimionetosum portulacoidis Paradis, Panaïotis, Piazza & Pozzo di Borgo 2013

Crithmo maritimi-Limonietum contortiramei (Re. Molinier & Ro. Molinier 1955) Géhu & Biondi 1994
typicum Géhu & Biondi 1994
halimionetosum portulacoides Géhu & Biondi 1994
frankenietosum laevis Géhu & Biondi 1994
dianthetosumsylvestris Géhu & Biondi 1994
lotetosum cytisoidis Paradis, Panaïotis, Piazza & Pozzo di Borgo 2013

Crithmo maritimi-Limonietum patrimoniense Géhu & Biondi 1994

EUPHORBIO PARALIAE-AMMOPHILETEA AUSTRALISGéhu & Géhu-Franck 1988 corr. Géhu 2004
Ammophiletalia australis Braun-Blanq. 1933
Ammophilion australis Braun-Blanq. 1921 *corr.*Rivas Mart., M. J. Costa & Izco *in* Rivas Mart., Lousã, T. E. Diáz, Fern.-Gonz. & J. C. Costa 1990
Sporobolenion arenarii Géhu 1988
Sporoboletum arenarii (Arènes 1924) Géhu & Biondi 1994
typicum Géhu & Biondi 1994
crithmetosum maritimae Géhu & Biondi 1994

Sporobolo arenarii-Elymenion farcti Géhu 1988
Sporobolo pungentis-Elymetum farcti (Braun-Blanq. 1933) Géhu *et al.* 1984
Echinophoro spinosae-Elymetum farcti Géhu 1988
Sileno corsicae-Elymetum farcti (Malcuit 1926) Bartolo *et al.* 1992
Typicum Géhu & Biondi 1994
medicaginetosum marinae Géhu & Géhu-Franck 1993

Eryngio maritimi-Elymetum farcti Géhu 1986 (race corso-sarde)
calystegietosum soldanellae Piazza & Paradis 1997
medicaginetosum marinae Piazza & Paradis 1997

Plantagino humilis-Lotetum cytisoidis Paradis & Piazza 1993

Ammophilenion australis Rivas Mart. & Géhu *in* Rivas Mart., M.J.Costa, Castrov. & Valdés Berm.1980 *corr.* Rivas Mart., Lousã, T.E.Diáz, Fern.-Gonz.& J.C.Costa 1990
Echinophoro spinosae-Ammophiletum arundinaceae Géhu & Biondi 1994
Sileno corsicae-Ammophiletum arundinaceae Géhu & Biondi 1994

Crucianelletalia maritimae G. Sissingh 1974
Crucianellion maritimae Rivas Goday & Rivas Mart. 1958
Pycnocomo rutifolii-Crucianelletum maritimae Géhu *et al*. 1987

Helichrysetalia italici Géhu & Biondi 1994
Euphorbion pithuysae Géhu & Biondi 1994
Euphorbio pithyusae-Helichrysetum italici Paradis & Piazza 1998
Thymelaeo hirsutae-Helichrysetum italici Molin. 1959
*typicum*Géhu & Biondi 1994

Thymelaeo tartonrairae-Helichrysetum italici Paradis *nom. prov.*
Thymelaeo tartonrairae-Rosmarinetum officinalis Paradis *nom. prov.*
Euphorbio spinosae-Helichrysetum italici Paradis *nom. prov.*
*Cisto cretici-Anthyllidetum barbae-jovis*Paradis 1997

FILIPENDULO ULMARIAE-CONVOLVULETEA SEPIUM Géhu & Géhu-Franck 1987
Loto pedunculati-Filipenduletalia ulmariae H. Passarge (1975) 1978
Dorycnio recti-Rumicion conglomerati Gradstein & Smittenberg 1977
Cirsio cretici-Dorycnietum recti Géhu & Biondi 1988
cladietosum marisci Géhu & Biondi 1998
alnetosum glutinosae Gamisans 1992

Iridetum pseudacori Eggler 1933
Cypero longi-Oenanthetum crocatae Paradis *nom. prov.*

Convolvuletalia sepium Tüxen 1950 *ex* Mucina *in* Mucina *et al.* 1993

Convolvulion sepium Tüxen *ex* Oberd. 1949
Calystegio sepium-Phragmitetum australis Royer, Thévenin & Didier 2006

Cynancho acuti-Calystegion sepium Rivas Goday & Rivas Mart. *ex* B. Foucault 2011
Arundini donacis-Convolvuletum sepium O. Bolòs 1962

GLYCERIO FLUITANTIS-NASTURTIETEA OFFICINALIS Géhu & Géhu-Franck 1987

Nasturtio officinalis-Glycerietalia fluitantis Pignatti 1953
Glycerio fluitantis-Sparganion neglecti Braun-Blanq. & G. Sissingh *in* Boer 1942
Apio nodiflori-Sparganietum neglecti Gamisans 1992
Glycerio fluitanti-Sparganietum neglecti W. Koch 1926
Sparganio erecti-Sagittarietumsagittifoliae Tüxen 1953
Glycerietum fluitantis Nowinski 1930

Apion nodiflori Segal *in* Westhoff & den Held 1969
Nasturtietum officinalis (Seibert 1962) Oberd. *et al*. 1967
Communities with *Veronica anagallis-aquatica*

HALODULO WRIGTHII-THALASSIETEA TESTUDINUM Rivas Mart., Fern. Gonz. & Loidi 1998

Thalassio testudinum-Syringodietalia filiformis Knapp *in* Borhidi, O.Muñiz & Del Risco 1983
Syringodio filiformis-Thalassion testudinum Borhidi *in* Borhidi, O.Muñiz & Del Risco 1983
Cymodoceetum nodosae Feldmann 1937

HELIANTHEMETEA GUTTATI (Braun-Blanq. ex Rivas Goday 1958) Rivas Goday & Rivas Mart. 1963

Helianthemetalia guttati Braun-Blanq. *in* Braun-Blanq., Re. Molinier & He. Wagner 1940
Helianthemion guttati Braun-Blanq. *in* Braun-Blanq., Re. Molinier & He. Wagner 1940
Sedetum caerulei Brullo 1975
Tuberario guttatae-Plantaginetum bellardii Aubert & Loisel 1971
*typicum*Aubert & Loisel 1971
airetosum caryophyllae Allier & Lacoste 1980
anthoxanthetosum ovati Paradis & Pozzo di Borgo 2005
stipetosum capensis Paradis, Panaïotis & Piazza 2014

Communities with *Plantago lagopus*
Anthoxanthetum ovati Gamisans & Paradis 1992
typicum Gamisans & Paradis 1992
tuberarietosum guttatae Gamisans & Paradis 1992

Malcolmietalia ramosissimae Rivas Goday 1958
Maresio nanae-Malcolmion ramosissimae (Rivas Mart. 1978) Rivas Mart., Costa & Loidi 1992
Ononidetum variegatae Piazza & Paradis 2002
Cutandietum maritimae Piazza & Paradis 1994
Typicum Piazza & Paradis 1994

Sileno sericeae-Matthioletum tricuspidatae Paradis & Piazza 1992
Allietum chamaemoly Molinier 1959

Laguro ovati-Vulpion fasciculatae Géhu & Biondi 1994
Sileno nicaeensis-Vulpietum fasciculatae (Paradis & Piazza 1991) Géhu & Biondi 1994
Typicum Géhu & Biondi 1994

ISOETO DURIEUI-JUNCETEA BUFONII Braun-Blanq. & Tüxen ex V. West., Dijk & Paschier 1946
Isoetetalia durieui Braun-Blanq. 1936
Cicendio filiformis-Solenopsion laurentiae Brullo & Minissale 1998
Junco capitati-Morisietum monanthi Gamisans 1975

Elatino triandrae-Cyperetalia fusci B. Foucault 1988
Heleochloion schoenoidis Braun-Blanq. *ex* Rivas Goday, Borja, Monasterio, Galiano & Rivas Mart. 1956
Polygono monspeliensis-Crypsidetum aculeata Paradis & Lorenzoni 1994

JUNCETEA MARITIMI Braun-Blanq. in Braun-Blanq., Roussine & Nègre 1952
Juncetalia maritimi Braun-Blanq. *ex* Horvatić 1934
Juncion maritimi Braun-Blanq. *ex* Horvatić 1934
Puccinellienion festuciformis (Géhu & Scoppola *in* Géhu, Scoppola, Caniglia, Marchiori & Géhu-Franck 1984) Géhu & Biondi 1995
Puccinellio festuciformis-Scirpetum compacti (Pignatti 1966) Géhu & Scopp. 1984
Limonio narbonensis-Pucinellietum festuciformis (Pignatti 1966) Géhu & Scopp. 1984 *in* Géhu *et al.* 1984
Juncenion maritimi Géhu & Biondi *ex* Géhu 2004
Puccinellio festuciformis-Juncetum maritimi (Pignatti 1966) Géhu *et al.* 1984
Spartino versicolori-Juncetum maritimi O. Bolòs 1962
Puccinellio festuciformis-Caricenion extensae Géhu & Biondi 1995 *nom. nud.*
Limonio narbonensis-Caricetum extensae Géhu & Biondi 1994
Limonio narbonensis-Juncetum gerardii Géhu & Biondi 1994

Agropyro-Artemision coerulescentis (Pignatti 1953) Géhu & Scop. 1984
Limonio narbonensis-Artemisietum caerulescentis (Pignatti 1953) Géhu & Scopp. 1984

Plantaginion crassifoliae Braun-Blanq., Roussine & Nègre 1952
Junco acuti-Schoenetum nigricantis Géhu *et al.*1987

typicum Géhu *et al.* 1987
limonietosum virgati Géhu & Biondi 1984
lotetosum tenuis Géhu *et al.* 1987

Juncetum acuti Re. Molinier & Tallon 1969
typicum
*atriplicetosum portulacoidis*Gamisans & Paradis 1992
elymetosum Gamisans & Paradis 1992
festucetosum corsicae Gamisans & Paradis 1992

LEMNETEA MINORIS Tüxen ex O. Bolòs & Masclans 1955
Lemnetalia minoris Tüxen *ex* O. Bolòs & Masclans 1955
Lemnion minoris Tüxen *ex* O. Bolòs & Masclans 1955
Lemnetum minoris Soó 1927
Lemnetum gibbae Miyawaki & J. Tüxen 1960

LYGEO SPARTI-STIPETEA TENACISSIMAE Rivas-Martínez 1978 nom. conserv.
Lygeo-Stipetalia Braun-Blanq. & O. Bolòs 1958
*Thero-Brachypodion ramosi*Braun-Blanq. 1925
Loto cytisoidis-Dactyletum hispanicae Biondi, Filigheddu & Farris 2001
dactyletosum hispanicae Biondi, Filigheddu & Farris 2001

NERIO OLEANDRI-TAMARICETEA AFRICANAE Braun-Blanq. & O. Bolòs 1958
Tamaricetalia africanae Braun-Blanq. & O. Bolòs 1958
Tamaricion africanae Braun-Blanq. & O. Bolòs 1958
Inulo crithmoidis-Tamaricetum africanae Gamisans 1992
Althaeo officinalis-Tamariscetum africanae Gamisans 1992

Nerio oleandri-Viticetalia agni-casti B. Foucault, Bensettiti, Noble & Paradis 2012
Rubo ulmifolii-Nerion oleandri O. Bolòs 1985
Rubo ulmifolii-Nerietum oleandri O. Bolòs 1956
Nerio oleandri-Viticetum agni-casti Paradis 2006
Rubo ulmifolii-Viticetum agni-casti Paradis 2006
typicum Paradis 2006
viticetosum agni-casti Paradis 2006
rubetosum ulmifolii Paradis 2006
rhamnetosum alaterni Paradis 2006

PARIETARIETEA JUDAICAE Rivas Mart. in Rivas Goday 1964
Parietarietalia judaicae Rivas Mart. *ex* Rivas Goday 1964
*Centrantho rubri-Parietarion judaicae*Rivas Mart. 1960
Hyoscyami albi-Parietarietum judaicae Segal 1969
Oxalido corniculatae-Parietarietum judaicae (Braun-Blanq., Roussine & Nègre 1952) Segal 1969
Adianto capilli-veneris-Parietarietum judaicae Segal 1969

PHRAGMITI AUSTRALIS-MAGNOCARICETEA ELATAE Klika in Klika & V. Novák 1941

Phragmitetalia australis W. Koch 1926
  Phragmition communis W. Koch 1926
    Phragmitetum australis Schmale 1939
    typicum
      calystegietosum sepii Gamisans 1992

    Typhetum angustifoliae (Allorge 1922) Pignatti 1953
    Typhetum latifoliae Lang 1973

  Carici pseudocyperi-Rumicion hydrolapathi H. Passarge 1964
    Thelypterido palustris-Phragmitetum australis Kuyper 1957 *ex* van Donselaar *et al.* 1961

Magnocaricetalia elatae Pignatti 1954
  Magnocaricion elatae W. Koch 1926
    Cladietum marisci (Allorge 1922) Zobrist 1939

Scirpetalia compacti Heijný *in* Holub, Heijný, Moravec & Neuhäusl 1967 *corr.* Rivas Mart., M. J. Costa, Castrov. & Valdés Berm. 1980
  Scirpion compacto-littoralis Rivas Mart. *in* Rivas Mart., M. J. Costa, Castrov. & Valdés Berm. 1980
    Scirpetum tabaernaemontani Soó 1962
    Kosteletzkyopentacarpos-Phragmitetum australis Gamisans 1992
    Inulo crithmoidis-Phragmitetum australis Gamisans 1992
    Scirpetum compacto-littoralis Braun-Blanq. (1931) 1952 Rivas Mart. *et al.* 1980
      typicum Géhu & Biondi 1994
      inuletosum crithmoidis Gamisans 1992

    Bolboschoenetum maritimi Eggler 1933

POLYGONO ARENASTRI-POETEA ANNUAE Rivas Mart. 1975 corr. Rivas Mart., Báscones, T. E. Diáz, Fern. Gonz. & Loidi 1991

Polygono arenastri-Poetalia annuae Tüxen *in* Géhu, J. L. Rich. & Tüxen 1972 *corr.* Rivas Mart., Báscones, T. E. Diáz, Fern. Gonz. & Loidi 1991
  Polycarpion tetraphylli Rivas Mart. 1975
    Vegetation with *Cotula coronopifolia*

POSIDONIETEA OCEANICAE Hartog 1976 ex Géhu 2004

*Posidonietalia oceanicae*Hartog *ex* Géhu 2004
  Posidonion oceanicae Braun-Blanq., Roussine & Nègre 1952
    Posidonietum oceanicae Funk 1927

QUERCETEA ILICIS Braun-Blanq. in Braun-Blanq., Roussine & Nègre 1952

Quercetalia ilicis Braun-Blanq. *ex* Re. Molinier 1934
  Fraxino orni-Quercion ilicis Biondi, Casavecchia & Gigante 2003
    Galio scabri-Quercetum ilicis Gamisans 1988
      fraxinetosum orni Gamisans 1988

lathyretosum veneti (Gamisans 1977) Gamisans 1988
quercetosum pubescentis Boyer *et al.* 1983

Ericion arboreae Rivas Mart. (1975) 1987
Pulicario odoratae-Arbutetum unedonis Allier & Lacoste 1980
phillyreetosum latifoliae Allier & Lacoste 1980
myrtetosum communis Paradis & Pozzo di Borgo 2005
juniperetosum turbinatae Paradis, Piazza & Pozzo di Borgo 2006a
quercetosum suberis (Gamisans 1991*nom. nud.*) *Reymann et al.* 2016

Pistacio lentisci-Rhamnetalia alaterni Rivas Mart. 1975
Oleo sylvestris-Ceratonion siliquae Braun-Blanq. *ex* Guin. & Drouineau 1944
Clematido cirrhosae-Pistacietum lentisci Gamisans & Muracciole 1984 *corr*. Géhu & Biondi 1994
tametosum communis Gamisans & Muracciole 1984
smilacetosumasperae Gamisans & Muracciole 1984
anthyllidetosum barbae-jovis Gamisans & Paradis 1992

Myrto communis-Oleetum sylvestris Bacchetta, Bagella, Biondi, Farris, Filigheddu & Mossa 2003
Genisto corsicae-Ericetum multiflorae Lejour & Delbosc 2016

Juniperion turbinatae Rivas Mart. 1975 *corr.* 1987
Oleo sylvestris-Juniperetum turbinatae Arrigoni, Bruno, De Marco & Veri 1985 *corr*. Biondi & Mossa 1992

QUERCO ROBORIS-FAGETEA SYLVATICAE Braun-Blanq. & Vlieger in Vlieger 1937
Fagetalia sylvaticae Pawł. *in* Pawł., Sołowski & Wallisch 1928
Lathyrion veneti Gamisans 1975
Lathyrenion veneti Gamisans 1975
Cardamino chelidoniae-Buxetum sempervirentis Gamisans 1975
Asperulo odorae-Taxetum baccatae Gamisans 1970
taxetosum baccatae Gamisans 1970
quercetosum pubescentis Boyer, Gamisans, Gruber & Quézel 1983

Buxenion sempervirentis Gamisans 1975
Oenanthe pimpinelloides-Quercetum pubescentis Boyer, Gamisans,
oenanthetosum pimpinelloidis Boyer, Gamisans, Gruber & Quézel 1983
saniculetosum europeae Boyer, Gamisans, Gruber & Quézel 1983

Ilici aquifolii-Quercetum ilicis Gamisans 1975

Populetalia albae Braun-Blanq. *ex* Tchou 1948
Populion albae Braun-Blanq. *ex* Tchou 1948
Populenion albae Rivas Mart. 1975
Populetum albae Braun-Blanq. 1931

Fraxino angustifoliae-Ulmenion minoris Rivas Mart. 1975
Communities with *Ulmus minor* et *Populus alba*

Communities with *Ulmus minor*
Communities with *Quercus robur*

Caricion microcarpae Gamisans (1968) 1975
Petasito-Adiantenion Gamisans 2014
Scrophulario auriculatae-Alnetumglutinosae Gamisans 2014
ficetosum caricae Gamisans 2014
geranietosum nodosi Gamisans 2014

Ericenion terminalis Gamisans 2014
Communities with *Salix atrocinerea*
Carici microcarpae-Ericetum terminalis Litard. & Malcuit 1926
caricetosum microcarpae Gamisans 2014
eupatorietosum corsici Gamisans 2014

RUPPIETEA MARITIMAEJ. Tüxen 1960 nom. nud.
Ruppietalia maritimae J. Tüxen 1960 *nom. nud.*
Ruppion maritimae Braun-Blanq. *ex* V. Westh. 1943 *nom. ined.*
Ruppietum cirrhosae (Hocquette 1927) *corr*. Iversen 1934

SAGINETEA MARITIMAEV. Westh., C. Leeuwen & Adriani 1962
Saginetalia maritimae V. Westh., C. Leeuwen & Adriani 1962
Saginion maritimae V. Westh., C. Leeuwen & Adriani 1962
Catapodio marini-Parapholidetum incurvae Géhu & B. Foucault 1978
Senecioni leucanthemifolii-Nanantheetum perpusillae Biondi, Filigheddu & Farris 2001
nanantheetosum perpusillae Biondi, Filigheddu & Farris 2001
plantaginetosum bellardii Biondi, Filigheddu & Farris 2001

Catapodio marini-Mesembryanthemetum nodiflori Paradis, Panaïotis & Piazza 2014

Frankenietalia pulverulentae Rivas Mart. *ex* Castrov. & J.Porta 1976
Polypogonion subspathacei Gamisans 1990
Polypogonetum subspathacei Gamisans 1990
Centaurio acutiflori-Hordeetum gussoniani Gamisans 1990
typicum
polypogonetosum monspeliensis Gamisans 1992

SALICORNIETEA FRUTICOSAE Braun-Blanq. & Tüxen ex A. Bolòs & O. Bolòs in A. Bolòs 1950
Salicornietalia fruticosae Braun-Blanq. 1933
Salicornion fruticosae Braun-Blanq. 1933
Arthrocnemenion fruticosi Rivas Mart. *in* Rivas Mart., M. J. Costa, Castrov. & Valdés Berm. 1980
Puccinellio festuciformis-Sarcocornietum fruticosae (Braun-Blanq. 1928) Géhu 1976

***SISYMBRIETEA OFFICINALIS* Gutte & Hilbig 1975**

Brometalia rubenti-tectorum Rivas Mart. & Izco 1977

Echio plantaginei-Galactition tomentosae O. Bolòs & Re. Molinier 1969

Echio lycopsis-Galactitetum tomentosae Re. Molinier 1937

Alyssetum corsici Molin. 1959

*Plantagino afrae-Lamarckietum aureae*Paradis, Panaïotis & Piazza 2014

Sisymbrietalia officinalis J. Tüxen *ex* Matuszk. 1962

Sisymbrion officinalis Tüxen, W. Lohmeyer & Preising *ex* von Rochow 1951

Hordeion murini Braun-Blanq. *in* Braun-Blanq., Gajewski, Wraber & Walas 1936

Hordeetum leporini Braun-Blanq. *in* Braun-Blanq., Gajewski, Wraber & Walas 1936

Chenopodietalia muralis Braun-Blanq. *in* Braun-Blanq., Gajewski, Wraber & Walas 1936

Chenopodion muralis Braun-Blanq. *in* Braun-Blanq., Gajewski, Wraber & Walas 1936

Chenopodietum muralis Braun-Blanq. & Maire *ex* Braun-Blanq. 1936

***THLASPIETEA ROTUNDIFOLII* Braun-Blanq. 1948**

Andryaletalia ragusinae Rivas Goday *in* Rivas Goday & Esteve 1972

Pimpinello tragium-Gouffeion arenarioidis Braun-Blanq. *in* Braun-Blanq., Roussine & Nègre 1952

Galio parisiense-Mercurialetum corsicae Delbosc & Bioret *ass. nov. hoc loco*

***THERO-SUAEDETEA SPLENDENTIS*Rivas Mart. 1972**

Thero-Salicornietalia dolichostachyae Tüxen *ex* Boullet et Géhu 2004

Salicornion patulae Géhu & Géhu-Franck *ex* Rivas Mart. 1990

Arthrocnemo glauci-Salicornietum emerici (O. Bolòs 1962) Géhu & Géhu-Franck 1978

Suaedo maritimae-Salicornietum patulae (Brullo & Furnari 1976) Géhu & Géhu-Franck 1984

Thero-Suaedion splendentis Braun-Blanq.*in* Braun-Blanq., Roussine & Nègre 1952

Cressetum creticae Brullo & Furnari 1976

Cresso creticae-Crypsidetum aculeatae Géhu *et al.* 1990

***ZOSTERETEA MARINAE*Pignatti 1954**

Zosteretalia marinae Bég. *ex* Pignatti 1954

Zosterion marinae W. F. Christ. 1934

Zosteretum noltii Pignatti 1953

References

Agence pour la Gestion des Espaces Naturels de Corse (A.G.E.N.C.) (1987) Le genévrier oxycèdre à gros fruits sur le littoral corse: écologie et protection, étude financée par la Région Corse et la DRAE, Bastia

Agence pour la Gestion des Espaces Naturels de Corse (A.G.E.N.C.) (1989) Les îlots satellites de la Corse: patrimoine naturel et conservation. Rapport technique non publié, Bastia

Agence pour la Gestion des Espaces Naturels de Corse (A.G.E.N.C.) (1994) Éléments pour un inventaire diagnostic du littoral sablo-graveleux de la Corse. Rapport technique, Bastia

Agence pour la Gestion des Espaces Naturels de Corse (A.G.E.N.C.) (1998) Documents d'Objectifs du site Îles Finocchiarola – Nord de Cap Corse. Programme Life. Réserves Naturelles de France – Agence pour la Gestion des Espaces Naturels de Corse

Allier C, Lacoste A (1980) Maquis et groupements végétaux de la série du chêne vert dans le bassin du Fango (Corse). Ecologia Mediterranea 5:59–82

Allier C, Lacoste A (1981) Processus dynamiques de reconstitution dans la série du Quercus ilex en Corse. Vegetatio 46:83–91

Amandier L, Dureau R, Joffre LM, Laurent JL (1984) Éléments pour un zonage agro-sylvopastoral de la Corse. SODETEG, Ajaccio

Angiolini C, De Dominicis V (2000) A synecological study of communities with Santolina corsica Jordan et Fourr. Acta Bot Croat 59(2):383–401

Angius R, Bacchetta G, Pontecorvo C (2011) Floristic and vegetational features of Monte Marganai (SW Sardinia). Conservazione Habitat Invertebrati 5:57–132

Anquez M (2010) Caractérisation des formations à *Myrtus communis* L. présentes en Corse, dans les milieux temporairement inondés des étages thermo- et mésoméditerranéen. Master Gestion de l'Environnement, Université de Corse, CBNC-OEC Corte

Arrighi J, Giorgetti F (1985) Géologie régionale: les granites alcalins de Corse, le complexe annulaire de Cauro-Bastellica. CNDP/CRDP de la Corse, Ajaccio

Aurière A (2013) Contribution à la typologie des maquis et autres fruticées sclérophylles de Corse des étages thermoméditerranéen, mésoméditerranéen et supraméditerranéen. Université de Bretagne Occidentale, Conservatoire botanique national de Corse – Office de l'environnement de la Corse, rapport de stage Master 2, Corte

B.C.E.O.M (2006) Étude hydrologique sur le périmètre du Schéma d'Aménagement et de Gestion de l'Eau de l'étang de Biguglia

Bacchetta G, Filigheddu R, Bagella S, Farris E (2007) Piano forestale ambientale regionale. Descrizione delle serie di vegetazione. Regione Autonoma Sardegna, Assessorato della difesa dell'ambiente

P. Delbosc et al. (eds.), *Plant Landscape of Corsica*, Geobotany Studies,
https://doi.org/10.1007/978-3-030-35776-4

Bacchetta G, Bagella S, Biondi E, Farris E, Filigheddu R, Mossa L (2009) Vegetazione forestale e serie di vegetazione della Sardegna (con rappresentazione cartografica alla scala 1:350,000). Fitosociologia 46(1 suppl. 1):3–82

Bacchetta G, Bagella S, Biondi E, Farris E, Filigheddu R, Mossa L (2010) Le serie di vegetazione della regione Sardegna. In: Blasi C (ed) La vegetazione d'Italia, con carta delle serie di vegetazione in scale 1:500,000. Roma, Palombi, pp 471–495

Bagnouls F, Gaussen H (1957) Les climats biologiques et leur classification. Annales Géographie 66:193–200

Barbero M, Bonin G, Loisel R, Quézel P (1990) Changes and disturbances of forest ecosystems caused by human activities in the western part of the mediterranean basin. Vegetatio 87:151–173

Bardat J, Bioret F, Botineau M, Boullet V, Delpech R, Géhu JM, Haury J, Lacoste A, Rameau JC, Royer JM, Roux G, Touffet J (2004) Prodrome des végétations de France, 61 Muséum national d'histoire naturelle, Paris

Béguin C (2003) De l'usage des cartes phytosociologique et géomorphologique pour la conceptualisation des unités de paysage végétal (Sigmeta) exemple dans la région de Lona (Valais – Suisse). Doc Phytosoc XX:155–166

Béguin C, Géhu JM, Hegg O (1979) La symphytosociologie: une approche nouvelle des paysages végétaux. Doc Phytosoc IV:49–69

Bensettiti F, Herard-Logereau K (2004) Cahiers d'habitats Natura 2000: Habitats rocheux. La Documentation Française 5

Bensettiti F, Rameau JC, Chevallier H (coord.) (2001) Cahiers d'habitats Natura 2000. Connaissance et gestion des habitats et des espèces d'intérêt communautaire. Tome 1 - Habitats forestiers. MATE/MAP/MNHN. Éd. La Documentation française, Paris, 2 volumes

Bensettiti F, Bioret F, Roland J, Lacoste J P (coord.) (2004) Cahiers d'habitats Natura 2000. Connaissance et gestion des habitats et des espèces d'intérêt communautaire. Tome 2 - Habitats côtiers. MEDD/MAAPAR/MNHN. La Documentation française, Paris

Bensettiti F, Boullet V, Chavaudret-Laborie C, Deniaud J (2005) Cahiers d'habitats Natura 2000: Habitats agropastoraux. La Documentation Française, Paris 4

Biondi E (2011) Phytosociology today: Methodological and conceptual evolution. Plant Biosyst 145:19–29

Biondi E, Catorci A, Pandolfi M, Casavecchia S, Pesaresi S, Galassi S, Pinzi M, Vitanzi A, Angelini E, Bianchelli M, Cesaretti S, Foglia M, Gatti R, Morelli F, Paradisi L, Ventrone F, Zabaglia C (2007) Il Progetto di "Rete Ecologica della Regione Marche" (REM): per il monitoraggio e la gestione dei siti Natura 2000 e l'organizzazione in rete delle aree di maggiore naturalità. Fitosociologia 44:89–93

Biondi E, Casavecchia S, Pesaresi S (2011) Phytosociological synrelevés and plant landscape mapping: From theory to practice. Plant Biosystems 145(2):261–273

Bioret F, Sturbois A (2009) Typologie et cartographie des habitats du site Natura 2000 FR9400600 Crêtes de Teghime-Poggio d'Oletta. Institut de Géoarchitecture Université de Bretagne Occidentale

Bioret F, Dominici JM, Sturbois A (2009) Évolution de la végétation terrestre de la Réserve Naturelle de Scandola (Haute-Corse) entre 1984 et 2007. Bulletin Société Sciences Historiques Naturelles Corse 728–729:63–68

Bioret F, Delbosc P, Panaïotis C (2014) Contribution to the phytosociological knowledge of rocky coastline of Corsica. Lazaroa 38(1):53–66

Bioret F, Delbosc P, Panaïotis C (2017) Contribution to the phytosociological knowledge of rocky coastline of Corsica: description of five new plant associations. Lazaroa 38(1):53

Bioret F, Boullet V, Choisnet G, Roux C, Thébaud G, Panaïotis C, Chalumeau A, Delbosc P, Demartini C, Gauberville C, Cianfaglione K, Bensettiti F, Lalanne A (2019) Landscape phytosociology concepts and definitions applied to serial and catenal vegetation mapping. Contrib Bot LIV:47–53

Biotope (2006) Inventaire et cartographie des habitats naturels du site Natura 2000 FR9400568 « Cap Corse nord & îles Finocchiarola, Giraglia, Capense ». Etude réalisée pour le compte de la Direction Régionale de l'Environnement de Corse.

Bissardon M, Guibal L, Rameau JC (1997) CORINE Biotopes, Types d'habitats français. E.N.G.R. E.F, Nancy

Blasi C (coord.) (2010) La vegetazione d'Italia, con carta delle serie di vegetazione in scale 1:500,000. Palombi, Roma

Blasi C, Capotorti G, Frondoni R (2005) Defining and mapping typological models at the landscape scale. Plant Biosystems 139(2):155–163

Blondel J (1986) Biogéographie évolutive. Masson Paris

Bossard M, Ferancec J, Otahel J (2000) CORINE Land Cover technical guide – Addendum 2000. European Environment Agency, Copenhague

Boteva D, Griffiths G, Dimopoulos P (2004) Evaluation and mapping of the conservation significance of habitats using GIS: an example from Crete, Greece. J Nat Conserv 12:237–250

Boullet V (2003) Notions d'habitat d'espèce végétale. Fédération des Conservatoires Botaniques Nationaux – Conservatoire Botanique National de Mascarin, St-Leu

Boullet V (2007) Eléments pour le dossier UNESCO: Habitats, végétation et flore. Habitats, flore et végétations: diversité et originalité. Conservatoire Botanique National de Mascarin

Boullet V (2008) Systémique et diversité végétales du littoral ouest de la Réunion (La Possession/ Saint-Pierre). Intérêt patrimonial et applications à la conservation de la biodiversité, Conservatoire Botanique National de Mascarin

Boyer A, Gamisans J, Gruber M, Quézel P (1983) Les chênaies à feuillage caduc de Corse. Ecologia Mediterranea 9(2):41–58

Braun-Blanquet J (1928) Pflanzensoziologie. Grundzüge der Vegetationskunde. Springer, Berlin

Braun-Blanquet J (1968) L'école phytosociologique Züricho-Montpelliéraine et la S.I.G.M.A. Vegetatio 16:1–78

Briquet J, de Litardière R (1936) Prodrome de la flore corse, Tome 2, partie 2. Lechevalier, Paris

Bruno C, Dupré G, Giorgetti G, Giorgetti JP, Alesandri J (2001) Chi tempu face ? Météorologie, climat et microclimats de la Corse. CRDP de Corse, Ajaccio

Burel F, Baudry J (1999) Écologie du paysage. Concepts, Méthodes et Applications. Technique & Documentation, Paris

Burel F, Baudry J, Clergeau P, Constant P, Eybert MC (1992) Approche spatiale des phénomènes écologiques: échelle et hiérarchie. Bulletin Écologique 23(1-2):93–101

Carcaillet C, Leys B (2012) Feux & Forêts. 11 000 ans d'histoire commune. Stantari 30:19–23

Carcaillet C, Barakat HN, Panaïotis C, Loisel R (1997) Fire and late Holocene expansion of Quercus ilex and Pinus pinaster in Corsica. J Veg Sci 8:85–94

Castelnau P (1920) Les côtes de Corse: étude morphologique. Revue Géographie annuelle, Librairie Delagrave IX(2)

Chalumeau A, Bioret F (2013) Méthodologie de cartographie phytosociologique en Europe: approches symphytosociologique et géosymphytosociologique. Synthèse bibliographique. Rapport Institut de Géoarchitecture, Université de Bretagne Occidentale, Ministère de l'Écologie, du Développement Durable et de l'Énergie, Brest

Choisnel E (1989) Variabilité du climat: sa prise en compte pour l'aménagement de l'espace rural. CR Acad Agric Fr 75(9):47–57

Clair M, Gaudillat V, Herard-Logereau K (2005) Cartographie des habitats naturels et des espèces végétales appliquée aux sites terrestres du Réseau Natura 2000 - Guide méthodologique. Fédération des Conservatoires botaniques nationaux, Muséum national d'histoire naturelle/ Ministère de l'Ecologie et du Développement durable

Collectivité Territoriale de Corse (C.T.C.) (2014a) La Terre. Comment concilier préservation et développement ? Consulté sur internet le 4 mars 2015, disponible sur le site (www.corse.fr/padduc/attachment/422609/)

Collectivité Territoriale de Corse (C.T.C.) (2014b) Plan d'Aménagement et de Développement Durable de la Corse. Livret I – Diagnostic stratégique territorial. Agence d'Aménagement Durable, de Planification et d'Urbanisme de la Corse, Ajaccio

Conservatoire Botanique National de Corse (2009) État des lieux de la biodiversité sur les sites du Conservatoire du Littoral en Corse. Conservatoire Botanique National de Corse. Office de l'environnement de la Corse, Corte

Conservatoire Botanique National de Corse (2015) Rapport d'activités lié à la convention MEDDE-CBNC de 2014. Programme CarHAB. CBNC-OEC, Corte

Contandriopoulos J (1962) Recherches sur la flore endémique de la Corse et sur ses origines. Ann Fac Sci Marseille 32:1–354

Daget P (1977a) Le bioclimat méditerranéen: analyse des formes climatiques par le système d'Emberger. Vegetatio 34(2):87–103

Daget P (1977b) Le bioclimat méditerranéen: caractères généraux, méthodes de classification. Vegetatio 34(1):1–20

de Foucault B (1986) Petit manuel d'initiation à la phytosociologie sigmatiste. Société Linéenne Nord France, Amiens, Laboratoire Botanique, Faculté Pharmacie, Lille II

de Foucault B (2011) Contribution au Prodrome des végétations de France: les *Filipendulo ulmariae-Convolvuletea sepium* Géhu & Géhu-Franck 1987. Journal de Botanique Société Botanique de France 53:73–137

de Foucault B (2012) Contribution au Prodrome des végétations de France: *lesSisymbrietea officinalis* Korneck 1974. Journal de Botanique, Société Botanique de France 58:55–116

de Foucault B (2013) Contribution au Prodrome des végétations de France: les *Isoëtetea velatae* B. Foucault 1988 et les *Juncetea bufonii* B.Foucault 1988. Journal de Botanique Société Botanique de France 62:35–70

de Foucault B (2015) Contribution au Prodrome des végétations de France: les *Pegano harmalae-Salsoletea vermiculatae* Braun-Blanq. & O. Bolòs 1958. Journal de Botanique Société Botanique de France 62:35–70

de Foucault B, Bioret F (2010) Contribution au Prodrome des végétations de France: les *Saginetea maritimae* Westhoff et al. 1962. Journal Botanique Société Botanique France 50:59–83

de Foucault B, Catteau E (2012) Contribution au Prodrome des végétations de France: les *Agrostietea stoloniferae* Oberd. 1983. J Bot Soc Bot Fr 59:5–131

de Foucault B, Catteau E (2015) Contribution au Prodrome des végétations de France: les *Epilobietea angustifolii* Tüxen & Preising in Tüxen 1950. J Bot Soc Bot Fr 59:5–131

de Foucault B, Argagnon O, Paradis G (2012a) Contribution au Prodrome des végétations de France: les*Cisto ladaniferi-Lavanduletea stoechadis* Braun-Blanq. In Braun-Blanq, Molin, Wagner (1940). Journal de Botanique, Société Botanique de France 57:59–82

de Foucault B, Bensettiti F, Noble V, Paradis G (2012b) Contribution au Prodrome des végétations de France: les*Nerio oleandri-Tamaricetea africanae* Braun-Blanq. & O. Bolòs 1958. Journal Botanique Société Botanique France 58:41–54

Delage A (2010) État des stations de *Woodwardia radicans* (L.) Sm. dans le vallon de Sisco (Localisation, effectifs, bilan). Conservatoire Botanique National de Corse, Corte

Delaporte C (2013) Inventaire floristique de la végétation rudérale des bordures herbacées de parcelles agricoles de la Corse. Mém. Univ. de Strasbourg, Office de l'environnement de la Corse – Conservatoire botanique national de Corse, Corte

Delaugerre M, Guyot I (1995) Contribution à la connaissance de l'histoire naturelle des îles Finocchiarola (Haute Corse). Trav Sci Parc Nat Rég Rés Nat Corse 53:51–69

Delbosc P (2015) Phytosociologie dynamico-caténale des végétations de la Corse: méthodologies typologique et cartographique. Thèse de Doctorat - Université de Bretagne Occidentale, Brest

Delbosc P, Bioret F, Panaïotis C (2015a) Les séries de végétation de la vallée d'Asco (typologie et cartographie au 1:25,000). Ecologia mediterranea 41(1):5–87

Delbosc P, Bioret F, Panaïotis C (2015b) Végétations et séries de végétation de la Réserve naturelle de l'Étang de Biguglia: Typologie, cartographie et analyse diachronique (1992-2006-2014). Université de Bretagne Occidentale, Conservatoire Botanique National de Corse, Ministère de l'Écologie, du Développement Durable et de l'Energie, Corte

Delbosc P, Bioret F, Panaïotis C (2017) Heritage assessment of vegetation series of Corsica. Plant Sociol 54(2):3–12

Delpech R (1996) Vocabulaire de phytosociologie et de synécologie végétale. In« La banque des mots », 91. Conseil International de la Langue Française, Paris

Demartini C (2016) Les végétations des côtes Manche-Atlantique françaises: essai de typologie et de cartographie dynamico-caténales. Thèse de Doctorat - Université de Bretagne Occidentale, Brest

Demartini J, Favreau P (2004) Les sols en Corse. Encyclopaedia corsicae, Éd. Dumane, Ajaccio 1: 121-155

Demartini J, Favreau P (2011a) La Corse. Office du Développement Agricole et Rural de la Corse, Bastia. In: Jamagne M. (coord.). Grands paysages pédologiques de la France. Éditions Quae: 467–487

Demartini J, Favreau P (2011b) Référentiel Pédologique Approfondi (R.P.A.), Caractérisation des sols des plaines et coteaux de basse altitude au 1:25,000. Office du Développement Agricole et Rural de la Corse, Bastia

Demartini C, Bioret F, Lazare JJ (2015) Typologie et cartographie des géopermaséries et des géocurtaséries des végétations littorales des côtes Manche-Atlantique françaises. Doc Phytosoc, série 3(6):317–332

Département de la Haute-Corse (2013) Plan de Gestion 2014-2018 de la Réserve naturelle de l'étang de Biguglia

Dupias G (1963) Carte de la végétation de la France, notice sommaire. Centre National Recherche Scientifique 80 et 81

Dupias G, Rey P (1985) Document pour un zonage des régions phyto-écologiques. Centre National de la Recherche Scientifique, Toulouse

Dupias G, Gaussen H, Izard M, Rey P (1965) Carte de la végétation de la France, N° 80-81, Corse. (Carte au 1:200,000ème; Notice sommaire par G. Dupias). Centre National de la Recherche Scientifique, Service de la Carte de la Végétation, Toulouse

Durand-Delga M, Amaudric Du Chaffaut S, Bonin B, Bonnal M, Caron JM, Conchon O, Delcey R, Orsini J, Orszag-Sperber F, Pilot MD, Vellutini P (1978) Corse. Guides Géologiques Régionaux. Masson, Paris

Emberger L (1955) Une classification biogéographique des climats. Revue travaux Laboratoire Botanique Faculté Sciences Montpellier 7:3–43

Emberger L (1961) Évolution, principes actuels et problèmes de la technique cartographique pratiquée au service de la carte des groupements végétaux. Méthodes de la cartographie de la cartographie de la végétation. Coll Internat Centre National Recherche Scientifique XCVII:211–146

Emberger L, Gounot M (1963) Séminaire de méthodologie phyto-écologique et phyto-géoographique. Centre d'études phytosociologiques et écologiques du C.N.R.S, 18-23 mars 1963, Montpellier

Faliński JB (1986) Vegetation dynamics in temperate lowland primeval forests. Ecological studies in Bialowieza forest. Geobotany 8:1–537

Faliński JB (1998) Maps a anthropogenic transformations of plant cover (maps of synanthropization). Phytocœnosis 10:15–54

Faliński JB, Pedrotti F (1990) The vegetation and dynamical tendancies in the vegetation of Bosco Quarto, Promontorio del Gargano, Italy. Braun-Blanquetia 5:1–31

Farris E, Fenu G, Bacchetta G (2012) Mediterranean *Taxus baccata* woodlands in Sardinia: a characterization of the EU priority habitat 9580. Phytocœnologia 41(4):231–246

Fascetti S (1997) I cespuglieti ad Erica multiflora L. della Basilicata. Fitosociologia 32:135–144

Favreau P (2002) Les sols de Corse. In: Gauthier A (ed) La Corse: une île-montagne au cœur de la Méditerranée. Delachaux et Niestlé, Grenoble, pp 84–95

Fieschi JB (1970) Carte de la végétation des bords de l'étang de Biguglia. Document inédit.

Gamisans J (1975) La végétation des montagnes corses. Université de Marseille, Thèse d'État

Gamisans J (1979a) À propos d'espèces indicatrices des étages de végétation en Corse. Ecologia Mediterranea 4:45–48

Gamisans J (1979b) Remarques sur quelques groupements végétaux assurant la transition entre les étages montagnard et subalpin en Corse. Ecologia Mediterranea 4:33–43

Gamisans J (1981) Hêtre, sapin, bouleau et pin laricio en Corse. Revue Forestière Française 33:260–277

Gamisans J (1983) L'aulne à feuilles en cœur *Alnus cordata* (Loisel.) Loisel. dans son milieu naturel en Corse. Revue forestière française 35:187–197

Gamisans J (1986) Les forêts de Quercus ilex de Corse: étude phytosociologique et place dans la dynamique de la végétation. Doc Phytosoc X:424–440

Gamisans J (1991) La végétation de la Corse. Conservatoire et jardins botaniques de la ville de Genève, réédité en 1999. Édisud, Genève

Gamisans J (2000) La végétation serpentinicole à l'étage mésoméditerranéen de la Corse – Candollea 55/1: 64–74

Gamisans J (2004) Poursuite de l'inventaire des crêtes asylvatiques du Cap Corse. dans le cadre plus général de l'étude d'impact des projets « sentier des crêtes » et « parc éolien », ainsi que de l'étude de la dynamique de la végétation après les incendies de 2003. Rapport technique

Gamisans J (2005) Renouvellement de l'inventaire de la végétation de la Réserve naturelle de l'étang de Biguglia. Rapport intermédiaire. Réserve naturelle de l'étang de Biguglia

Gamisans J (2006) Nouvel inventaire de la flore, espèces patrimoniales, mise en place de lignes permanentes, évolution de la végétation, proposition de gestion – rapport final

Gamisans J (2010) Le paysage végétal de la Corse. Albiana, Ajaccio

Gamisans J (2012) Forêts marécageuses, ripisylves et fruticées ripicoles de Corse, Première synthèse. Office de l'environnement de la Corse – Conservatoire botanique national de Corse, Corte

Gamisans J (2013) Forêts marécageuses, ripisylves et fruticées ripicoles deCorse. Bull Soc Bot Centre-Ouest 44:383–452

Gamisans J, Grüber M (1979) La végétation du Niolu (Corse). Ecologia Mediterranea 4:141–156

Gamisans J, Marzocchi JF (2010) La flore endémique de la Corse. Edisud, Aix-en-Provence

Gamisans J, Murracciole M (1984) La végétation de la Réserve Naturelle de la presqu'île de Scandola (Corse). Étude phytosociologique et cartographie au 1:10,000^{e}. Ecologia Mediterranea 10(3-4):159–205

Gamisans J, Piazza C (1992) Flore et végétation de la Réserve naturelle de l'étang de Biguglia. A.G. E.N.C, pour le compte du Conseil Général de la Haute-Corse

Gamisans J, Grüber M, Bonin G (1981) Mise en évidence des principaux stades de la dynamique de la végétation dans les étages sylvatiques de la vallée du Taravu (Corse). Ecologia Mediterranea 7(2):45–77

García-Barriuso M, Bernardos S, Nabais C, Pereira D, Amich F (2011) Phytogeochemical, geographical and vulnerability study of the Paleosubtropical element *Notholaena marantae* subsp. *marantae* (Sinopteridaceae) at the western edge of its range. Biologia 66(2):258–265

Gauberville C (2010) Végétations forestières de Corse, référentiel des groupements forestiers reconnus. Office de l'Environnement de la Corse, Conservatoire Botanique National de Corse, Corte

Gaudillat V, Haury J, Barbier B, Peschadour F (2002) Cahiers d'habitats Natura 2000: Habitats humides. La Documentation Française, Paris 3

Gaussen H (1933) Géographie des plantes. Armand Colin, Paris

Gaussen H (1936) Le choix des couleurs dans les cartes botaniques. Bulletin Société Botanique France 83(6-7):374–480

Gaussen H (1945–1948) La cartographie phytogéographique en France. Association française Avancement Sciences 3:589–605

Gaussen H (1954) Géographie des plantes, 2ème éd. Colin, Paris

Gaussen H (1961) L'emploi des couleurs pour la cartographie de la végétation. Méthode de la Cartographie de la végétation, Colloques internationaux du CNRS, Édition du CBNRS, Toulouse XCVII: 137–145

Gauthier A (1983) Roches et paysages de la Corse. Découverte de la nature 27. PNRC, Ajaccio

Gauthier A (2005) Par les chemins du littoral Corse: randonnées littorales et belvédères côtiers. Albiana, Ajaccio

Gauthier A (2006) Des roches des paysages et des hommes. Géologie de la Corse. Albiana, Ajaccio

Gauthier A, Quilici JP (1997) Lacs de la montagne Corse. Glénat, Ajaccio

Gauthier A, Roche B, Frisoni GF (1984) Contribution à la connaissance des lacs d'altitude de la Corse. Rapport Parc Naturel Régional de Corse, Ajaccio

Géhu JM (1979) Pour une approche nouvelle des paysages végétaux: la symphytosociologie. Bulletin Société Botanique Centre-Ouest, Lettres Botaniques 126(2):213–223

Géhu JM (1986) Des complexes de groupements végétaux à la phytosociologie paysagère contemporaine. Informatore botanico italiano 18(1-2-3):53–83

Géhu JM (1988) L'analyse symphytosociologique et géosymphytosociologique de l'espace. Théorie et méthodologie. Colloques phytosociologiques, Phytosociologie et Paysages XVII:11–46

Géhu JM (1991a) La Phytodynamique: approche phytosociologique. Coll Phytosoc 20:15–28

Géhu JM (1991b) L'analyse symphytosociologique et géosymphytosociologique de l'espace. Théorie et méthodologie. Coll Phytosoc XVII:11–46

Géhu JM (2006) Dictionnaire de sociologie et synécologie végétales. Cramer, Berlin, Stuttgart

Géhu JM, Biondi E (1994) Végétation du littoral de la Corse: essai de synthèse phytosociologique. Braun-Blanquetia 13:1–149

Géhu JM, Rivas-Martínez S (1981) Notions fondamentales de phytosociologie. Berichte der Internationalen Symposien der Internationalen Vereinigung für Vegetationskunde. Syntaxonomie. Cramer, Berlin, pp 5–33

Géhu JM, Biondi E, Géhu-Franck J, Taffetani F (1987) Données sur la végétation maritime du littoral oriental de la Corse. V Jornadas de Fitosociologia. Universidad de La Laguna. Ser. Informes 22:363–391

Géhu JM, Costa M, Biondi E (1990) Les *Junipereta macrocarpae* sur sable. Acta Botánica Malacitana 15:303–309

Giacomini V (1958) Le suddivisioni regionali botaniche. In: Giacomini V, Fenaroli L (eds) Conosci l'Italia: la flora. Touring Club Italiano, Milano

Guinochet M (1973) Phytosociologie. Masson, Paris

Guyot G (1997) Climatologie de l'Environnement, de la plante aux écosystèmes. Masson, Paris

Hugot L, Spinosi P, Jeanmonod D, Schlüssel A, Paradis G, Argagnon O, Manfredi A, Médail F, Diadema K (2006) Mercurialis corsica Cosson. In: Jeanmonod D, Schlüssel A (eds) Notes et contributions à la flore de Corse, XXI. Candollea 61:119–120

Inventaire Forestier National (I.F.N.) (2006) Inventaire forestier départemental - Haute Corse (2004) et Corse du Sud (2003) – 3ème inventaire

Inventaire Forestier National (IFN) (1988) Inventaire forestier National. Départements de Haute-Corse et de Corse du Sud. Ministère Agricole et Développement Rural, Direction Espace Rural et Forestier, Paris

Jeanmonod D, Gamisans J (2013) Flora Corsica. Bulletin Société Botanique Centre-Ouest, Société Botanique Centre-Ouest 39 N.S.

Lazare JJ (2009) Phytosociologie dynamico-caténale et gestion de la biodiversité. Acta Botanica Gallica 156(1):46–61

Le Houérou HN (1971) L'écologie végétale dans la région méditerranéenne. Institut agronomique méditerranéen, Bari

Le Houérou HN (1989) Classification écoclimatique des zones arides (s.l.) de l'Afrique du Nord. Ecologia Mediterranea XV(3-4):95–144

Le Houérou HN (1995) Bioclimatologie et biogéographie des steppes arides du Nord de l'Afrique. Diversité biologique, développement durable et désertisation. Options méditerranéennes, Série B, études et recherches 10:1–396

Lefort P (2013) Étude du paysage végétal de la vallée du Niolu [Haute-Corse]. Université de Toulouse Paul Sabatier, Conservatoire Botanique National de Corse, Office de l'Environnement Corse, Corte

Lejour L (2012) Les maquis de Haute-Corse, synthèse phytosociologique. Mém. AgroparisTech Nancy, Conservatoire botanique national de Corse – Office de l'environnement de la Corse, Rapport de stage Master 2, Corte

Leveau P, Walsh K, Trement F, Barker G (eds.) (1999) Environmental reconstruction in Mediterranean landscape archeology 1998. Mediterranean Landscape Archeology 2, Oxbow Publ.

Loidi J, Biurrun I, Campos JA, García-Mijangos I, Herrera M (2011) La vegetación de la Comunidad Autonoma del Pais Vasco, Leyenda del mapa de series de vegetación a escala 1:500,000. Laboratorio Botanica, Depto Biologia Vegetal y Ecologia

Lorenzi LJ (2002) Le maquis corsed'après les textes anciens et modernes. L'Harmattan, Paris

Lorenzoni C (1997) Étude de la végétation des mares temporaires de la Corse. (Collab. G. Paradis). Collectivité Territorriale Corse, Office de l'Environement de la Corse. Programme Life

Marsili S (2004) Etudes sur la flore et la végétation serpentinicole en Corse. Università di Genova

Meddour R (2010) Bioclimatologie, phytogéographie et phytosociologie en Algérie: exemple des groupements forestiers et préforestiers de la Kalybie Djurdjureenne. Thèse de Doctorat, Université Mouloud Mammeri de Tizi Ouzou

Mériaux JL, Géhu JM (1977) De l'analyse symphytosociologique des complexes de végétation à celle des végétations complexes. Exemple des groupements aquatiques et subaquatiques. In: Tüxen R (ed) Assoziationkomplexe (Sigmeten). Cramer, Rinteln, pp 97–116

Mesléard F (1988) Dynamique, après perturbation, de peuplements de deux ériçaies (*Arbutus unedo* L. et *Erica arborea* L.) en Corse. Parc Naturel Régional de Corse, Ajaccio

Migliore J, Baumel JM, Diadema K, Hugot L, Verlaque R, Médail F (2011) Genetic diversity and structure of a Mediterranean endemic plant in Corsica (*Mercurialis corsica*, Euphorbiaceae). Popul Ecol 53:573–586

Molinier R (1959) Étude des groupements végétaux terrestres du Cap Corse. Bulletin Museum Histoire Naturelle Marseille XIX:5–75

Molinier R (1962) Notice explicative de la carte des groupements végétaux terrestres et des biocénoses marines du Cap Corse. I.G.N, Paris

Moneglia P, Burquet-Moretti A, Lair E, Pastenellia M (2012) Document d'objectifs du site Natura 2000 FR9400569 « Crêtes du Cap Corse, vallon de Sisco » - Rapport d'étape du 13 juillet 2012, 49 p

O.E.C (2002) Etude de la végétation des mares temporaires de Capandola (Cap Corse). Rapport interne – Office de l'Environnement de la Corse, Corte

Organisation Météorologique Mondiale (O.M.M.) (2015) Oragnisation Météorologique Mondiale, Terre, climat, Eau. Disponible sur l'internet: (https://www.wmo.int/pages/index_fr.html), consulté sur internet le 21 mars 2015.

Orsomando E, Pedrotti F (1985) Carta della vegetazione del foglio Passignano sul Trasimeno (1,50,000). Giorn Bot Ital 120(2):161

Ozenda P (1963) Principes et objectifs d'une cartographie de la végétation des Alpes à moyenne échelle. Documents cartographie écologique XVI:5–18

Ozenda P (1985) La végétation de la chaîne alpine dans l'espace montagnard européen. Masson, Paris

Ozenda P (1986) La cartographie écologique et ses applications. Masson, Paris

Ozenda P, Wagner H (1975) Les séries de végétation de la chaîne alpine et leurs équivalences dans les autres systèmes phytogéographiques. Documents cartographie écologique XVI:49–64

Palanqui JP, Giorgetti JP (2004) Les climats de la Corse. Encyclopaedia corsicae, Éditions Dumane I:220–234

Palmieri J (2004) Géomorphologie: formes du relief et paysages morphologiques. In Sabiani T, Alesandri J, Andrei-Ruiz C, Bellan-Santini D (coord.) Encyclopedia Corsicae, Dumane 1, Ajaccio: 79–120

Paradis G (1991) Les formations à *Juniperus phoenicea* et à *Juniperus oxycedrus* subsp. *macrocarpa* sur le littoral de la Corse. Coll Phytosoc XX:345–358

Paradis G (1993) Les formations à *Juniperus phoenicea* et à *Juniperus oxycedrus* subsp. *macrocarpa* sur le littoral de la Corse. Coll Phytosoc XX:345–358

Paradis G (2004) Flore et végétation. In Sabiani T, Alesandri J, Andrei-Ruiz C, Bellan-Santini D (coord.) Encyclopedia Corsicae, Dumane 1, Ajaccio: 457-572

Paradis G (2005) Synécologie en Corse de la paléoendémique protégée Nananthea perpusilla (Compositae). Bulletin Société Botanique Centre-Ouest N.S. 36:109–130

Paradis G (2006) Répartition en Corse et description phytosociologique des stations des deux espèces protégées Nerium oleander et Vitex agnus-castus. J Bot Soc Bot Fr 33:49–91

Paradis G (2010) Evaluation des habitats rocheux littoraux du thermoméditerranéen et du mésoméditerranéen inférieur de Corse. Office de l'Environnement de la Corse, Conservatoire Botanique National de Corse, Corte

Paradis G (2013) Synthèse phytosociologique des zones humides de Corse. Office de l'Environnement de la Corse, Conservatoire Botanique National de Corse, Corte

Paradis G (2014) Végétation et géomorphologie du littoral sableux de la Corse: essai de synthèse. Association Scientifique de Travaux, Études et Recherches sur l'Environnement. Conservatoire Botanique National de Corse – Office de l'Environnement de la Corse, Corte

Paradis G, Lorenzoni C (1999) Description dans le but de gestion conservatoire des stations corses de l'espèce rare *Cressa cretica* L. (Convolvulaceae). J Bot Soc Bot Fr 9:5–34

Paradis G, Piazza C (1996) Éléments pour une gestion des habitats littoraux sableux et graveleux de la Corse. Programme Life « Conservation des habitats naturels et des espèces végétales d'intérêt prioritaire de la Corse ». Université de Corse, Office de l'environnement de la Corse, Corte

Paradis G, Piazza C (2011) Biodiversité végétale de cinq sites sableux et graveleux du golfe de Valinco (Corse). Bulletin Société Botanique Centre-Ouest - N. S 42:85–128

Paradis G, Tomasi JC (1991) Aperçus phytosociologique et cartographique de la végétation littorale de Barcaggio (Cap Corse, France): rochers, dunes, étangs et dépressions. Doc Phytosoc N.S. XIII:175–208

Paradis G, Lorenzoni C, Piazza C (1994) Flore et végétation de l'île Piana (Réserve des Lavezzi, Corse du Sud). Travaux Scientifiques Parc Naturel Régional Réserves Naturelles 50:1–87

Paradis G, Lorenzoni-Pietri C, Pozzo di Borgo ML, Sorba L (2009) La végétation des mares temporaires méditerranéennes de la Corse. Bull Soc Sci Hist Nat Corse 728-729:19–62

Paradis G, O'Deye-Guizien K, Piazza C (2013) Étude floristique, phytosociologique et cartographique des zones humides. J Bot Soc Bot Fr 63:15–54

Paradis G, Feral C, Passigny-Hernandez C, Nicolau J, Carles S (2014) Paysage végétal de la vallée du Baracci et du nord du golfe de Valinco (sud-ouest de la Corse): phytosociologie et carte de la végétation. J Bot Soc Bot Fr 67:9–105

Pedrotti F (2004) Cartographia Geobotanica. Pitagora, Bologna

Pedrotti F (2013) Plant and vegetation mapping. Springer, Heidelberg

Penas A, Del Río S (2012) Cartografía temática de las series, geoseries, geopermaseries, permaseries y curtoseries de vegetación. (communication). Workshop Européen « Cartographie phytosociologique dynamique et paysagère », 12 Septembre 2012, Brest

Pesaresi S, Biondi E, Casavecchia S, Catorci A, Foglia M (2007) Il geodatabase del sistema informativo vegetazionale delle Marche. Fitosociologia 44(2):95–101

Petit Y (2010) Étude de la distribution de l'écologie et des menaces pesant sur les populations corsez de la Brassicaceae paléoendémique *Morisia monanthos*, en vue de sa conservation. Muséum National d'Histoire Naturelle, Université Pierre et Marie Curie (Paris VI), Conservatoire Botanique Nationa de Corse – Office de l'Environnement de la Corse

Piazza C, Paradis G (1997) Essai de présentation synthétique des groupements végétaux de la classe des *Euphorbio-Ammophiletea* du littoral de la Corse. Bulletin Société Botanique Centre-Ouest N. S. 28:119–158

Piazza C, Paradis G (1998) Essai de présentation synthétique des végétations chaméphytique et phanérophytique du littoral sableux et sablo-graveleux de la Corse (classes des *Helichryso-Crucianelletea, Cisto-Lavanduletea* et *Quercetea ilicis*). Bulletin Société Botanique Centre-Ouest N.S. 29:109–167

Piazza C, Paradis G (2002) Essai de présentation synthétique des groupements théophytiques printaniers des sites littoraux sableux et graveleux de la Corse (classes des *Ononido variegatae-Cutendia maritimae, Tuberietea guttatae, Stellarietea mediae* et *Saginetea maritimae*). Bulletin de la société botanique Centre-Ouest N.S. 33:47–126

Pinto-Gomez CJ, Paiva Ferreira RJP (2005) Flora e Vegetaçào do Barrocal Algarvio (Tavira-Portimào). Comissào de Coordenaçào e desenvolvimento Regional do Algarve

Pons A, Quezel P (1985) The history of the flora and vegetation and past and present human disturbance in the Mediterranean region. In: Gomez-Campo C (ed) Plant conservation in the Mediterranean area. W. Junk Publishers, Dordrecht, The Netherlands, pp 25–43

Pons A, Quézel P (1998) À propos de la mise en place du climat méditerranéen. C R Acad Sci Paris, Science de la terre et des planètes 327:755–760

Quézel P (1971) La haute montagne méditerranéenne. Signification phytosociologique et bioclimatique générale. Coll Interdisc Mil Nat Supraforestiers Perpignan:1–15

Quézel P, Barbéro M (1982) Definition and characterization of Mediterranean-type ecosystems. Ecologia Mediterranea VIII(1/2):15–29

Quezel P, Medail F (2003) Ecologie et biogéographie des forêts du bassin méditerranéen. Elsevier, Paris, Francia

Rameau JC, Chevallier H, Bartoli M, Gourc J (2001) Cahiers d'habitats Natura 2000: Habitats forestiers. La Documentation Française, 1 et 2

Ravel L (1911) La Corse. Ressources de son sol et de son climat. Librairie des sciences agricoles Charles Amat éditeur, Paris (VI[e])

Ravis-Giordani G (1983) Berges corses, les communautés villageoises du Niolu. Édisud, Aix-en-Provence

Ravis-Giordani G (1988) Organisation sociale et représentation fantasmatiques du travail et des conflits dans le cadre de la transhumance corse. Mélanges de l'Ecole française de Rome, Moyen-Age, Temps modernes 100(2):803–820

Reille M (1975) Contribution pollenanalytique à l'histoire de la végétation tardiglaciaire et holocène de la montagne corse. Thèse de doctorat d'Etat ès Sciences, Université d'Aix-Marseille, Marseille

Reille M (1988a) Recherches pollenanalytiques dans le Cap Corse: analyse pollinique du marais de Barcaggio. Travaux Scientifique du Parc Naturel Régional de Corse, Réserve Naturelle de Corse 18:77–92

Reille M (1988b) Recherches pollenanalytiques sur le littoral occidental de Corse, région de Galéria: la place naturelle d'*Erica arborea* et de *Quercus ilex*. Travaux Scientifique du Parc Naturel Régional de Corse, Réserve Naturelle de Corse 18:53–75

Reille M (1992) New pollen-analytical researches in Corsica: the problem of *Quercus ilex* L. and *Erica arborea* L., the origin of Pinus halepensis miller forests. New Phytol 122:359–378

Reille M, Pons A (1992) The ecological signifiance of sclerophyllous oak forest in the western part of the mediterranean Basin: a note on pollen analytical data. Vegetatio 99(100):13–17

Reille M, Triat H, Vernet JL (1980) Les témoignages des structures actuelles de végétation méditerranéenne durant le passé contemporain de l'action de l'homme. Naturalia Monspeliensa 237:79–87

Rey P (1961) De la clarté en toute chose, même en cartographie de la végétation. 97e Colloque international de la recherche scientifique, Paris CNRS: 283–288

Rey P (2009) Histoire de la cartographie de la végétation en France. CFC 199:105–115

Reymann J (2011) Inventaire et cartographie des habitats prairiaux de l'étage mésoméditerranéen en Corse. Master Biodiversité Ecologie Environnement, Université de Grenoble, CBNC-OEC Corte

Reymann J, Panaïotis C, Bioret F, Delbosc P, Gamisans J, Pioli A, Gauberville G, Piazza C, O'Deye-Guizien K, Hugot L (2016) Prodrome des végétations de Corse. Documents phytosociologiques 3(4):1–175

Richard PJH (1997) Les climats annuels, la variabilité climatique et le bioclimat. Consulté sur internet le 20 juin 2014. Disponible sur le site: (www.geogr.umontreal.ca/donnees/geo3152), consulté le 11 août 2014

Richard F (1998) Contribution à l'étude fongique des litières d'une vieille futaie de chênes verts (Quercus ilex L.). Réserve MAB du Fango (Haute-Corse). Mémoire DESS « ecosystèmes méditerranéens », Université de Corse, Corte

Richard F (2004) Les champignons ectomycorhiziens du chêne vert (Quercus ilex L.) en Corse: diversité et rôle de la symbiose. Thèse de Doctorat, Université de Toulouse III

Rivas-Martínez S (1976) Sinfitosociologia, una nueva metodologia para el estudio del paisaje vegetal. Anal Inst Bot Cavanilles 33:179–188

Rivas-Martínez S (1981) Les étages bioclimatiques de la végétation de la péninsule ibérique. Actas III Congr Optima Anales Jard Bot Madrid 37(2):251–268

Rivas-Martínez S (1982) Étages bioclimatiques, secteurs chorologiques et séries de végétation de l'Espagne méditerranéenne. Ecologia mediterranea VIII(1/2):275–288

Rivas-Martínez S (1987) Memoria del mapa de series de vegetación de España. Ministerio de Agricultura, Pesca y Alimentación. Editions I.C.O.N.A. Série Técnica, Madrid

Rivas-Martínez S (2005a) Avances en Geobotánica. Discurso de Apertura del Curso Académico de la Real Academia Nacional de Farmacia del año 2005, Madrid

Rivas-Martínez S (2005b) Notions on dynamic-caténal phytosociology as a basis of landscape science. Plant Biosystems 139(2):135–144

Rivas-Martínez S (2007) Mapa de series, geoseries y geopermaseries de vegetación de España (Memoria del mapa de vegetacion potencial de España). Itinera geobotanica 17:1–436

Roche D, Roux C (1976) Les sols d'une séquence bioclimatique méditerranéo-montagnarde en Corse cristalline. Mémoire de DEA, CEPE, Montpellier

Rome S, Giorgetti JP (2007) La montagne corse et ses caractéristiques climatiques. La Météorologie 59:39–50

Romeyer K (2014) Typologie phytosociologique des forêts de chêne de Corse. Mém. Univ. de Lorraine, Conservatoire botanique national de Corse – Office de l'environnement de la Corse, Corte

Rossi P, Rouire J (1980a) Carte géologique de la France à 1/250,000. Ministère de l'Industrie, Bureau de Recherches Géologiques et Minières, Service géologique national, Orléans

Rossi P, Rouire J (1980b) Notice explicative de la feuille Corse à 1:250,000. Ministère de l'Industrie Bureau de Recherches Géologiques et Minières, Service géologique national, Orléans

Rossi P, Durand-Delga M, Caron JM, Guieu G, Conchon O, Libourel G, Loÿe, Pilot P (1994) Carte géologique de la France au 1/50 000. Feuille de Corte avec notice explicative - BRGM

Rouire J (1980) Carte géologique de la France à 1:250,000ème. BRGM

Saïd S, Rameau JC, Brun JJ (2003) Évolution et diversité végétales en Corse suite à la déprise agricole. Revue forestière française 55:309–322

Sauvage C (1963) Étages bioclimatiques. Atlas du Maroc, Comité National de Géographie du Maroc, Rabat

Selvi F (2007) Diversity, geographic variation and conservation of the serpentine flora of Tuscany (Italy). Biodivers Conserv 16:1423–1439

Simi P (1964) Le Climat de la Corse. Bulletin Section de Géographie LXXVI, Paris

Simi P (1974) Histoire et économie du maquis. Bulletin de la Somivac Setco, Bastia

Simi P (1981) Précis de géographie. Bulletin de la Société des Sciences Histoires et Natures en Corse, Colloque d'hier et de demain 11:63–66

Stanisci A, Feola S, Carranza ML, Balteanu D, Blasi C (2004) Unità di vegetazione naturale potenziale e incidenza degli incendi nell'isola di Ponza (Italia Centrale). Fitosociologia 41 (1):79–83

Tanné M (2014) Végétations et séries de végétation du Haut-Vénacais (Haute-Corse): typologie, cartographie et analyse diachronique. Mémoire de Master II – Agrocampus-ouest – Conservatoire Botanique National de Corse/Office de l'Environnement de Corse, Corte

Tatoni T (1992) Évolution post-culturale des agrosystèmes de terrasses en Provence calcaire; phytoécologie et impact humain. Thèse de doctorat d'état en Sciences, Université de Provence, Marseille

Theurillat JP (1992a) Études symphytocœnologiques dans la région d'Aletsch (Valais, Suisse). Thèse de doctorat ès Sciences, Université de Berne

Theurillat JP (1992b) L'analyse du paysage végétal en symphytocœnologie: ses niveaux et leurs domaines spatiaux. Bull Ecol 23(1-2):83–92

Thinon M (1992) L'analyse pédoanthracologique: aspects méthodologiques et applications. Thèse de Doctorat d'Etat, Université d'Aix-Marseille III, Marseille

Thinon M (1998) Étude de l'aire potentielle du pin laricio en Corse: approche pédoanthracologique. Programme Life de la Commissionndes Communautés Européennes « Conservation des habitats naturels et des espèces végétales d'intérêt communautaire prioritaire de la Corse ». Institut Méditerranéen d'Écologie et de Paleoécologie, Marseille

Tüxen R (1979) Sigmeten und Geosigmeten, ihre Ordnung und ihre Bedeutung für Wissenschaft. Naturschutz und Planung. Biogeographica 16:79–92

Vasseur J (2014) Inventaire de la flore spontanée et des végétations des vignobles de Corse. Mémoire de Master II – Université de Bretagne Occidentale – Conservatoire Botanique National de Corse/Office de l'Environnement de Corse, Rapport de stage Master 2, Corte

Vellutini P (1977) Le magmatisme permien de la Corse du nord-ouest. Son extension en méditerranée occidentale. Université de Droit d'Economie et des Sciences d'Aix-Marseille III, Thèse de Doctorat, Marseille

Weber H, Moravec J, Theurillat JP (2000) International Code of Phytosociological Nomenclature. 3e ed. J Veg Sci 11:739–768